Comments on Regulating Greenhouse Gas Emissions under the Clean Air Act; Advanced Notice of Proposed Rulemaking RIN 2060-AP12[1]

In response to the EPA's call for comments under its Advanced Notice of Proposed Rulemaking on the regulation of greenhouse gas (GHG) emissions, we wish to emphasize the following:

1.1 The Clean Air Act does not provide an adequate basis for regulating GHG emissions because it takes a bureaucratic approach to an issue better addressed with broader measures.
1.2 Any approach to reducing GHG emissions should be market driven, for efficiency and technology availability reasons;
1.3 Any efforts to cut GHG emissions should be applied broadly, and not just to a few large "polluters";
1.4 The EPA, both legally and temperamentally, may not be the right organization to be given the role of finding efficient solutions to climate change issues;
1.5 Approaches to climate change must be able to trade off the benefits of adaptation against the benefits of mitigation (emissions controls).

2.1 Further research into clarifying the structural uncertainty inherent in climate sensitivity estimates is needed.
2.2 Uncertainty should be incorporated into policy modeling exercises by attaching distributions to the key magnitudes, and not merely through sensitivity or scenario analysis.
2.3 EPA should pay as much attention to quantifying the costs of GHG abatement as it is paying to the benefits.

3.1 The Climate Framework for Uncertainty, Negotiation and Distribution (FUND) Model does not provide an adequate basis for modeling the effects of government policies on climate change – it is mechanistic, does not handle uncertainty well, and lacks endogenous behavioral responses. [2]
3.2 A better approach would be to base policy analysis on a (possibly modified) version of The Dynamic Integrated model of Climate and the Economy (DICE) Model,[3] which endogenizes the effects of GHG abatement on economic growth.

4.1 Projects related to GHG abatement should be evaluated using a discount rate that is an appropriately weighted average of the rate of return on capital (historically about 7%) and the social rate of time

[1] This note was written by Paul Bachman, Jonathan Haughton, and Alfonso Sanchez-Penalver of the Beacon Hill Institute.
[2] David Anthoff and Richard S.J. Tol; *The Climate Framework for Uncertainty, Negotiation and Distribution (FUND), Technical Description, Version 3.3*; July 2008. Accessed online on October 27 2008 at http://www.mi.uni-hamburg.de/index.php?id=5679&L=3.
[3] Nordhaus, William, *A Question of Balance: Weighing the Options on Global Warming Policies*; February 2008. Accessed online on October 22, 2008 at http://nordhaus.econ.yale.edu/Balance_2nd_proofs.pdf. For some useful simulations using this model, see William Nordhaus, "A Review of the *Stern Review on the Economics of Climate Change*", *Journal of Economic Literature*, XLV: 686-702, September 2007.

preference (historically about 3%), which would represent only a modest modification to current practice.

4.2 The case for using a very low discount rate in GHG abatement projects, however seductive, is very weak.

4.3 Recent legislative proposals for reductions in GHG emissions – of 60% to 80% below 1990 levels by 2050 – are likely to be hugely expensive.

5.1 That there is a bias in the tone and text of the EPA's ANPR that appears to presume that anthropogenic global warming is a serious problem and the only remaining issue is how to solve it effectively;

5.2 This bias leads to an understatement of the costs of GHG abatement, and inadequate attention to the uncertainties on both the benefit and cost sides.

6.1 If the EPA is to play any role in global GHG abatement measures, it must coordinate with the State Department and other entities responsible for international relations.

The Beacon Hill Institute (BHI) is submitting the following comments and suggestions to the U.S. Environmental Protection Agency Regulation Identification Number 2060-AP12.

Under the federal Clean Air Act, (CAA), the U.S. Environmental Protection Agency (EPA) is charged with the regulation of air quality in the United States. On April 2, 2007, The U.S. Supreme Court issued a ruling in which it directed the EPA to determine whether or not to regulate greenhouse gas (GHG) emissions from motor vehicles as a pollutant under the federal CAA.[4]

Subsequently President Bush issued Executive Order 13432 that instructs the EPA and the Departments of Energy and Transportation to cooperate in an effort *"to protect the environment with respect to greenhouse gas emissions from motor vehicles, nonroad vehicles, and nonroad engines, in a manner consistent with sound science, analysis of benefits and costs, public safety, and economic growth."*[5]

In an effort to implement EO-13432, the EPA has developed a methodology for estimating the benefits of greenhouse gas emissions reductions. On July 11, 2008, the EPA issued an Advance Notice of Proposed Rulemaking (ANPR) which seeks comments on several key principles including

> addressing GHG emissions in a manner that does not harm the U.S. economy; encouraging the technological development that is essential to significantly reducing GHG emissions; and recognizing that U.S. efforts to reduce GHG emissions could be undermined if other countries with significant GHG emissions fail to control their emissions and U.S. businesses are put at a competitive disadvantage relative to their foreign competitors.[6]

The EPA discusses and seeks comment on whether and how these principles can inform decisions regarding GHG regulation under the CAA in the ANPR. In addition, the EPA released a report, which includes more 500

[4] U.S. Supreme Court; Massachusetts et al v. Environmental Protection Agency et al; No. 05–1120. Argued November 29, 2006—Decided April 2, 2007; Internet; available at http://www.supremecourtus.gov/opinions/06pdf/05-1120.pdf; accessed August 28, 2008.

[5] U.S. President, "Executive Order 13432- Cooperation Among Agencies in Protecting the Environment With Respect to Greenhouse Gas Emissions From Motor Vehicles, Nonroad Vehicles, and Nonroad Engines;" (May 14, 2007); http://www.presidency.ucsb.edu/ws/index.php?pid=75108; accessed August 25, 2008.

[6] U.S. Archives and National Records Administration, Federal Register, EPA, Regulating Greenhouse Gas Emissions Under the Clean Air Act: Proposed Rule (Washington, D.C., July 30, 2008); 44397.

pages of comments from federal government agencies, background and technical information, and in which it details its methodology.[7]

We hereby submit the following comments under the six section heading listed below.

