

**STATEMENT TO THE
COMMITTEE ON GOVERNMENT REFORM
OF THE UNITED STATES HOUSE OF REPRESENTATIVES**

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How much longer do you think it will take before [the nation's climate researchers] are able to hone [their] conclusions down to some very simple recommendations, on tangible, specific action programs that are rational and sensible and cost effective for us to take . . . justified by what we already know?¹

Representative James Scheuer (D-NY), 1992

Clearly, it's time for some radical ideas about solving global warming. But where's the radical realism when we need it?²

Katherine Ellison, 2006

I thank the Chairman and the Committee for the opportunity to offer testimony this morning on "Climate Change: Understanding the Degree of the Problem."

My name is Roger Pielke, Jr. and I am a Professor of Environmental Studies at the University of Colorado where I also direct the CIRES Center for Science and Technology Policy Research.³ My research focuses on the connections of science and decision making. I have been studying climate change science and policy for about 15 years. A short biography can be found at the end of my written testimony, including links to my publications. In my oral testimony I'd like to highlight eight "take home points," which are developed in greater detail in my written testimony and in the various peer-reviewed scientific papers cited therein.

¹ House Committee on Science, Space, and Technology, 1992. Hearing on U.S. Global Change Research Program, May 5, Committee Report 102-148, at p. 88.

² Ellison, K. 2006. Turned off by global warming, *The New York Times*, Late Edition - Final, Section A, Page 13. <http://select.nytimes.com/gst/abstract.html?res=F60B17FA385A0C738EDDAC0894DE404482>

³ CIRES is the Cooperative Institute for Research in Environmental Sciences, a joint institute of the University of Colorado and the National Oceanic and Atmospheric Administration. The Center that I direct has received research funding from a number of other federal research agencies, including NSF and NASA. As can be gleaned from the citations, much of the work presented here that I have been involved in has benefited from collaboration with Daniel Sarewitz of Arizona State University. The views presented here are my own.

Abstract: The main message of my testimony is that the questions about what actions on climate change make sense in the short –term raised in the italicized quotes above remain largely unanswered, and that until we better organize the climate science and technology enterprise to focus on policy options for the short term, the climate debate is likely to remain in its present gridlock. Policies that address climate change – both mitigation (focused on modulating future climate via greenhouse gas emissions) and adaptation (focused on managing the impacts of climate events by increasing resilience and reducing vulnerabilities) -- have both long-term and short-term effects. To date climate policy has focused primarily on the long-term, and so too has research supported to inform policy. As a consequence, too little attention is paid to policy options and technological alternatives that might make sense in the short-term. One reason for the oversight of the short-term is the intellectual gerrymandering of the climate change issue at the international level to focus extremely narrowly on greenhouse gases and their effects. Billions of dollars of public investments in climate science and technology might be reoriented to better serve the needs of decision makers grappling with climate change, which will be a policy issue for decades to come, by focusing on policies that make sense in the short term as well as long term.

Take Home Points

1. Human-caused climate change is real and requires attention by policy makers to both mitigation and adaptation – but there is no quick fix; the issue will be with us for decades and longer.
2. Any conceivable emissions reductions policies, even if successful, cannot have a perceptible impact on the climate for many decades.
3. Consequently, costs (whatever they may be) are borne in the near term and benefits related to influencing the climate system are achieved in the distant future.
4. However, many policies that result in a reduction in emissions also provide benefits in the short term unrelated to climate change.
5. Similarly adaptation policies can provide immediate benefits.
6. But climate policy, particularly international climate policy under the Framework Convention on Climate Change, has been structured to keep policy related to long-term climate change distinct from policies related to shorter-term issues of energy policy and adaptation.
7. Following the political organization of international climate change policy, research agendas have emphasized the long-term, meaning that relatively very little attention is paid to developing specific policy options or near-term technologies that might be put into place with both short-term and long-term benefits.
8. The climate debate may have begun to slowly reflect these realities, but the research and development community has not yet focused much attention on developing policy and technological options that might be politically viable, cost effective, and practically feasible.

