POLICY BRIEF

G8 Leadership is Critical to Curbing Energy-Related CO_2 Emissions

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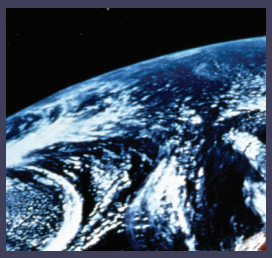



G8 Leadership is Critical to Curbing Energy-Related CO_2 Emissions

Multilateral commitments from G8+5 countries can be an important first step to keeping atmospheric CO_2 concentrations in the safe zone to avoid dangerous climate change.

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I. Summary

The "Heiligendamm Process" conceived at the recent Group of Eight (G8) summit in Germany calls for the G8 countries plus the five largest developing nations (G8+5) to negotiate commitments to reduce greenhouse gas emissions to mid-century levels that would avoid dangerous climate change. This analysis demonstrates that commitments from these thirteen nations, with particular emphasis on the United States and China, are critical to keeping atmospheric carbon dioxide concentrations (CO_2) concentrations in the "safe zone" – below 450 ppm. Given projected global growth in emissions, atmospheric CO_2 concentrations will start approaching unsafe thresholds around 2030. Timely commitments, even with a ten year lag between developed and developing nations, can provide a pragmatic approach to stabilizing atmospheric CO_2 concentrations below the 450 ppm threshold.

Introduction

It has long been recognized that a multi-national effort to reduce greenhouse gas emissions will be required to avoid the most dangerous effects of climate change. Yet this effort will necessarily be composed of a series of individual and collective national decisions that will determine whether the world will move toward climate stabilization. This analysis focuses on the substantial contributions toward avoiding dangerous climate change that can be made by just thirteen countries.

Following the ratification of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, nations have made varying levels of commitments to reduce their emissions, through either the Kyoto Protocol or local or regional efforts. Meanwhile, growth in global emissions has continued and accelerated, predicted climate change effects are being seen world wide, and climate science has matured in its understanding of the critical need to reduce global emissions by mid-century to avoid the worst effects.[1]

Worldwide negotiations are underway for the next phase of climate agreements, or the "post-Kyoto" phase which begins when the Kyoto Protocol expires in 2012. These negotiations include all 190+ UNFCCC party or observer nations.

While an inclusive global climate policy is valuable, the majority of and thus the most critical emissions reductions can come from just thirteen countries – the so-called "G8+5" – the Group of Eight developed nations, and the five largest emerging economies of the developing world: China, India, Brazil, South Africa, and Mexico (see Figure 1). Currently, all members of the G8 except the United States have begun mandatory emissions reductions either under Kyoto or through their own system, while the five developing nations have not yet agreed to mandatory emissions reductions.

The United States agreed to participate in and host the first meeting of these countries in what is being called the "Heiligendamm process." At the 2007 G8 Summit in Heiligendamm, Germany – which also included participation by the "+5" nations – the Summit Declaration stated that the G8 countries are "committed to strong and early action to tackle climate change in order to stabilize greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system."[2] The declaration also stresses the "leadership role that

developed economies will have to play in any future climate change efforts to reduce global emissions." The G8 countries agreed to launch a new partnership with these developing economies through a series of dialogues aimed at tackling important global issues, including climate change.

An analysis of potential emissions reductions by the G8+5 countries highlights how securing reductions commitments from participants in the Heiligendamm process can put the world on a path to avoiding the more dangerous potential impacts of climate change, even as global "post-2012" negotiations continue.

II. Key Findings

The findings of this study confirm the importance of positive outcomes from the Heiligendamm process.