1. The Use of Market Solutions to Reduce Emissions

We argue that:

1.1 The Clean Air Act does not provide an adequate basis for regulating GHG emissions because it takes a bureaucratic approach to an issue better addressed with broader measures.

1.2 Any approach to reducing GHG emissions should be market based, for efficiency reasons.

1.3 Any efforts to cut GHG emissions should be applied broadly, and not just to a few large "polluters."

1.4 The EPA, both legally and temperamentally, may not be the right organization to be given the role of finding efficient solutions to climate change issues.

1.5 Approaches to climate change must be able to trade off the benefits of adaptation against the benefits of mitigation (emissions controls).

Markets are more efficient than command and control

Under the CAA, the EPA does not have the statutory authority to implement market-based approaches – such as a carbon tax, or broad-based cap and trade mechanisms – to GHG reductions. Under current CAA rules, it must generally determine ambient standards without giving any consideration to the cost of meeting them. In non-attainment areas, major new or modified sources of air pollution must reach the lowest achievable emission rate (LAER); and in areas where the rule is to achieve a prevention of significant deterioration in air quality, new sources must install the best available control technology (BACT).

Presumably, if GHG abatement is to occur, EPA will need to arrive at a finding of non-attainment – otherwise, what is the point of the current exercise? – but this would trigger the application of the prevention of significant deterioration (PSD) program and all the associated regulatory apparatus and case-by-case permitting nationwide. Currently the EPC handles 200-300 cases annually under the PSD program, and the ANPR suggests that the number may rise tenfold.[8] But this too is likely to be an underestimate, given that an estimated 1.2 million commercial buildings and factories emit at least 250 tons per year of CO_2, the trigger point for PSD controls. Such a program is likely to be "extraordinarily intrusive and burdensome."[9]

The problem is that if, indeed, GHG emissions are to be reduced, the EPA's command and control approach is a very inefficient way to do it. Numerous studies have found command and control costs to be twice as high as the least cost approaches to reducing pollution.[10] ***This is why, if GHG emissions are to be reduced, we favor the use of market-driven, rather than command and control, approaches.***

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[7] U.S. EPA, "Advance Notice of Proposed Rulemaking: Regulating Greenhouse Gas Emissions under the Clean Air Act," (July 11, 2008): http://www.epa.gov/climatechange/anpr.html; accessed August 25, 2008.

[8] ANPR 44499.

[9] ANPR 44359, from a letter to OIRA Administrator Susan Dudley from the Secretaries of the US Departments of Agriculture, Commerce, Transportation, and Energy, dated July 9, 2008.

[10] The classic study is S. E. Atkinson and D. H. Lewis, "A Cost-Effectiveness Analysis of Alternative Air Quality Control Strategies," *Journal of Environmental Economics and Management*, 1(3): 237-250, 1974, which found the cost of reducing particulates in the St. Louis metropolitan area using command and control techniques to be six times as high as the least-

The Clean Air Act mandates an inefficient, control-based approach to GHG emissions

It appears that market-driven(???) approaches to global warmng cannot generally be used under the strictures of the Clean Air Act which, anyway, was originally intended to limit pollutants that cause direct health effects, and was never designed to tackle the issue of GHG emissions. It follows that ***the Clean Air Act does not provide an adequate basis for regulating global greenhouse gases***, and in this we agree with the conclusion of the EPA Administrator.[11]

The EPA is not the only agency that strays from market-based solutions: Corporate Average Fuel Economy (CAFÉ) standards, Renewable Portfolio Standards, building codes, subsidies for hybrid cars, subsidies for wind power, and utility conservation programs are among the many examples of piecemeal and generally inefficient approaches to energy policy. [12] One example of this inefficiency is to be found in the Cape Wind project, which would site 130 wind turbine generators (WTGs) off the coast of Cape Cod, Massachusetts.[see attachment A] A study by the Beacon Hill Institute found that despite subsidies equivalent to about half of the total costs, the project would be barely commercially viable.[13]

The principle we recommend is clear and clean: if GHG emissions are considered to have negative effects, the equivalent of an effluent charge should be charged, so firms and consumers internalize the negative effects of their actions and change their behavior accordingly. Nothing else is needed, especially as GHG emissions do not have local effects, but only operate at a worldwide level. This, coupled with the technical complexity of microregulation, helps explain why economists and policy makers tend to favor measures such as a tax on carbon use, or a GHG emission cap and trade program, which are broad in scope.[14]

There is an important corollary: ***any measures taken to reduce GHG emissions should be applied broadly***, and not single out a few large factories or power stations. Otherwise the law of unintended consequences will surely apply: for instance, if power stations have to reduce their GHG emissions but householders do not, then some households will switch their heating from electricity (now more expensive) to other fuels (heating oil, natural gas, coal, wood), with little if any net effect on GHG emissions.

To the extent that the EPA is hampered in applying market-driven solutions for regulation of U.S. GHG air emissions, it should seek the relevant statutory authority before introducing any rules related to GHG emissions. In contrast to the limitations of the Clean Air Act, the Safe Drinking Water Act appears to allow the necessary balancing of costs and benefits. A change in mindset will also be required, and ***we are not convinced that the EPA is the agency best suited, either by temperament or statute, to drive and implement policy related to GHG emissions.***

Fostering efficient adaptation versus costly mitigation

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cost approach. For a summary of some other studies see, for instance, Ton Tietenberg, *Environmental Economics and Policy*, 5th edition, Addison Wesley, 2006.

[11] ANPR 44355.

[12] Paul Joskow and Donald Marron. "What Does a Negawatt Really Cost? Evidence from Utility Conservation Programs," *Energy Journal*, 13(4): 41-74, 1992.

[13] Jonathan Haughton with Sarah Glassman and Michael Head. *Free but Still Costly: The Costs and Benefits of Offshore Wind Power in Massachusetts*, Beacon Hill Institute at Suffolk University, Boston MA, April 2008.