Discussion of the 8 Take-Home Points

- 1. Human-caused climate change is real and requires attention by policy makers to both mitigation and adaptation – but there is no quick fix; the issue will be with us for decades and longer.**

Nothing in this testimony should be interpreted as contradicting the assessment of climate change science provided by Working Group I of the Intergovernmental Panel on Climate Change (IPCC).⁴ The IPCC has concluded that greenhouse gas emissions resulting from human activity are an important driver of changes in climate. And on this basis alone I am personally convinced that it makes sense to take action to limit greenhouse gas emissions. Of course, the answer to “what action?” is not at all straightforward. (e.g., on what timescales, at what costs, with what consequences, with what foregone opportunities? etc.) One of the important messages of the IPCC is that there is no quick fix to issues of climate change. In its most recent report the IPCC concluded, “Anthropogenic climate change will persist for many centuries.”⁵ More recent research has concluded that even under a hypothetical instantaneous curtailment of emissions, the world is committed to some degree of climate change into the future.

Note that throughout this testimony I use the phrase “climate change” as defined by the IPCC⁶ to mean: “a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.”

The IPCC defines “climate variability” to mean: “variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability).”

Under the IPCC definitions both climate change and variability have human and non-human elements, and the human element goes beyond greenhouse gases to include other sources of human influences on the climate system (such as the effects of aerosols and land use changes). Clearly explicating these definitions are important because the Framework Convention on Climate Change uses a different and much narrower definition of climate change that is focused only on the marginal effects of greenhouse gas emissions on the climate system. The different definitions profoundly affect climate policy and the relationship of research and policy, which I discuss below under take-home point #7.

⁴ <http://www.ipcc.ch>

⁵ <http://www.ipcc.ch/pub/spm22-01.pdf> at p. 17

⁶ http://www.grida.no/climate/ipcc_tar/wg1/518.htm

2. Any conceivable emissions reductions policies, even if successful, cannot have a perceptible impact on the climate for many decades.

At a Senate hearing on climate change science and economics held one year ago, James Hurrell of the U.S. National Center for Atmospheric Research, made a very important observation about the timescale of the benefits of mitigation policies for altering climate behavior: “it should be recognized that mitigation actions taken now mainly have benefits 50 years and beyond now.”⁷ And Science magazine reported earlier this year, “The wheels of global climate change are in motion, and there is little we can do to stop them, at least in the short-term”⁸ The long lead time until mitigation could have a perceptible effect on the climate systems seems to have been well appreciated by scientists and policy analysts, but seems to be less well appreciated in public and political debate over climate policy.

Scientists sometimes tend to overshadow this important point by talking about “scenarios” for future emissions rather than actual policies that lead to particular outcomes. Such scenarios have an important role for shaping thinking and research on the range of possible futures. At the same time, it is quite easy to postulate various alternative scenarios for future emissions that lead to changes in global temperature in future decades discernibly different than business as usual. It is of course similarly quite easy to discuss various rosy “scenarios” for global poverty, democracy in Iraq, or the future state of the deficit. What matters for real-world outcomes are not future scenarios but concrete, practical policy actions that lead to desirable outcomes.

From this perspective, for all of the bluster about the Kyoto Protocol, its implementation is much more about symbolism and setting the stage for future policy action rather than any significant effect on the climate system. Economist William Nordhaus of Yale University wrote recently that “the Kyoto Protocol is widely seen as somewhere between troubled and terminal. . . Even if the current Protocol is extended, models indicate that it will have little impact on global temperature change. Unless there is a dramatic breakthrough or a new design, the Protocol threatens to be seen as a monument to institutional overreach.”⁹

According to Oxford’s Steve Rayner the focus on Kyoto has distracted attention from other possible approaches,

Unfortunately, support for Kyoto has become a litmus test for determining those who take the threat of climate change seriously. Between Kyoto’s supporters and those who scoff at the dangers of leaving greenhouse gas emissions unchecked, there has been a tiny minority of commentators and analysts convinced of the

⁷http://energy.senate.gov/public/index.cfm?FuseAction=Hearings.Testimony&Hearing_ID=1484&Witness_ID=4227

⁸<http://www.aaas.org/news/releases/2005/0318scipak.shtml>

⁹<http://www.fpif.org/fpiftxt/3167>

urgency of the problem while remaining profoundly sceptical of the proposed solution. But their voices have largely gone unheard.¹⁰

Nordhaus would seem to agree on this point: “Nations are now beginning to consider the structure of climate-change policies for the period after 2008-2012. Some countries, states, cities, companies, and even universities are adopting their own climate-change policies. Are there in fact alternatives to the scheme of tradable emissions permit embodied in the Protocol? The fact is that alternative approaches have not had a serious hearing among natural scientists or among policymakers.”

