

Princeton University
Woodrow Wilson School of Public and International Affairs
Graduate Program

**WWS 591e Policy Workshop
Post-Copenhagen Climate Change Initiatives:
Fast Action Mitigation Strategies**

Fall Term - 2010

Mondays, 7-10pm, Robertson Hall 014

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INTRODUCTION, CLIENT, AND ASSIGNMENT

Climate change is a global environmental threat which will have increasingly undesirable effects around the world in our lifetimes. International negotiations to limit the emissions of long lived greenhouse gases (GHG) have stalled. There is a very real possibility that current emissions of GHG have already committed the world to “dangerous anthropogenic interference with the climate system”.

Given current and projected GHG emissions and the domestic and international political situations, the goal of this workshop is to identify fast action technological and regulatory strategies to reduce radiative forcing that can be implemented under existing authority. Fast action strategies are defined as those which can begin in 2-3 years, be substantially implemented within 5-10 years, and have the goal of producing the desired climate response within decades (Molina et al., 2009). Examples of such strategies are: accelerate the phase-out of hydrochlorofluorocarbons (HCFCs), phase down the production of hydrofluorocarbons (HFCs) with high global warming potential, reduce emissions of black carbon (BC) particularly from sources where most of the soot is released in the form of BC rather than organic carbon (OC) and in regions where BC emissions affect snow and ice (eg. Himalaya-Tibetan glaciers, Arctic, etc.), reduce emission of tropospheric ozone (O₃) precursors (particularly methane), enhance biosequestration of carbon, increase surface albedo (eg. white roofs, roads), etc.

Our clients are Dr. Richard Duke, Deputy Assistant Secretary for Climate Policy, Office of Policy and International Affairs at the Department of Energy and Dr. Shalini Vajjhala, Deputy Assistant Administrator, Office of International & Tribal Affairs at the U.S. Environmental Protection Agency. Direct contacts at DoE are Dr. Robert Kopp (Robert.Kopp@hq.doe.gov) and at EPA is Dr. Anthony Socci (socci.anthony@epa.gov).

The workshop's task is to develop creative yet realistic, well-reasoned and supported policy recommendations for the U.S. Department of Energy and Environmental Protection Agency that describe feasible domestic and international actions that can be rapidly implemented to reduce radiative forcing within decades.

COURSE REQUIREMENTS AND PROCESS

The workshop will prepare a coherent, integrated, collective final report, with a one-page executive summary, findings, recommendations, and supporting rigorous analyses, emphasizing policy recommendations (15-20 single-spaced pages, plus exhibits and supporting individually- or collectively-written appendices). In addition, a concise PowerPoint presentation for briefing the clients and perhaps other relevant audiences will also be prepared.

Initial background readings, lectures, discussions, an introductory meeting with the DoE and EPA clients in Washington D.C., and informal briefings by pertinent governmental, scientific, and NGO experts will take place during Weeks 1-6. Additional day trips for meetings with key experts may also be arranged.

Each workshop member will research and write a 10-15 page (double-spaced), well-referenced background paper on one of the key aspects of the workshop's assignment during Weeks 1-6. The written paper will be submitted to the workshop. The key findings and recommendations from the papers will be presented orally by each workshop member to the entire group in Week 6, assisted by a concise PowerPoint presentation. Possible background paper topics will be distributed in the second week of class. Workshop members should select, define, and refine the individual paper topic in consultation with the clients, workshop members and the professor. Ideally these individual papers will provide background guidance for field research conducted during fall break and will contribute to the final report.

The workshop's final collective report will not simply be a compendium of the individual background papers however, although some background papers, with rewriting, may be included as appendices in the workshop's final report.

During the fall recess (October 30 - November 7, 2010), small groups of students may travel to various domestic and foreign destinations, e.g., Washington DC, California, Germany, etc., to conduct interviews and gather information relevant and helpful for the workshop's assignment.

Weeks 7-12 will be devoted to the workshop's collective effort to develop a coherent final report and PowerPoint presentation. An interim workshop report outline is due at the end of Week 6, before the fall recess, in order to help structure research during break week. The outline will be discussed with DoE and EPA clients and rapid turn-around comments requested. Additional speakers and field trips may be arranged as needed during Weeks 7-12

Throughout the semester, workshop members are expected and encouraged to share information with each other via Blackboard as well as via e-mail and memos, on

research leads, findings, etc. that will contribute to the group's deliberations and collective final report.