- *Prompt and aggressive action to curb energy-related CO_2 emissions is needed to maintain atmospheric CO_2 concentrations below the 450 ppm threshold, the "safe zone" for avoiding the most dangerous effects of climate change.*

- *Leadership from the G8+5 nations is critical to avoid dangerous climate change.*

- *If the United States and other members of the G8 act decisively and soon, keeping atmospheric concentrations of greenhouse gases in the 'safe zone' can be achieved-- even if China and the other four major developing nations wait ten years to start their emissions reductions.*

- *Early action will allow a measured, smoother path to emissions reduction.*

- *Reductions in emissions of CO_2 from fossil fuels from non G8+5 countries, of CO_2 from deforestation, and of greenhouse gases other than CO_2 will further reduce atmospheric concentrations of greenhouse gases and will be necessary over the next few decades.*

III. Results and Context

Significant emissions reductions are needed—not just halted growth

If atmospheric carbon dioxide concentrations increase beyond 450 ppm we face a significant probability of human-induced warming exceeding 2° C (3.6° F) above pre-industrial levels.[3] Above this temperature the scientific community predicts a high probability of escalating and dangerous impacts.[4]

Atmospheric CO_2 concentrations will approach this 450 ppm threshold by around 2030 if global energy-related CO_2 emissions grow as projected by the U. S. Energy Information Administration (US/EIA)[6] (see Figure 1). The projections estimate that cumulative energy-related CO_2 emissions between 2010 and 2030 alone will total about 200 Gt C. Even if one takes the optimistic view

that energy-related CO_2 emission growth rates will begin to slowly level off after 2030 so that emissions remain constant after 2050, cumulative CO_2 emissions will total about 460 Gt C during 2010-2050 and more than 1100 Gt C during 2010-2100. This *'emissions stabilization' scenario* results in continuing increases in atmospheric CO_2 concentrations, and is clearly insufficient to avoid a significant and, by current definitions, dangerous build-up in the atmosphere (see Figure 1). Rather, prompt and aggressive action to curb energy-related CO_2 emissions is needed to maintain atmospheric CO_2 concentrations below the 450 ppm threshold.

A G8-led emissions reductions effort involving G8+5 countries is an important first step

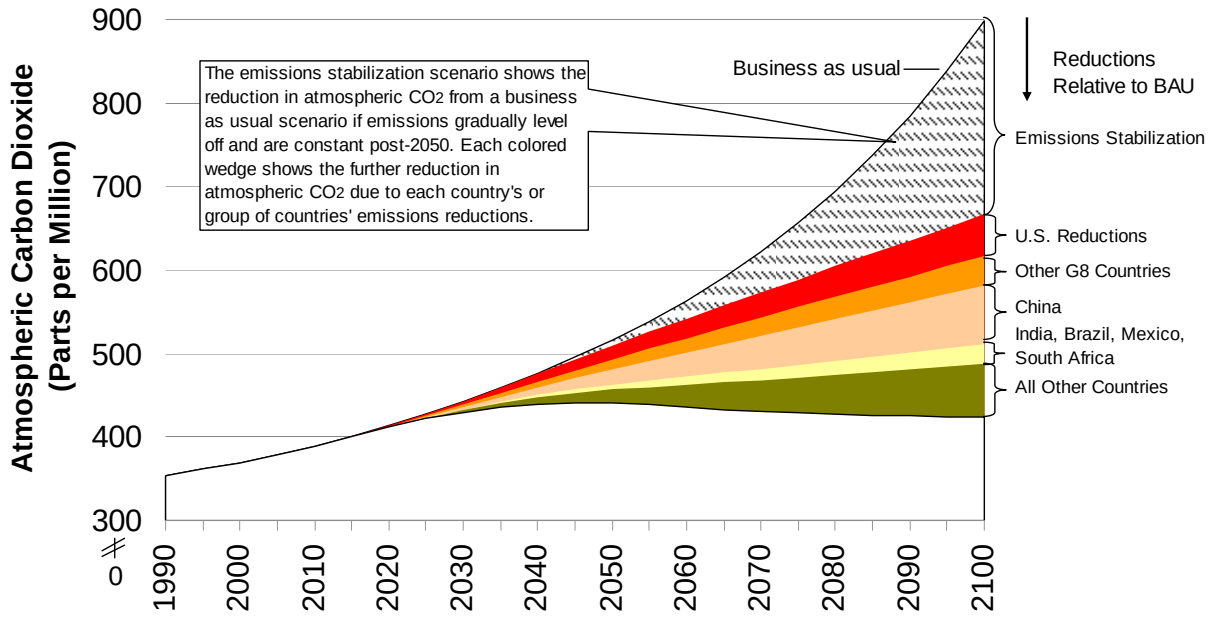
Together, the thirteen 'G8+5' countries account for about 70% of the 7.5 Gt C/year emitted globally from fossil-fuel combustion.[5] The latest US/EIA projections show a substantial rise in energy-related CO_2 emissions over the next two decades, with the G8+5 countries continuing to be dominant contributors (accounting for about 8 Gt C/year of the global total of 11.5 Gt C/year in 2030).[6] However, relative contributions within the G8+5 countries are predicted to shift markedly over that period, fueled by strong growth in energy-related emissions from China (and to a lesser extent from the other '+5' countries). As a result, the G8 countries are projected to account for about 50% of G8+5 energy-related CO_2 emissions in 2030, compared to about 75% in 1990.