Experience indicates that even those countries expressing strong support for emissions reductions face difficulties achieving those reductions in practice. Tim Dyson from the London School of Economics has offered a sobering view of such “climate realism”:

“... in the last decade or so virtually all countries have continued to burn greater amounts of fossil fuel. This also applies to those that have arguably been most prominent in supporting the Kyoto process - notably Canada, Japan and those of the EU. Many of these countries are unlikely to meet their CO₂ reduction targets agreed under the Kyoto treaty (which finally came into force in 2005). Thus comparing 1990 and 2002, it is estimated that Canada's emissions increased by 22 percent and Japan's by 13. While the CO₂ emissions of the EU(15) remained roughly constant, this was mainly due to reductions in Germany and Britain - both of which gained fortuitously from a move away from coal towards natural gas (which emits less CO₂ per unit of energy). Of the remaining countries in the EU(15), only Sweden - which relies heavily on hydro and nuclear - registered a fall in CO₂ emissions. Of the 36 'Annex B' countries of the Kyoto treaty (i.e. the industrialized countries, including former eastern bloc nations), only 12 experienced declines in emissions: the three in the EU(15), plus nine former eastern bloc nations. If one excludes these, then CO₂ emissions among the remaining 24 Annex B countries rose by 13 percent during 1990-2002 (Zittel and Treber 2003). Of course, the United States, the world's largest emitter of CO₂, is not a signatory to the Kyoto treaty. And, to complete the list of predictable social reactions, the 'Kyoto process' has involved no shortage of rather bitter recrimination between representatives of the US and EU countries.”¹¹

¹⁰ Rayner, S. 2004. Memorandum to: The Environmental Audit Committee House of Commons The international challenge of Climate Change: UK leadership in the G8 and EU, 24 September, <http://sciencepolicy.colorado.edu/prometheus/archives/EAC%20memo%20fin.doc>

¹¹ Dyson, T. 2005 "On development, demography and climate change: The end of the world as we know it?" London School of Economics, Paper prepared for Session 952 of the XXVth Conference of the International Union for the Scientific Study of Population, Tours, 18-23 July, 2005. <http://iussp2005.princeton.edu/download.aspx?submissionId=50222> Compare, In 1995, Pekka E. Kauppi wrote presciently in *Science* that the goal of the Framework Convention on Climate Change to prevent “dangerous interference” in the climate system was either “unattainable or irrelevant If [climate model] projections are right, the climate will change, there will be dangerous effects and the Convention objective will be unattainable” (in *Science*, 220:1454).

The bottom line is that with respect to modulating the behavior of the climate system current greenhouse gas mitigation policies being (discussed or implemented) are more symbolic than substantive. A number of observers believe that focusing on such policies has limited the scope of discussions about alternative policies that might show greater substantive outcomes. Advocates for action have limited discussion of alternatives by asserting that, for all of their flaws current approaches are merely “first steps” and a discussion of options might diminish political momentum for action. Of course, opponents to action don’t wish to discuss policy options in the first place. As discussed below, action on adaptation has been a victim of the institutionalization of climate policy, which shows a strong bias in favor of mitigation over adaptation. But even with a pace of emissions reductions that seems practically if not politically inconceivable today, such reductions would have little or no perceptible effect on the climate system for decades.

More than ever, we need new and creative policy options on climate change that make sense in the short term.

3. Consequently, costs (whatever they may be) are borne in the near term and benefits are achieved in the distant future.

The reality of the time-lag of costs to benefits illustrates the disingenuousness of using current climate events to justify mitigation action. Due to the properties of greenhouse gases in the atmosphere and their effects on the climate system, even if society takes immediate and drastic action on emissions, there can be no scientifically valid argument that such actions will lead to a perceptibly better climate in the coming decades. For the foreseeable future the most effective policy responses to climate-related impacts (e.g., such as hurricanes and other disasters or diseases such as malaria) will necessarily be adaptive.

The point of this analysis is not to throw up our hands and do nothing about mitigation. But the asymmetry in costs and benefits suggest that if meaningful action is to occur on mitigation we must think about different strategies, and in particular policy options that have more symmetry between the timing of costs and benefits.

I fully intend that this perspective be viewed as an alternative to the two-sided debate that has been caricatured as “climate skeptics” vs. “climate alarmists”. Perhaps those holding this third position might be characterized as “climate realists.”

4. Many policies that result in a reduction in emissions also provide benefits in the short term unrelated to climate change.