[14] ANPR 44380; Edward Lazear (Chairman, Council of Economic Advisers) and John Marburger III (Director, Office of Science and Technology Policy), writing to Susan Dudley, note, "The widespread support for such schemes… as carbon taxes, technology-neutral subsidies, or carbon trading schemes for GHG mitigation … is itself evidence for the impracticality of the array of regulatory mechanisms on which the ANPR seeks comment."

It is often cost-effective to help people adapt to climate change, rather than change the climate. Indur Goklany argues convincingly that the place to start is with market-oriented solutions that reduce barriers to economic growth and technical change (in both rich and poor countries), remove subsidies that raise energy use (such as agricultural supports, or land clearance subsidies), and attack climate-sensitive problems such as the provision of clean water or the elimination of malaria.[15] EPA's authority is ill suited to promoting or accounting for the benefits of adaptation.

2. Uncertainty and the Implications for Applying Benefits

We recommend:

2.1 Further research into clarifying the structural uncertainty inherent in climate sensitivity estimates.

2.2 Uncertainty should be incorporated into policy modeling exercises by attaching distributions to the key magnitudes, and not merely through sensitivity or scenario analysis.

2.3 EPA should pay as much attention to quantifying the costs of GHG abatement as it is paying to the benefits.

The need for better estimates of uncertainty in the climate sensitivity used in models

The uncertainty regarding the relationship between temperature and GHG emissions is at the center of the GHG policy debate. If we assume that current science is correct and that the relationship between GHG concentrations in the atmosphere and global warming is positive, then we need to identify the sensitivity of the climate to increases in greenhouse gas concentrations. The Intergovernmental Panel on Climate Change (IPCC) defines this climate sensitivity (CS) parameter in terms of the "the global average surface warming following a doubling of carbon dioxide concentrations."[16] The IPCC (2007) reports a mean estimate of 3°C for the CS parameter, with about a 90% probability that it is between 2ºC and 4.5ºC.

These numbers have recently been criticized as representing serious overestimates; figure 1 (from Monckton 2008) shows that over a period of 600 million years the atmospheric concentration of CO_2 has fallen far more dramatically than temperature;[17] and a recent post by Dr. Roy Spencer suggests that climate sensitivity may be no more than 0.5ºC based on recent peer reviewed papers.[18] At the very least, such estimates indicate that there is far more uncertainty about the size of the "forcing" effect of CO_2 emissions on climate change than the IPCC (and the US Climate Change Science Program)was willing to recognize. This is also consistent with the absence of a rise in global temperatures over the past decade, as shown in figure 2.

[15] Indur Goklany, "What to Do about Climate Change", *Policy Analysis*, 609, Cato Institute, Washington DC, February 2008.
[16] Quoted from Martin Weitzman, Structural Uncertainty and the Value of Statistical Life in the Economics if Catastrophic Climate Change" National Bureau of Economic Research, Working Paper no. 13490 (Cambridge, MA: 2007),2.
[17] See, for instance, Christopher Monckton of Brenchley, "Climate Sensitivity Reconsidered," American Physical Society, Physics and Society, July 2008. http://www.aps.org/units/fps/newsletters/200807/monckton.cfm
[18] Roy Spencer, « Global Warming : Has the Climate Sensitivity Holy Grail Been Found ? », http://www.weatherquestions.com/Climate-Sensitivity-Holy-Grail.htm

Figure 1. Fluctuating CO_2 but Stable Temperature for 600m Years

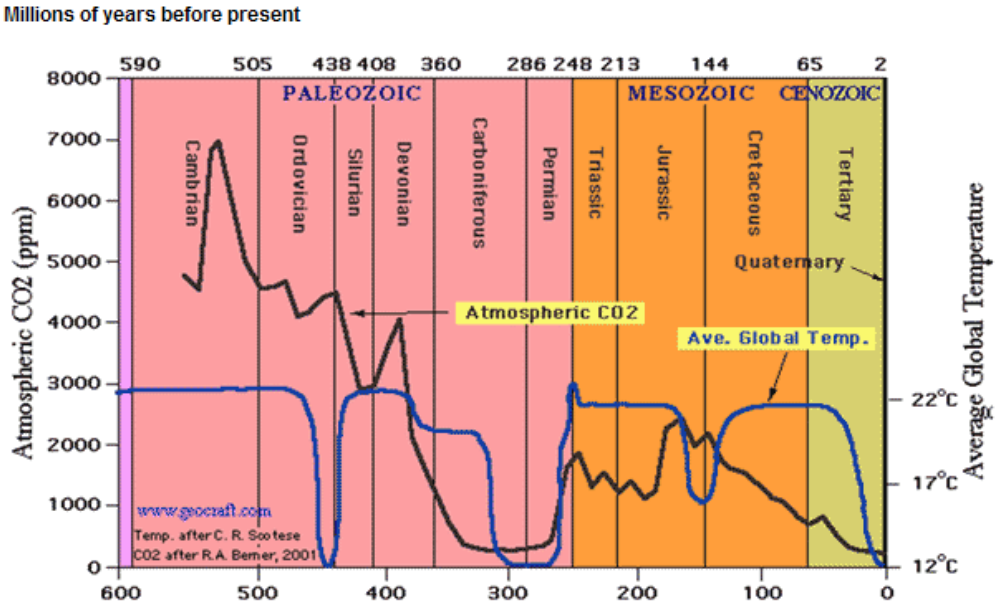
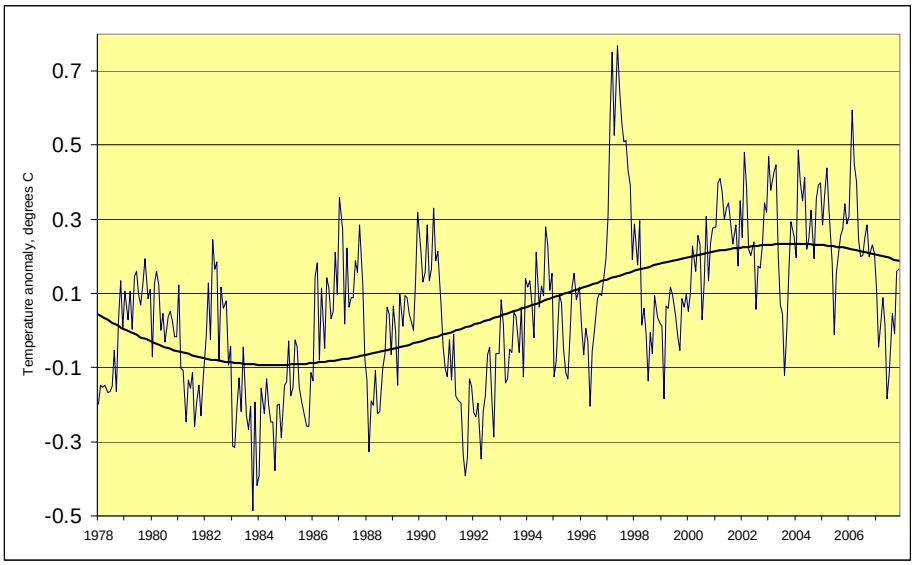