A draft of the workshop's final report is due Monday December 13, 2010 with a **presentation to DoE and EPA scheduled for early January 2011** in Washington D.C. Revisions to the report responding to EPA comments can be made during reading period and are encouraged. The final report is due to the instructor and clients by the end of the semester.

EVALUATION

The final course grade and written evaluation of a student's performance in the workshop will be based upon:

Workshop participation	20%
Individual paper	25%
Student presentations	15%
Final report	40%

READINGS

Most reading material for this course will be posted on Blackboard. Other readings are accessible on the Web through links in this syllabus. Books listed in this syllabus are on reserve in the Stokes Library. Additional material may be distributed during the semester. Students are encouraged to share useful documents, papers and websites with each other as they find them. Such exchanges can be done via Blackboard so that they are available to all in a central location.

Workshop members are urged to do as much reading as possible in advance of the weekly workshop meeting, and recognize that the readings listed by week are also a resource for use throughout the semester. In addition to readings listed by week, this syllabus closes with lists of additional resources on reserve in Stokes Library and helpful web sites.

WEEKLY SCHEDULE (Readings, Assignments, and Guest Speakers)

WEEK 1. September 20, 2010.

Climate Science and general introduction/organization.

Introduction to workshop assignment. Basic background information. Discussion of workshop process. Fall recess travel. Organizational matters and logistics for the semester. Selection of student liaisons with Graduate Program Office.

Introduction to current state of understanding of climate change science. Technical overview of possible fast action mitigation strategies for consideration by the workshop.

Required Readings:

Mario Molina, Durwood Zaelke, K. Madhava Sarma, Stephen O. Andersen, Veerabhadran Ramanathan, and Donald Kaniaru, Reducing abrupt climate change risk using the Montreal Protocol and other regulatory actions to complement cuts in CO₂ emissions, Proceedings of the National Academy of Science, December 2009.

Climate Change 2007 Synthesis Document: Summary for Policymakers, Intergovernmental Panel on Climate Warming. http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf

US Global Change Research Program publications and reports may be more accessible than some of the IPCC reports. <http://globalchange.gov/publications>
Worth checking out, particularly Climate Change Impacts in the United States : <http://globalchange.gov/publications/371> .

Penner, JE et al., Commentary: Short-lived uncertainty? *Nature-Geoscience*, 2010.

For those interested in a highly accessible article intended for the non-scientist you will find this one to be a compelling summary of the threats of climate change by one of the top US climate scientists.

Hansen, Jim. "The Threat to the Planet." *New York Review of Books*. Vol. 53, No. 12, July 13, 2006, pp. 12-16. <http://www.nybooks.com/articles/19131> (see e-reserves for version with important graphics)

Rosen, Richard A. Reply to Weiner, and reply by Jim Hansen. "The Threat to the Planet: An Exchange." *New York Review of Books*. Vol. 53, No. 14, September 21, 2006, p. 98. <http://www.nybooks.com/articles/19304>

Recommended Background Readings:

This is the web site where you can find all of the 2007 IPCC reports in .pdf format: <http://www.ipcc.ch/> Depending on your focus you will want to look at relevant sections of the detailed reports on "Science", <http://www.ipcc.ch/ipccreports/ar4-wg1.htm> and "Mitigation", <http://www.ipcc.ch/ipccreports/ar4-wg3.htm>.

WEEK 2. Monday September 27. Overview of possible fast action mitigation strategies for consideration by the workshop (continued from week 1).

As we will be spending all day on Friday travelling to and from Washington DC, the Monday class meeting will end at 8:30.

We will have a brief meeting on Monday September 22, 2008 to finish business from week 1, continue discussing technical aspects of fast action mitigation strategies, and to prepare for our trip to Washington D.C. on Friday October 1, 2010.

Required Reading

U.S. Department of State, U.S. Climate Action Report, 2010. Fifth Climate Action Report to the UN Framework Convention on Climate Change. Pay particular attention to the policy and measures chapter. <http://www.state.gov/g/oes/rls/rpts/car5/index.htm>.