Observers of climate policy have long recognized that mitigation actions can provide benefits that go beyond their effects on the long-term behavior of the climate system. In 2001 the IPCC’s Working Group III on Mitigation argued,

“The effectiveness of climate change mitigation can be enhanced when climate policies are integrated with the nonclimate objectives of national and sectorial policy

development and be turned into broad transition strategies to achieve the long-term social and technological changes required by both sustainable development and climate change mitigation. Just as climate policies can yield ancillary benefits that improve wellbeing, non-climate policies may produce climate benefits. It may be possible to significantly reduce greenhouse gas emissions by pursuing climate objectives through general socioeconomic policies.”¹²

This conclusion has been backed up by empirical research of communities in the United States that are taking action to mitigate greenhouse gas emissions. Consider the following extended excerpt from a study of local initiatives on climate change by M. Betsill at Colorado State University.

“The experience of CCP [Cities for Climate Protection (CCP) campaign sponsored by the International Council for Local Environmental Initiatives] communities indicates that global climate change is most likely to be reframed as a local issue when city officials recognise that actions to control GHG emissions also address other local concerns already on their agendas. Localisation requires the prior existence of a local hook on which to hang the issue of global climate change. Localising global climate change is an important first step in developing a municipal response to global warming; it helps generate political support for reducing local GHG emissions. However, not all communities are able to move from reframing to policy action. There are several institutional barriers that make it difficult for cities to develop and implement policies and programmes for mitigating climate change: the issue does not fit the way most city governments organise themselves; many city governments lack the administrative capacity to monitor their GHG emissions; and there are often budgetary constraints that make it difficult to invest in emissions reduction activities. Ultimately, motivating local action to mitigate global climate change calls for an indirect strategy, focused on the ways in which emissions-producing activities are embedded in broader community concerns (Rayner & Malone, 1997). The primary benefit of an indirect approach is that it avoids many of the political debates about climate change science that have plagued international efforts to address this issue (Sarewitz & Pielke, 2000). Several officials noted that it really does not matter whether global climate change science is credible. Since the emphasis is on how reducing GHG emissions can help the city address other (more pressing) problems, questions of the scientific basis for climate change rarely come up. When and if they do, city officials can easily reply that these are actions they should take anyway.”¹³

When it comes to effective substantive action on mitigation, I would argue that the available research and experience shows quite clearly that progress is far more likely when such actions align a short-term focus with the longer-term concerns. In practice, this typically means focusing such actions on the short-term, with the longer-term

¹² <http://www.ipcc.ch/pub/wg3spm.pdf> at p. 12

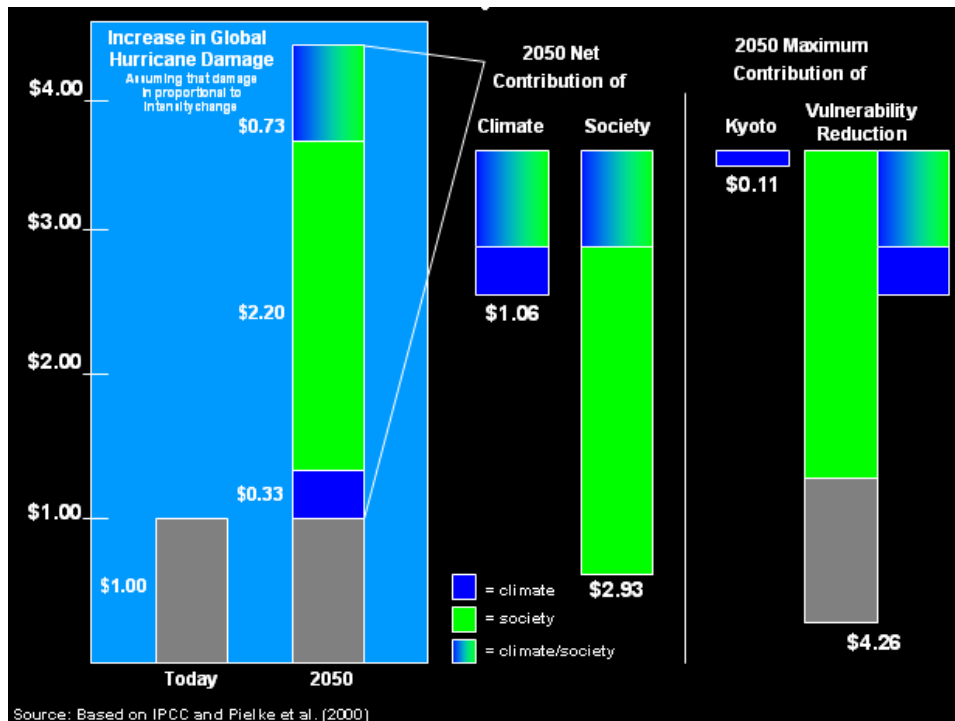
¹³ Betsill, M. 2001. Mitigating Climate Change in US Cities: opportunities and obstacles, *Local Environment*, 6:393-406. <http://www.colostate.edu/Depts/PoliSci/fac/mb/Local%20Environment.pdf>