Figure 2. Temperature anomalies, globally, based on satellite data, 1978-2008[19]



If the relationship between the buildup of greenhouse gases and global warming is overestimated, then there is a risk that one might spend too much on abatement or adaptation costs, but if the relationship is underestimated, the envisaged GHG reductions might be too small. Either way, there are costs associated with making mistakes, which is why further information is crucially valuable.

[19] Hadley data, from the National Space Science and Technology Center, available at http://vortex.nsstc.uah.edu/public/msu/t2lt/tltglhmam_5.2 .

A robust response to this challenge is to ***accelerate the pace of scientific research in an attempt to provide better estimates of climate sensitivity based on observations*** The reduction or elimination of the uncertainty in the estimates of climate sensitivity would, in turn, reduce much of the uncertainty surrounding the other aspects of climate change, such as impacts of climate change and our adaptive responses. One might add that in order to satisfy the requirements of the Information Quality Act (IQA), the research must be done to U.S. standards, and existing U.S. models need to be independently evaluated before they can be used as a basis for concrete policy decisions.

The Benefits Technical Support Document reports estimates from meta-analysis of the peer reviewed literature produced by Tol, in which he estimates the density function for the sample of estimates.[20] But the EPA characterizes the estimates from the FUND model as "extremely preliminary,"[21] and it is curious that the EPA's Council for Regulatory Environmental Modeling (CREM) does not include the FUND model among the 120 that it currently lists.[22] At what point does EPA intend to expose the FUND model to the IQA requirements?

Uncertainty drives several analyses to focus on the low probability of high impact damages, such as a slowing or halting of the ocean circulation system, which helps to produce mild temperatures in some northern regions.[23] The analysts focus on the positive tail of the probability density function (PDF) of temperature change resulting from a doubling, or even tripling, of GHG concentrations. In a recent paper, Martin Weitzman contends that the Cost Benefit Analysis (CBA)

> "… of fat-tailed potential catastrophes is inclined to favor paying a lot more attention to learning how fat the bad tail might be and, if the tail is discovered to be too heavy for comfort after the learning process, is a lot more open to at least considering undertaking serious mitigation measures (including, perhaps, geoengineering in the case of climate change) to slim it down fat." [24]

Many researchers and proponents of implementing large GHG reduction polices today have echoed this premise. However, one must be cautious of taking Weitzman's analysis too literally. In his paper, he proposes that the "bad tail" could be large enough so that there is a 1% probability of a temperature change greater than 22.6°C due to a doubling of GHG gas concentrations. This is a possibility that the IPCC does not consider remotely possible.

In a critique of Weitzman's paper, Jim Manzi makes a compelling case that Weitzman's "bad tail" is far too pessimistic, writing that, to put this in perspective, "the average adult male in the US in about 5'9" tall; if this tail held for the distribution of male height in the US, there would be more than a million 40- foot-tall men walking around America."[25] Manzi also notes that Weitzman uses language and caveats that call into question the robustness of his results.

The point that Weitzman makes is that the deep structural uncertainty regarding climate change renders traditional CBA less scientifically conclusive. He sensibly calls for more research to "the deep uncertainty (which potentially permeates the economic analysis) concerning the less plausible scenarios located in the bad fat tail. Moreover, Weitzman calls for more research into "options for dealing with high-impact climate-change extremes."[26] ***We echo Weitzman's call for more research and clarity surrounding the structural uncertainty of global warming estimates based on greenhouse gas forcing.***

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[20] [20] Technical Support Document on Benefits of Reducing GHG Emissions, U.S. Environmental Protection Agency June 12, 2008 ,12.
[21] Ibid, 14.
[22] http://cfpub.epa.gov/crem/knowledge_base/crem_results.cfm?Act
[23] U.S. Congress, Congressional Budget Office; "Uncertainty in Analyzing Climate Change: Policy Implications;" January 2005, p.10.
[24] Weitzman, 34.
[25] Jim Manzi, "Weitzman: Formalism Run Amok"; Internet; available at http://theamericanscene.com/2008/01/04/weitzman-formalism-run-amok.
[26] Weitzman, 35

Why Monte Carlo simulation, not just sensitivity or scenario analysis, is needed

In the absence of better estimates of climate sensitivity, one still needs to be able to estimate the costs and benefits of GHG mitigation and adaptation policies. The EPA recommends providing a range of cost and benefit estimates as well as the potential implications of non-monetized and non-quantified benefits.