Kerry, Lieberman American Power Act Bill.

http://lieberman.senate.gov/assets/pdf/APA_full.pdf

Skim text on fast mitigation strategies.

V. Ramanathan, Y Xu, The Copenhagen Accord for limiting global warming: Criteria, constraints and available avenues, PNAS, May 2010.

Ramanathan, V. and Y. Feng. On avoiding dangerous anthropogenic interference with the climate system Formidable challenges ahead, *Proceedings of the National Academy of Sciences*, 2008.

WWS 2008 Workshop report, "Black Carbon: A review and policy recommendations".

<http://www.princeton.edu/~mauzeral/WWS591e/Princeton.WWS591E.Black.Carbon.report.2009.pdf>

Friday October 1, 2010: meeting at DoE in Washington D.C.

WEEK 3. October 4, 2010

Guest Speaker: Dr. Stephen Andersen, co-chair Technology and Economics Panel (TEAP), Montreal Protocol.

The Montreal Protocol is widely viewed as the most successful global environmental treaty, phasing out production of nearly 100 ozone depleting substances (ODS). These chemicals are also strong greenhouse gases that contributed 20% of net anthropogenic forcing in 2005 (IPCC, 2007). Some chemical replacements for the phased-out ODSs are also strong greenhouse gases, and one fast action climate mitigation approach would be to limit or prohibit their production. Dr. Andersen has been a leader in facilitating industry-government cooperation in the phase-out as both the co-chair of the TEAP of the Montreal Protocol and as head of special climate projects at EPA. He will discuss possible opportunities for additional climate protection through the Montreal Protocol.

Required reading:

Molina, M, et al., Reducing abrupt climate change risk using the Montreal Protocol and other regulatory actions to complement cuts in CO₂ emissions, *Proceedings of the National Academy of Science*, December 2009.

Montreal Protocol and HFCs. Recent International Developments in Saving the Ozone Layer. Joint amendment proposal from the US, Canada, and Mexico to the Montreal Protocol to Phase-down HFCs. <http://www.epa.gov/ozone/intpol/mpagreement.html>

Velders, Guus; SO Andersen, JS Daniel, DW Fahey, M McFarland, The importance of the Montreal Protocol in protecting climate, PNAS, March 2007

The following book, on reserve in entirety and with four chapters highlighted below on e-reserve is very useful for understanding technology transfer approaches that were successful under the Montreal Protocol and that may have aspects that are applicable to BC mitigation for climate change and air quality.

Andersen, Steven O., Sarma, K. Madhava, Taddonio, Kristin N., Technology Transfer for the Ozone Layer: Lessons for Climate Change, chapters 2, Contours of technology transfer, chapter 3: Background of the ozone and climate agreements; chapter 13: Awareness and capacity building; chapter 14: Lessons, Earthscan, London, 2007. (Available on E-reserve).

HFCs: A growing threat to the climate; the worst greenhouse gases you've never heard of... Greenpeace, December 2009.

Supplementary material for those focusing on HFCs

UNEP. Technology and Economic Assessment Panel. Assessment of HCFCs and Environmentally Sound Alternatives Scoping Study on Alternatives to HCFC Refrigerants at High Ambient Temperatures, May 2010. The Executive Summary (15 pages) is a good overview of existing low-GWP alternatives across all sectors.

Proklima. Natural refrigerants: Sustainable ozone and climate friendly alternatives to HCFCs. 2008.

A report GTZ Proklima (an arm of the German Technical Cooperation commissioned by the German Federal Ministry for Economic Cooperation and Development) on Natural Refrigerants is a useful resource, particularly the first section entitled "Policy/Legislation on F-Gases and Alternatives".

WEEK 4. October 11, 2010 – Black carbon mitigation opportunities

Guest Speaker: Mr. Dennis Clare, Institute for Governance and Sustainable Development

The reading below ranges from a WWS 2008 policy workshop report to policy papers to very technical research articles. Please read the abstract of all the articles below and then pick and choose the areas you'd like to read in greater depth. Readings are arranged in order of importance.

Reading:

2008 WWS workshop report: Black Carbon: A review and recommendations, <http://www.princeton.edu/~mauzeral/WWS591e/Princeton.WWS591E.Black.Carbon.report.2009.pdf>

Bond, T. C., D. G. Streets, K. F. Yarber, S. M. Nelson, J.-H. Woo, and Z. Klimont (2004), A technology-based global inventory of black and organic carbon emissions from combustion, *J. Geophys. Res.*, 109, D14203, doi:10.1029/2003JD003697.