concerns taking a back seat. Examples of such short-term issues related to mitigation include the costs of energy, the benefits of reducing reliance on fossil fuels from the Middle East, the innovation and job-creating possibilities of alternative energy technologies, particulate air pollution, transportation efficiencies, and so on. This approach to climate change is contrary to the dominant approach (see point #6 below).

5. In coming decades the only policies that can effectively be used to manage the immediate effects of climate variability and change will be adaptive.

This conclusion results inescapably from the fact that any realistic greenhouse gas mitigation policies will have no perceptible impact on climate behavior for decades and longer (point #2 above). This conclusion is illustrated in the following figure, which comes from research that I am currently preparing for publication on the relative contributions of societal changes (e.g., population growth and development) and climate changes on future hurricane damages.¹⁴

The figure illustrates how \$1.00 in global hurricane damage today will increase by 2050 under assumptions about changing hurricane intensity, societal development, and the relationship between increased hurricane intensity and damage.¹⁵



¹⁴ Note that the more general term for hurricanes is “tropical cyclone.”

¹⁵ The figure assumes that by 2050 all hurricanes increase in intensity by 10% (based on Henderson-Sellers, A., H. Zhang, G. Berz, K. Emanuel, W. Gray, C. Landsea, G. Holland, J. Lighthill, S-L Shieh, P. Webster, and K. McGuffie, 1998: Tropical cyclones and global climate change: A post-IPCC assessment. *Bulletin of the American meteorological Society* 79:19-38.), that population and wealth increase by a combined 1.1% per year (the lowest rate of increase used by the IPCC in its Special Report on Emissions Scenarios), and that hurricane damage increases are proportional to the increase in wind speed (which is an over-estimate).

The light blue box within the figure shows that for \$1.00 in hurricane damage today (grey bar), by 2050 there will be an increase in damage of \$0.33 due to the increased intensity of the storms (blue increment), \$2.20 due to more exposed people and wealth in coastal locations (green increment), and \$0.73 due to the cumulative effects of the increased intensity on the additional people and exposed property (green-blue increment). Adding these increments together ($\$1.00 + \$0.33 + \$2.20 + \0.73) results in a total damage in 2050 of \$4.26 for every \$1.00 today.

The middle two bars in the graph, labeled “Net Contribution of Climate [and] Society,” summarize the total effects of changes in climate (increments with blue) of \$1.06 and changes in society (increments with green) of \$2.93. To get a sense of the relative potential for mitigation and adaptation to reduce the increasing damage requires several other assumptions. Here I have chosen to illustrate this analysis with the Kyoto Protocol because it will be familiar to most readers, but substituting other policies results in qualitatively similar results.

If we assume that greenhouse gas reductions have an instantaneous (i.e., contemporaneous with the reductions) and proportional (i.e., a 50% decrease in emissions decreases the projected increase in hurricane intensity by 50%) effect on hurricane intensity,¹⁶ then full implementation of Kyoto (including U.S. participation) would roughly decrease projected greenhouse gas emissions under the “business-as-usual” scenario by about 10% by 2050.¹⁷

Under these assumptions the *maximum potential effectiveness* of Kyoto for reducing future global hurricane damage is \$0.11 (that is, 10% of \$1.06) and the maximum potential effectiveness of adaptation (i.e., reducing the vulnerability of people and property) is about 40 times greater, or \$4.26.¹⁸ While it would of course not be cost-effective to reduce damages 100% (e.g., by moving everyone away from the coast), this idealized exercise indicates that a 2.5% reduction in vulnerability leads to about the same effect on future damages as 100% success of Kyoto. These conclusions are qualitatively insensitive to the magnitude of the projected increase in hurricane intensity or population scenarios. Consider that if we instead assume that hurricane intensity increases by 40% the ratio of maximum potential effectiveness of adaptation to mitigation is about 14 to 1.¹⁹

¹⁶ Of course, the real climate system does not work this way, and the effects of mitigation on hurricane behavior remains poorly understood, but it is certainly less direct than the oversimplification offered here.