Given the predominance of G8+5 countries' current and future greenhouse gas emissions, their leadership can put the world on a path to keeping atmospheric concentrations of CO_2 in the 'safe zone,' avoiding the most dangerous effects of climate change.

We demonstrate this by comparing three hypothetical scenarios: (1) a "business-as-usual" scenario in which annual energy-related emissions continue to grow out to 2100; (2) an "emissions stabilization" scenario, in which energy-related emissions starts to decline in 2030 leading to emissions stabilization in 2050; and (3) an "emissions reduction" scenario of 2% per year for 40 years, with G8 countries starting their reductions by 2011 using 2010 emissions as a baseline, and non-G8 countries starting 10 years later in 2021, using 2020 emissions as a baseline.

We find that prescribed reductions by the G8+5 alone are sufficient to keep atmospheric CO_2 concentrations near 450 ppm through 2050. Further, emissions reductions from just the U.S. and China are responsible for fully two-thirds of the decrease in atmospheric CO_2 concentrations relative to the emissions stabilization scenario. This highlights the critical need for both countries to participate in a global effort to mitigate climate change.

Figure 1. The Impact of Fossil Fuel CO_2 Emissions Reductions of 2% per Year for 40 Years, with a 10 Year Delay in Implementation for Non-G8 Countries.



Note: The hatched segment in Figure 1 depicts the predicted incremental reduction in atmospheric CO_2 concentrations relative to the BAU scenario, due to emissions stabilization post-2050. Each colored segment shows depicts additional reductions in atmospheric CO_2 due to emissions reductions in one or more countries.[7]

If G8 countries act now, mid-century emissions targets can be achieved even if developing countries delay reductions

Reductions of CO_2 emissions from fossil fuels of 2% per year can put us on the path toward safe levels even with a 10 year lag between a G8 start on reducing emissions and developing nations' reduction trajectories. Despite U.S. concerns about rising emissions from China, it is not necessary to start reducing emissions from China and other developing nations right away. While these data suggest that a collaborative effort to cut emissions in all of the G8+5 nations rather than G8 countries alone is essential, that effort does not have to begin all at once.

Early G8 action including the U.S. will allow a measured, smoother path

There is a significant amount to be achieved through early G8 – particularly U.S. – action to cap and reduce emissions. Early action will allow a measured, smoother path such as the one described above, and provides more assurance of maintaining atmospheric emissions concentrations in the "safe zone." If the U.S. waits until 2020 or later to reduce emissions, the reductions necessary to avoid exceeding 450 ppm in 2050 will be necessarily more dramatic, and perhaps much more costly.

Additional sources of emissions reductions

The G8+5 emission-reduction trajectory leads to a significant decrease (~ 50 ppm) in projected atmospheric CO_2 concentrations in 2050 relative to the emission-stabilization trajectory. This is

not sufficient, however, to maintain atmospheric CO_2 concentrations below 450 ppm beyond 2050 (see Figure 1). Additional reductions by the G8+5 countries or a more comprehensive, global CO_2 emission reduction strategy involving non-G8+5 countries will be needed in the longer term.