Providing a range of costs and benefits would, however, be an incomplete method of treating uncertainty. The EPA used this method in running the Climate Framework for Uncertainty, Negotiation and Distribution (FUND) integrated assessment model. The modelers simply ran a series of six simulations for both global and domestic estimates of marginal benefits of GHG reduction using different assumptions about future emissions and discount rates. The researchers fail to attach a probability or likelihood to the FUND model simulations, which, as stated above, is incomplete.[27]

One should instead attach probabilities to all the key parameters and relations in order to generate estimates of the expected value of benefits and costs and their associated distribution. This can be accomplished by running Monte Carlo simulations that involve running a model many (ten thousand or more) times with parameter values randomly drawn from assumed probability distributions. The simulations reveal the range of possible outcomes and the likelihood of those different outcomes. This method is dependent on accurately selecting the probability density function (PDF) and the absence of data or knowledge, particularly in the tails of the distribution, can make the selection difficult.[28] The development of this data requires complete transparency and public comment before any modeling can proceed.

Pay attention to GHG abatement costs as well as benefits

The approach taken by the EPA to the measurement of costs is, in places, utterly naïve. The ANPR argues that emission standards for new motor vehicles would more than pay for themselves in fuel savings, and would yield net benefits to consumers even without factoring in any effects on the climate.[29]

If this were indeed the case, then why the need for regulation? Surely consumers would seize the opportunity to save money without any further prompting. Of course what is being left out here is any consideration of the value that consumers place on automobile performance and safety, both of which risk being compromised by tighter emissions standards. Where in EPA's CAA authority can it account for balancing measurable public safety benefits called for in E.O. 13432?

The belief that there are opportunities to reduce emissions at zero cost, or even making a profit in the process, is surprisingly widespread, and is invariably incorrect. The Beacon Hill Institute has produced a series of reports that take issue with such claims.[30][See Attachments]

More generally, the ANPR underplays the costs of reducing GHG emissions. As we note elsewhere, the costs can be very large. Even a comparatively modest proposal can be pricey: William Nordhaus would phase in GHG limits slowly, with costs of control starting at 0.3 percent of GDP in 2010 and peaking at 0.9% of GDP in 2065. Even this implies a net present value of controls of $2 trillion; he estimates that it would reduce climate change damages by $5 trillion, but that there would still be damage of $17 trillion that would not be worth trying to mitigate.

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[27] Benefits Technical Support Document , 13.

[28] Martin Weitzman, "On Modeling and Interpreting the Economics of Catastrophic Climate Change" ReSTAT Final Version; July 7, 2008; Internet Available at http://www.economics.harvard.edu/faculty/weitzman/papers_weitzman;34

[29] ANPR 44441.

[30] For instance, David Tuerck, Paul Bachman, Alfonso Sanchez-Penalver, and Michael Head. *The Economics of Climate Change Legislation in North Carolina*, Beacon Hill Institute at Suffolk University, April 2008.

The ANPR also ignores the option of adaptation. It may sometimes be cheaper to help people adapt to climate change than to try to alter the climate. The most important adaptation is to encourage economic growth. A richer, more technologically advanced world would be better equipped to engage in emissions mitigation policies as well as better adapt to climate change. In addition, evidence points to the fact that once wealthier societies are convinced of a problem, they respond quicker, spend more and have a higher level of environmental protection than poorer societies.[31] Barring the current economic crisis, the world will have more resources and better technology to mitigate emissions and adapt to warmer climate in 20 years than today.

The essential point here is that, ***while the*** *Benefits Technical Support Document* ***focuses mainly on estimating the benefits of GHG abatement, the many costs of abatement – direct and indirect – should receive the same consideration and treatment as benefits, as should the costs and benefits of spending on adaptation.***

For example, suppose resources are diverted from research in the healthcare sector to GHG reduction in the energy sector. This would reduce the pace of technological advance in healthcare, and thus slow the development of new treatments and, ultimately, cause suffering and cost lives that may have been prevented in the absence of the resource reallocation. Furthermore, it may be more beneficial to increase resources devoted to healthcare research because any advancements may help society adapt to a warmer world that might include more incidence of tropical disease at the same time the advancements could help current residents in tropical areas. This could be a better use of scarce resources.

According to Circular A-4 from OMB, in the treatment of non-quantifiable or non-monetized factors, the analysis should include all relevant quantifiable info and a description of the unquantified effects.[32] Moreover, the OMB states that "For cases in which the unquantified benefits or costs affect a policy choice, you should provide a clear explanation of the rationale behind the choice" and "include detailed information on the nature, timing, likelihood, location, and distribution of the unquantified benefits and costs."[33] This is sound advice.

The pace and timing of technological change can indeed dramatically affect the level and cost of GHG emissions. However, one ought to be careful in assuming the links between policies aimed at stimulating technological change and the timing and pace of technological advancement. The assumption that if firms are forced to use new technologies their cost will automatically fall enough does not always hold. Some technologies never become cheap enough and thus are abandoned. Nevertheless, public and private spending on basic research on technological change can lead to dramatic technological innovations, though often the particular applications that result are in completely different fields.

3. Use of the FUND Model for the Basis of Policy Analysis

BHI believes that:

3.1 The FUND model does not provide an adequate basis for modeling the effects of government policies on climate change – it is mechanistic, does not handle uncertainty well, and lacks endogenous behavioral responses.

3.2 A better approach would be to base policy analysis on a modified version of the DICE Model, which endogenizes the effects of GHG abatement on economic growth.

The inadequacy of the FUND model for GHG policy analysis

[31] Indur M Goklany; "Is a Richer-but-Warmer World Better Than Poorer-but Cooler Worlds"; presented at the North American Conference of the USAEE/ISAEE (Denver: September 18-21, 2005) 1037.
[32] http://www.whitehouse.gov/omb/circulars/a004/a-4.html;
[33] Ibid

The EPA's estimates of the extent of the benefits and costs of GHG emissions are heavily based on the FUND model, although the EPA does characterize the model as "preliminary".

The FUND model assumes baseline trajectories for population and per capita income, making income exogenous. In the model, GHG abatement has costs, but may generate benefits in future years in the form of higher output from agriculture and forestry, higher (or perhaps lower) costs of energy for cooling and heating, greater biodiversity, improved human health, and less damage from storms. The model is used to generate measures of the marginal benefits from GHG abatement, under different assumptions about which benefits are taken into account (global or domestic), the extent of expected climate change and levels and growth of income (low/central/high), and varying discount rates.