¹⁷ I am assuming a 120 ppm increase in carbon dioxide (or equivalent) by 2050 under “business as usual”, and that Kyoto would reduce this by 12 ppm, or 10%. The conclusions are not sensitive to these assumptions, feel free to substitute others if you would prefer, the qualitative results will not change.

¹⁸ The maximum potential effectiveness of adaptation is equal to the total costs. If atmospheric concentrations of greenhouse gases could be instantly be held constant such that there would be no effect of human-caused climate change on hurricanes, then the maximum effectiveness of mitigation would in this case be \$1.06. In reality this number is substantially smaller given the commitment to climate change and the time lag of emissions reductions effects on the climate system.

¹⁹ This ratio remains constant under both the low or high SRES estimates for wealth and population.

To emphasize, this is not an argument against Kyoto specifically or mitigation of greenhouse gases generally. Instead, this simple analysis under the most favorable assumptions for mitigation indicates that in the short term (decades into the future) any realistically achievable mitigation policies can have at best only an imperceptible effect on global hurricane damage. The same conclusion holds for other extreme events, and I would hypothesize, for the vast majority of society-climate interactions. In fact, I am not aware of a single study that suggests that there will be significant short-term benefits of climate mitigation for climate impacts.

This reality explains why adaptation necessarily must be at the center of climate policy. It also helps to explain why mitigation policies in the short-term necessarily must be focused on their non-climate benefits.

6. But climate policy, particularly international climate policy under the Framework Convention on Climate Change, has been structured so as to keep policy related to long-term climate change distinct from policies related to shorter-term issues of energy policy and adaptation.

The climate issue suffers from a bizarre sort of intellectual gerrymandering that has little basis in science or policy. The Framework Convention on Climate Change (FCCC), focused on international policy, and the Intergovernmental Panel on Climate Change (IPCC), focused on scientific assessments in support of the FCCC, use different definitions of climate change. Understanding the effects of the two definitions on the politics of the climate issue helps one to understand the current international stalemate on climate policy, a stalemate that matters because climate change is real and actions are needed to improve energy policies and to reduce the vulnerability of people and ecosystems to climate effects.

Point #1 above explained that the IPCC's Working Group I has a very broad definition of climate change, that is, changes in the climate occurring for any reason.²⁰ By contrast, the FCCC is narrowly focused on climate change from greenhouse gas emissions. Taken literally, the focus of the FCCC would necessarily limit attention to the long-term consequences of climate change and only on the role of greenhouse gas emissions in driving those consequences. I have written that this focus creates a bias against adaptation, because it creates a cost/benefit calculus in which adaptation has only costs and no benefits.²¹ The FCCC definition also encourages the waging of political battles through science as evidence for the detection and attribution of climate change (and whether it will exceed a threshold of "dangerous interference" in the climate system under FCCC Article 2) is a prerequisite for action under the FCCC.

²⁰ By contrast the IPCC's Working Groups II and III often utilize the FCCC definition of climate change rather than the IPCC definition. See Pielke (2005) cited in the following footnote for discussion.

²¹ The logic behind costs without benefits is that without the marginal influence of greenhouse gas caused climate change on the climate system, such adaptation would be, by definition, unnecessary. See Pielke, Jr., R.A., 2005. Misdefining "climate change": consequences for science and action, *Environmental Science & Policy*, 8:548-561.

http://sciencepolicy.colorado.edu/admin/publication_files/resource-1841-2004.10.pdf

Numerous participants and analysts have recognized this fundamental flaw in the structure of the FCCC and have worked hard to overcome it by emphasizing the relationships of climate policy and sustainable development.²² Some involved in the IPCC have also recognized the importance of integrating issues of climate change and sustainable development, and a chapter on the subject is to be included in the next assessment report in 2007.²³ Nonetheless, I remain skeptical that such efforts will do much to alter the narrow intellectual approach to the FCCC and reflected throughout the IPCC.²⁴

The narrow focus of the FCCC helps to explain why we see so many supposedly scientific debates related to detection (of changes) and attribution (to human greenhouse gases), such as the ongoing battle over the infamous “hockey stick” graph. Given the emphasis placed on detection and attribution it is not too much of an exaggeration to observe that many proponents of action on emissions reductions want to characterize every climate event or trend as the result of human-caused climate change, whereas opponents of action on emissions reductions want to cast as much doubt as possible on such claims. We have seen a perfect example of this dynamic in public debate over hurricanes and climate change over the past few years as the science of hurricanes became almost instantaneously caught up in the politics of the global warming debate.