This analysis covers reductions of CO_2 emissions from fossil fuels because this is by far the largest contributor to climate change and because there is little uncertainty about these emissions or the sources. However, if reductions in other gases and from other sources occur in tandem with the CO_2 reductions from fossil fuels shown, the G8+5 reductions considered here would likely keep atmospheric concentrations within the 'safe zone' well past 2050. Reductions of non-CO_2 emissions are often considered to be more cost-effective than reductions of fossil fuel CO_2 emissions,[8,9] and consequently these may play a bigger role in early reductions.

An especially promising opportunity for additional cuts in the short term can be found in the tropical rainforest countries; slowing deforestation rates could provide an additional 15 ppm cut in atmospheric CO_2 concentrations.[10,11] Cuts in non-CO_2 greenhouse gases could further limit the rise in atmospheric greenhouse gas concentrations and aid in avoiding dangerous climate change.[12]

IV. Conclusion

Regardless of how the world community chooses to address the issue of dangerous climate change after 2050, it is imperative that significant emission cuts begin as soon as possible to ensure that atmospheric CO_2 concentrations do not exceed 450 ppm in the coming decades. A substantive and aggressive program to reduce energy-related CO_2 emissions involving the 13 countries that participated in the Heiligendamm summit can be a major step towards the ultimate goal of stabilizing atmospheric concentrations of greenhouse gas emissions in the "safe zone". It would also be consistent with the objectives of the United Nations Framework Convention on Climate Change. The planned 'Heiligendamm Process' thus could serve as a forum for forging a new developed-developing country alliance to take the necessary first steps to address climate change.

Note on Methods

Emissions Scenarios: In the business-as-usual emissions scenario, all countries' emissions continue to grow through 2100 at the 2025-2030 growth rate projected by the U.S. International Energy Information Administration.[13] For the emissions reduction scenarios, G8 countries reduce emissions by 2% from 2010 levels for 40 years, so that in 2050 their emissions are 80% below 2010 emissions. Non-G8 countries reduce emissions by 2% from 2020 levels for 40 years, so that in 2060 their emissions are 80% below 2020 emissions. The annual reductions in emissions are thus constant.

Atmospheric Carbon Dioxide Concentrations: For each emissions scenario, atmospheric concentrations of carbon dioxide were predicted using the MAGICC v. 4.1 model (Model to Assess Greenhouse-gas Induced Climate Change).[14] MAGICC is a simplified, coupled gas—climate model that allows for the examination of potential climatic impacts of different

greenhouse gas emissions trajectories. It includes a carbon cycle model that relates emissions and physical and chemical sinks to changes in the atmospheric carbon dioxide concentration.

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[4] J. Hansen *et al.*
[5] U.S. Energy Information Administration (2007).
[6] U.S. Energy Information Administration (2007).
[7] In all scenarios, emissions from tropical deforestation are specified to be 1 Gt C in 1990, with the spatial distribution prescribed according to estimated C emission from fires in tropical forests during the 1997-2005 period. Post-1990 deforestation fluxes are specified assuming that the deforestation rate in each country continues at the 1990 rate until 15% of forest remains, at which point deforestation stops.
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The Nicholas Institute for Environmental Policy Solutions at Duke University is a nonpartisan institute founded in 2005 to engage with decision makers in government, the private sector and the nonprofit community to develop innovative proposals that address critical environmental challenges. The Institute seeks to act as an "honest broker" in policy debates by fostering open, ongoing dialogue between stakeholders on all sides of the issues and by providing decision makers with timely and trustworthy policy-relevant analysis based on academic research. The Institute, working in conjunction with the Nicholas School of the Environment and Earth Sciences, leverages the broad expertise of Duke University as well as public and private partners nationwide.

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