The results vary widely; at a 7% discount rate, the "central" cost assumption finds that GHG abatement has a **net cost** of $\$1/tCO_2$ in 2022 (in 2006 prices) at the Global level; at a 2% discount rate, using the high cost variant, GHG abatement would bring **net benefits** of $\$1,083/tCO_s$.

The FUND model is unsatisfactory in several respects:

- It is an engineering-based model that is essentially mechanical in nature. As such,
  - It does not allow behavior to change in response to policy. For instance, in practice innovation responds to higher prices, but the model does not allow for induced innovation of this nature.[34]
  - It does not allow for macroeconomic effects; yet the use of resources for GHG abatement is likely to reduce directly productive investment and so slow down the *growth* of income over time.
- It is a forecasting rather than a policy model, and so could not easily handle the effects of, for instance, the introduction of a carbon tax, or the tradeoffs between spending on GHG abatement vs. measures to increase adaptation.to global warming.
- It does not handle uncertainty adequately. There is uncertainty at every level, over the costs of GHG abatement, the reaction of agriculture, of forestry, of storms, of the value put on diversity, and so on. A standard approach to incorporating such uncertainty would be to attach distributions to the (many) parameters in the model. This could, and should, be done, and would represent a serious advance over the approach taken to date, which is to present a few possible scenarios without regard to probability.
- The model does not deal with the effects of GHG abatement on the structure of national production, or the effects on trade and competitiveness (leakage).
- The FUND model assumes that the health effects of global warming would be negative. This is far from obvious: more people die in winter than summer!
- The model does not include any measure of the potential recreational benefits of a warmer climate.

Better policy models are available

There are now numerous available models on climate policy. The Dynamic Integrated model of Climate and the Economy (DICE model) presents one alternative approach to addressing these issues. Even though it considers population growth as exogenous, it considers income to be endogenous and accounts for a tradeoff of current income for future income. The scope of the DICE model is global, since it aggregates different countries into a single level of output, capital stock, technology and emissions.

In the DICE model, different policies are evaluated on the basis of their contribution to the economic consumption of different generations. The DICE model does not, however, allow for endogenous technological improvement, via research and development programs, across time. Technology deployment is a critical missing element that must be addressed by any model used by EPA.

[34] For a good discussion of endogenous technical change in the energy sector, see David??? Popp, "Induced Innovation And Energy Prices," *American Economic Review*, 2002, 92: 160-180.

Thus the DICE model presents a sounder economic framework in which to analyze the economic effects of GHG emissions reduction policies than the FUND model. It is, therefore, our recommendation that EPA to discard the FUND model as its sole evaluation tool and direct its attention towards the DICE model, or some model that follows similar assumptions. Indeed a strong case can be made for drawing on a variety of models when modeling the effects of policies related to an issue as important as GHG abatement. The EPA is well aware of this; in its analysis of the Lieberman-Warner Climate Security Act of 2008 it applied two economy-wide computable general equilibrium models – the Applied Dynamic Analysis of the Global Economy (ADAGE) model, and the Intertemporal General Equilibrium Model (IGEM) – as well as its proprietary Integrated Planning Model.[35] Any future analysis must be conducted with models that fully comply with the IQA.

4. Use of Discount Rates…

We suggest that

- **4.1 Projects related to GHG abatement be evaluated using a discount rate that is an appropriately weighted average of the rate of return on capital (historically about 7%) and the social rate of time preference (historically about 3%), which would represent only a minor adjustment to current practice.**
- **4.2 The case for using a very low discount rate in GHG abatement projects, however seductive, is very weak.**
- **4.3 Recent legislative proposals for reductions in GHG emissions – of 60% to 80% below 1990 levels by 2050 – are likely to be hugely expensive**

Current OMB-inspired policy on discounting could be improved

Current policy on discounting for cost-benefit analysis is set out in OMB Circular A-4 of September 17, 2003.[36] At one extreme, capital used in projects may reduce investment in other (private) projects, denying society a real rate of return on that capital. Historically, the pre-tax average real rate of return to capital has been about 7%, and the OMB recommends that analysts use this rate in their analysis.

Alternatively, capital used in projects may call forth more saving; individuals are compensated for their patience by being paid a real after-tax "social rate of time preference." The OMB puts this rate at about 3%,[37] and suggests that projects also be evaluated at this rate.

The most coherent approach, and the one we favor, is that proposed by Arnold Harberger, who proposes that one typically use a weighted average of the real return on capital and the social rate of time preference, with the weights reflecting the relative elasticities of demand for investment and supply of savings.[38]

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[35] The Applied Dynamic Analysis of the Global Economy (ADAGE) model was developed and is run by RTI International; see http:///www.rti.org/adage . The Intertemporal General Equilibrium Model (IGEM) was developed and is run by Dale Jorgenson Associates; see http://post.economics.harvard.edu/faculty/jorgenson/papers/papers.html .Information on the Integrated Planning Model may be found at http://www.epa.gov/airmarkets/progsregs/epa-ipm/index.html . The basic reference here is US Environmental Protection Agency, Office of Atmospheric Programs: EPA Analysis of the Lieberman-Warner Climate Security Act of 2008, March 14, 2008.

[36] Office of Management and Budget, *Circular A-4*, September 17, 2003.

[37] Between 1973 and 2003 the yield on 10-year Treasury notes averaged 8.1%; adjusted for the average CPI inflation of 5% p.a. during this period gives a real rate of about 3%.

[38] Arnold Harberger and Glenn Jenkins, *Manual on Cost Benefit for Investment Decisions*, Queen's University, Kingston, Ontario, 2002. See too Arnold Harberger, *Project Evaluation*, University of Chicago Press, 1976.