The effect of the intense politicization of climate change has been to preclude most reasoned discussion of innovative or new policy options on climate change. Most of the focus instead is on empty exhortations of support for “action” or claims of “too much uncertainty.” Such expressions may be emotionally satisfying but do little to move the political debate forward in any meaningful way. Despite strong public support for action on climate change, the lack of meaningful alternatives in the public debate sets the stage for what T. Dyson has called a recipe for only marginal action:

“The prospects for an enforceable international agreement to significantly reduce CO₂ emissions are very poor. While it may be in the interest of the world as a whole to restrict the burning of fossil fuels, it is in the interest of individual countries to avoid making such changes. Moreover, the enormous complexities involved - many of them created and informed by matters of interest - will also hinder agreement. Doubtless there will be gains in energy use efficiency, shifts towards less carbon intensive fuels, and greater use of renewable energy sources (e.g. solar, wind and tidal power). But except for a massive shift towards nuclear - which has many serious problems attached, and would in any case take decades to bring about - there are limits to what such changes could possibly achieve in terms of CO₂ reduction. Other technological ideas - like the development of the so-called 'hydrogen economy', or the extraction of CO₂ from coal and its sequestration underground or at sea - are remote, even fanciful ideas as large scale and significant solutions to the problem. Indeed, such notions can themselves be the basis of avoidance inasmuch as they suggest that something is being done. Understandably, poor countries are unlikely to put great

²² See, e.g., Klein, R.J.T., E.L.F. Schipper and S. Dessai, 2005: Integrating mitigation and adaptation into climate and development policy: three research questions. *Environmental Science & Policy*, 8:579-588.

²³ See, e.g., <http://www.ipcc.ch/am-sd.pdf>

²⁴ As a practical matter, discourse on climate policy reinforces the intellectual gerrymandering through new concepts such as “mainstreaming” that preserve rather than move beyond the status quo.

effort into constraining their CO₂ emissions - especially in the face of massive discrepancies between them and the rich. In sum, for the foreseeable future the basic response to global warming will be one of avoidance and, at most, marginal change.”²⁵

A recent poll conducted by the National Journal of the perspectives of members of Congress on climate science and policy supports the importance of short-term policy issues as a focal point of policies to reduce greenhouse gas emissions.²⁶ The poll asked, *“Do you think it’s been proven beyond a reasonable doubt that the Earth is warming because of man-made pollution?”* The replies are interesting with 98% of Democrats saying “Yes” and only 23% of Republicans saying “Yes.”²⁷

Even with the party divisions, a clear majority of members of both the House and Senate believe that global warming is real and caused by humans. If the poll numbers accurately reflect Congressional perspectives, then 55 members of the Senate and 251 members of the House believe that “it’s been proven beyond a reasonable doubt that the Earth is warming because of man-made pollution.” This seems to be inescapable evidence that there is exceedingly little value left in continuing to argue the science of this particular question. Clearly, there are other factors at play here beyond “skepticism” which shapes how decision makers act on climate change. Efforts to educate Congress on the reality of climate change are in my view completely wasted on a majority of the convinced

The poll asks a second question, “Which of these actions to reduce pollution could you possibly support?” and the answers included five options, Mandatory limits on carbon dioxide emissions, Increased spending on alternative fuels, Greater reliance on nuclear energy, Higher fuel-efficiency standards for automobiles, and a Higher gasoline tax. For each of these issues, except a gasoline tax, which is not favored by members of either party, there is far more agreement than was displayed on the question of science. And in each case there is evidence of enough support to suggest that agreement across parties might be found on particular policy options. The devil is of course always in the details, but what this poll shows is that debate on climate policy should be taking place in terms of policy options, and not science. There is ample evidence that there is room for compromise across partisan boundaries, without the need to turn Republicans into Democrats or vice versa.

²⁵ Dyson, T. 2005 "On development, demography and climate change: The end of the world as we know it?" London School of Economics, Paper prepared for Session 952 of the XXVth Conference of the International Union for the Scientific Study of Population, Tours, 18-23 July, 2005.