Why discount rates should not be unduly low

This approach is also appropriate for decisions related to GHG abatement. The point needs emphasis, because some influential discussions – most notably the *Stern Review on the Economics of Climate Change* – have argued that future generations should be accorded essentially equal consideration – this implies that their utility should be discounted at a rate close to zero (the *Stern Review* uses 0.1%) – and the elasticity of marginal utility with respect to consumption is low (the *Stern Review* typically uses 1).[39]

This latter position, using especially low discount rates for long-lived projects, is untenable; it creates a conflict between discounting within generations and between generations, and is inconsistent with observed interest rates. Nordhaus, in his discussion of the *Stern Review*, points out that the low discount rates used in that report, along with elasticities, imply that it would be worth reducing world income for a year now from $10,000 to $4,400 per person in order to prevent a permanent reduction in incomes from $130,000 to $129,870 starting in 2208.[40] Clearly this is an absurd conclusion.

The cost of large GHG emission cuts is likely to be too high

Because of the low discount rates it uses, the *Stern Review* would put in place a tax of $350 per ton of carbon in 2015, rising to $650 by 2050.[41] This is in stark contrast with the more sensible results of the DICE model, which would put a tax on carbon of $35 per ton in 2015 (about $10 per tonne of CO_2, equivalent to between $14 and $28 per ton of coal), and $85/tonne of carbon by 2050.[42]

The optimized path implied by the DICE model would reduce emissions by 14% in 2015 and 25% by 2050, while the *Stern Review* would reduce emissions by 53% in 2015. These are not small differences, although most recent legislative proposals have also called for dramatic reductions in GHG emissions, as shown in the table. ***It follows that current legislative proposals all look too draconian, and hence too expensive.***

The EPA is aware of the high costs of such proposals, but one would not know that from reading the ANPR. A striking example is its analysis of the Lieberman-Warner Climate Security Act of 2008 (S.2191), which would reduce US GHG emissions by about 25 percent by 2050, relative to 1990 levels.[43] The EPA estimates that the proposal, which would put in place a cap and trade program for GHG emissions, would reduce GDP by between 2.4% and 6.9% by 2050 – that represents a total of between $1.0 and $2.9 trillion – relative to its baseline; by then, household average consumption would be about $4,377 lower than baseline. The costs would be about $1.2 trillion over the period 2009-2018.[44] Even these numbers may be optimistic, as they assume that nuclear power, and coal powerplants using carbon capture and storage, would be extensively deployed by 2020; if not, the costs would be over 80% higher than those reported here.

Legislation	Year	Proposed reduction in GHG emissions by 2050:
Lieberman-McCain	2007	60% below the 1990 level
Kerry-Snowe	2007	65% below the 2000 level
Sanders-Boxer	2007	80% below the 1990 level
Waxman	2006	80% below the 1990 level

[39] If consumption rises by 10% and as a result the marginal utility of consumption falls by 10%, then this elasticity equals 1.
[40] Nordhaus, William D.; "A Review of the Stern Review on the Economics of Climate Change;" *Journal of Economic Literature*, vol. 45, issue 3, pp. 686-702; September 2007.
[41] *Ibid*, p. 698.
[42] The mean mine-head price of coal in the US was $26/ton in 2007. A tax of $35 per tonne of carbon would be equivalent to between $14 and $28 per tonne of coal, depending on the type of coal.
[43] EPA Analysis of the Lieberman-Warner Climate Security Act of 2008.
[44] Robert Shackleton , CBO's Assessment of America's Climate Security Act of 2007 (S.2191), Presentation to the U.S. Chamber of Commerce ,Congressional Budget Office, April 25, 2008

Feinstein	2006	70% below the 1990 level
Lieberman-Warner	2007	70% below the 2005 level

Source: Paltsev et al. 2007.

The EPA was able to do sophisticated modeling of a cap and trade proposal, but there is no equivalent analysis attached to the ANPR. Yet such effort must be made to estimate the cost of compliance under the proposed regulation under the CAA, along with the associated uncertainties about such important factors as which technologies will be available (e.g. for carbon capture, auto efficiency) and which energy sources are realistic candidates for near term expansion (e.g. will nuclear power overcome the strong opposition from activist groups).

5. The Presence of Bias in Statements and Literature Selection

We note:

5.1 That there is a bias in the tone and text of the EPA's ANPR that appears to presume that anthropogenic global warming is a serious problem and the only remaining issue is how to solve it effectively;

5.2 This bias leads to an understatement of the costs of GHG abatement, and inadequate attention to the uncertainties on both the benefit and cost sides.

Bias in tone

The Federal Register and the Benefits Technical Support Document presents numerous examples of language that is biased towards (1) the benefits of GHG emissions reduction, (2) an endangerment finding, (3) the risk of catastrophic events due to rising global temperatures and (4) neglecting to explore the role of societies' ability to makes adaptive responses to climate change. The language tends to under-emphasize the social costs of GHG emission mitigation policies and the possibility that the relationship between GHG emissions and global average temperatures is being overestimated. Here is a sampling:

EPA: "*The IPCC goes on to note that climate sensitivity is "very unlikely" to be less than 1.5°C and "values substantially higher than 4.5°C cannot be excluded." IPCC WGI (2007).*"[45]

> **BHI:** Putting these two tails on an equal footing is misleading: According to IPCC, "very unlikely" is a (probability) P < 10%, but the term "cannot be excluded" is not defined precisely. Is it P < 1% or P < 0.5%, or even P < .005%? Without accompanying probability values it is inappropriate to mention these two tails in the same breath. Recent peer review studies that became available since the IPCC report was prepared suggest that the climate sensitivity range is centered below the low range of the IPCC (less than 1.5). This development has profound implications for every model that EPA uses to assess "endangerment".

EPA: "*We seek comment on how the potential for some benefits [of climate change] GHG should be viewed against the full weight of evidence showing numerous risks and the potential for adverse impacts.*"[46]

> **BHI:** The EPA appears to dismiss the positive impacts that some regions would experience under climate change by using the phrase "potential for *some* benefits" while over emphasizes the negative impacts by using the phrase "full weight of evidence" and "potential for adverse impact." By using this phrasing, the EPA appears to disregard the previous discussion of "how to handle uncertainty in

[45] Technical Support Document on Benefits of Reducing GHG Emissions, 13.
[46] Federal Register, 44427.

benefits and costs calculations and application, given the quantified and unquantified uncertainties."[47] The benefits from climate change in some regions, such as higher crop yields due to longer growing season and increased rainfall, fewer deaths due to the cold, and lower heating costs, are at least as certain or uncertain as the "numerous risks and the potential for adverse impacts."