²⁶ <http://iussp2005.princeton.edu/download.aspx?submissionId=50222>

²⁷ <http://nationaljournal.com/>

²⁷ Interestingly, as has been found in many areas, the views of members of Congress are more ideologically determined than those of their party membership among the general population. In opinion polls of the public asking a similar question, Democrats do not show such unanimity of opinion, and Republican views are not so consolidated. This may be a consequence of the effects of gerrymandering of Congressional districts which has often been pointed to as a key factor in a legislature far more ideological than the people who they actually represent.

The nation awaits politically creative policy options that can navigate the complicated set of interests of 535 members of Congress to start taking effective action on climate policy. All of the precursors for such action are in place, minus the politically creative options. Efforts to debate the science are simply misplaced in such a context. Die-hard partisans will no doubt come up with a range of excuses why they cannot compromise, and will gravitate back to the science as a comfortable home for maintaining the present debate. Such partisans typically point the finger of blame at their political opponents, though they should be looking in the mirror. The evidence from this poll suggests very strongly that such reactions are grounded more in a desire to maintain the present gridlock, rather than to move the issue of climate policy forward.

7. Following the political organization of international climate change policy, research agendas have emphasized the long-term, meaning that relatively very little attention is paid to developing specific policy options or near-term technologies that might be put into place with both short-term and long-term benefits.

In 1994 I argued that the U.S. Global Change Research Program was likely to produce good science, but would be unlikely to deliver “useful information” to policy makers as had been called for in the legislation that created the program. I wrote that instead of a long-term focus on large-scale climate change the USGCRP could “distill the practical significance of scientific information, and at the same time develop a wide range of action alternatives ...”.²⁸ The USGCRP, and its successor the Climate Change Science Program, have never placed the needs of decision makers at the center of their mission, focusing instead on advancing scientific understandings. Part of the explanation for this situation lies in the fact that the scientific community has benefited immensely from the current approach, and an emphasis on short-term policy and technological options would necessarily imply a different approach to climate science and technology policy priorities.²⁹ Another part of the explanation is that it is quite easy for policymakers to put the burden of “solving” the climate problem onto the scientific community, which also has the effect of using research policies as substitute for other types of action. And with political advocates on either side of the issue also looking to science as a leading fixture of their public relations and political lobbying campaigns, it should be no surprise that scientific and technological research on climate has focused on long-term issues over the generation of practical options for short-term consideration.

²⁸ Pielke Jr., R. A., 1994: Scientific Information and Global Change Policymaking. *Climatic Change*, **28**, 315-319. http://sciencepolicy.colorado.edu/admin/publication_files/1994.02.pdf

For an early evaluation of USGCRP, see: Pielke Jr., R. A., 1995: Usable Information for Policy: An Appraisal of the U.S. Global Change Research Program. *Policy Sciences*, **38**, 39-77. . http://sciencepolicy.colorado.edu/admin/publication_files/resource-109-1995.07.pdf

²⁹ Pielke, Jr., R. A. and D. Sarewitz, 2003. Wanted: Scientific Leadership on Climate, *Issues in Science and Technology*, Winter, pp. 27-30. http://sciencepolicy.colorado.edu/admin/publication_files/2003.01.pdf

8. The climate debate may have begun to slowly reflect these realities, but the research and development community has not yet focused much attention on developing policy and technological options that might be politically viable, cost effective, and practically feasible.

I am convinced that as people begin to see the limited performance of existing approaches to emissions reductions and as the toll of climate-related disasters grows due to ever-increasing vulnerabilities that there will be a shift to a more short-term focused approach to climate mitigation and adaptation. However, given the institutional and political momentum which currently characterizes the climate issue, there is a substantial risk that the issue will continue to display sound and fury with most action being symbolic or simply ineffectual. The question is whether we can organize our intellectual infrastructure to invent and bring forward policy and technological options that will satisfy both the short-term and long-term facets of this incredibly complex issue. Through oversight of the Climate Change Science Program and Climate Change Technology Program, Congress might motivate the evolution of these programs to focus more explicitly on the needs of decision makers.

Short Biography

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For more information see:

http://sciencepolicy.colorado.edu/about_us/meet_us/roger_pielke/

All of my publications referenced here can be found online at:
<http://sciencepolicy.colorado.edu> In particular see our NSF-sponsored research project titled Science Policy Assessment and Research on Climate:
<http://sciencepolicy.colorado.edu/sparc/>

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