Understatement of abatement costs

EPA: What Reductions Could Be Achieved From Efficiency Improvements at Existing Sources? Here is what the EPA writes:

> "*Recognizing that existing sources do not have as much flexibility in the levels of control that may realistically be achieved at a new source, a section 111(d) standard regulating GHG from existing sources would at this time most likely focus on currently available measures to increase the energy efficiency at the facility, thereby reducing GHG emissions. Examples of typical measures that promote energy efficiency include the use of cleaner fuels and equipment replacement or process improvements which reduce energy consumption. How well a measure, or combination of measures, will reduce GHG emissions at an individual facility will vary. A review of available literature suggests a range of improvements for various industry sectors that may be achievable through energy and process efficiency improvements, and some representative examples are summarized below. This information is illustrative, and does not represent any final technical determination by the agency as to what emission reduction requirements might be appropriate to require from the source categories discussed below.*"[48]

BHI: With its talk of "emission reduction requirements … [by] source categories", the mindset here is one of microregulation of the command and control variety. The subtext here is that energy conservation, such as "process improvements which reduce energy consumption", is likely to be essential and should be straightforward.

We caution that this optimism is misguided, and "negawatts" are not cheap, as Joskow and Marron found in their study of utility conservation programs.[49] Many recent studies contain wildly optimistic estimates of gains that can be made from energy efficiency programs, by using unrealistic assumptions, failing to account for the interaction between policies and thus double counting the efficiency gains, and making other methodological mistakes.[50]

EPA: "*In uncertain situations such as that associated with climate, EPA typically recommends that analysis consider a range of benefit and cost estimates, and the potential implications of non-monetized and non-quantified benefits.*"[51]

BHI: There appears to be no consideration for non-monetized and non-quantified costs or an attempt to explore the unintended consequences of GHG mitigation polices. The ANPR language again is biased toward identifying benefits over costs.

6. Consideration of Global Benefits of GHG Emissions Reduction

[47] Federal Register, 44415
[48] Federal Register, 44491.
[49] Joskow and Marron, "What does a *negawatt* really cost?".
[50] See Robert Stavins, Judson Jaffe, Todd Schatzki; "Too Good to be true? An Examination of Three Economic Assessments of California Climate Change Policy;" National Bureau of Economic Research; Working Paper 13587; (Cambridge, MA: November 2007). Also, see [50] Minnesota Climate Change Advisory Group. "Minnesota Climate Change Advisory Group Final Draft Report," Appendix I (February 2008): http://www.mnclimatechange.us/MCCAG.cfm and North Carolina Climate Action Plan Advisory Group, "Recommended Mitigation Options for Controlling Greenhouse Gas Emissions," Draft Final Report (October 2007).
[51] Preamble, 144.

We recommend that

6.1 If the EPA is to play any role in global GHG abatement measures, it must coordinate with the State Department and other entities responsible for international relations.

When a government agency considers the benefits and costs of applying a certain policy, it must primarily consider the benefits and costs that such policy has on its own region (country, state, province, etc…). It is not appropriate to consider the benefits that the policy would have on another region, unless it is to estimate how those benefits would affect the benefits for the original region.

Since global climate is a global public good, there is a free-rider issue with GHG emissions reduction policies. If the U.S. spends money on GHG emissions reduction, this will provide an incentive for Canada to spend less money on it, since it will get the benefit of the U.S. investment. A lower Canadian reduction will, in turn, reduce the expected benefits of the U.S. investment and it is this second effect the one that should be considered when estimating the benefits to the U.S. of the policy. When analyzing whether the U.S. should enact the policy, the direct benefits to Canada should not be considered.

Some of these issues could be analyzed using, for instance, the MiniCAM model, as was done in the EPA's analysis of the Bingaman-Specter Low Carbon Economy Act of 2007 (S.1766).[52] Unfortunately, no such analysis is presented for the ANPR. That report examined a number of scenarios that made unrealistic alternate assumptions about international actions on emissions that might be taken by China, India, and Russia.

The assumptions one chooses make a huge difference: if the U.S. were to reduce economy-wide GHG emissions under S.1766 and other countries were not, then atmospheric CO_2 concentrations in 2095 would be 696 ppm, or 23 ppm below the reference case. But if all countries (including China and India) were to make efforts to reduce economy-wide GHG emissions, then CO_2 concentrations in 2095 would be 491 ppm. The total effective concentration must include the effects of the non-CO2 emissions (methane, nitrous oxide, etc). The additional impact is another ~110 ppm CO2 equivalent for a total of ~800-600 ppm. With or without international cooperation, the effects of emissions reductions from new U.S. motor vehicles (the focus of the ANPR) on the global concentrations would be negligible (~ 0.1 ppm) and within the margin of error for assumptions of emissions growth in China alone. In the ANPR, EPA appears to equate GHG emissions with GHG concentrations, which is a gross error. EPA cannot justify any action based on the *de minimus* impact on global greenhouse gas concentrations.

It is worth noting that forecasts of future emissions are highly unreliable. The EIA International Energy Outlook 2004 predicted that China's emissions would exceed those of the U.S. by 2030, but in fact China overtook the U.S. in 2007. Without acceptably accurate forecasts for international emissions and the resulting concentrations of greenhouse gases, it is difficult for the EPA to measure the extent of "endangerment" resulting from the emissions from new more efficient U.S. motor vehicles, which would be needed to trigger emission controls.

[52] EPA-Office of Atmospheric Programs. EPA Analysis of Bingaman-Specter Request on Global CO_2 Concentrations, October 1, 2007. See http://www.epa.gov/climatechange/downloads/s1766analysispart1.pdf .