Clare, D., Pistone, K, Ramanathan, V. Getting Rid of Black carbon: A Neglected but effective near-term climate mitigation avenue, *Georgetown Journal of International Affairs*, submitted 2010

Rypdal, K., T. Berntsen, J. Fuglestedt, K. Aunan, A. Torvanger, F. Stordal, J. M. Pacyna, and L. P. Nygaard (2005), Tropospheric ozone and aerosols in climate

agreements: scientific and political challenges, *Environmental Science & Policy*, 8, 29-43.

Department of Energy. Alternative fuels and advanced vehicles data center. This site describes the replacement of high BC emitting diesel with CNG and LNG http://www.afdc.energy.gov/afdc/vehicles/natural_gas_emissions.html

Kopp, RE and Mauzerall DL. Assessing the climatic benefits of black carbon mitigation. *Proceedings of the National Academy of Sciences*, 2010. [[full text](#)] [[supplementary information](#)]

Jacobson, Mark. Short-term effects of controlling fossil-fuel soot, biofuel soot and gases and methane on climate, Arctic ice and air pollution health. *Journal of Geophysical Research*, 2010.

Ramana, MV et al., Warming influenced by the ratio of black carbon to sulphate and the black-carbon source, *Nature Geoscience*, July 2010.

Chen WT, et al., Will black carbon mitigation dampen aerosol indirect forcing? *Geophysical Research Letters*, 2010.

Ramanathan, V., and G. Carmichael (2008), Global and regional climate changes due to black carbon - Review article, *Nature Geoscience*.

Reddy, M. S., and O. Boucher (2007), Climate impact of black carbon emitted from energy consumption in the world's regions, *Geophys. Res. Lett.*, 34, L11802, doi:10.1029/2006GL028904.

Introduced legislation:

110 Cong., 2nd session. HR-6739. Congressman Inslee's climate warming legislation, TITLE V—REDUCTION OF BLACK CARBON EMISSIONS TO PRESERVE THE ARCTIC.

110 Cong., 2nd session. Clinton amendment To require emission reductions for emissions of black carbon and tropospheric ozone precursors

WEEK 5 October 18, 2010

Guest speaker: Mr. Daniel Reifsnyder, Deputy Assistant Secretary of State for the Environment, US Department of State.

In addition to his current position, Mr. Reifsnyder was one of the key US negotiators on climate change since the late 1990s. In preparation for his visit, please review some of the material from the first few weeks of class. He should be able to answer questions on everything related to the workshop and will be a superb resource for research contacts for fall break.

Reading:

Price Forecast and Risk Assessment of Methane Projects and Methodologies, A delivery to the Global Methane Fund Point Carbon, DRAFT final report. June 2010

[Clean Air Task Force white paper on methane:
http://www.catf.us/resources/whitepapers/files/Methane-Tapping_the_Untapped_Potential.pdf](http://www.catf.us/resources/whitepapers/files/Methane-Tapping_the_Untapped_Potential.pdf)

Hashem Akbari, Surabi Menon and Arthur Rosenfeld. Global cooling: increasing world-wide urban albedos to offset CO₂, Climatic Change, 2008.

<http://www.springerlink.com/content/r465853147015k4g/fulltext.pdf>

Think about potential international fast action technology initiatives that could leverage the high-level policy dialogue of the Clean Energy Ministerial. See <http://cleanenergyministerial.org/>

WEEK 6. October 25, 2010. Student Presentations and Discussions

Assignments: First papers due. Ten minute oral presentations of individual papers.
Workshop initial outline of final report due for discussion and submission to client for comments. Discussion of proposed field research during recess.

FALL RECESS, October 30 - November 7, 2010: Field Research

WEEK 7. November 8, 2010

Discussion of findings from field research during fall recess. Finalizing of workshop final report organization and workshop member responsibilities. Feedback from client on initial outline of final report. Dr. Robert Kopp, DoE, visits class to provide feedback.

WEEK 8. November 15, 2010

Discussions and decisions on joint recommendations. Planning the workshop's final report. Assignments of remaining work.

WEEK 9. November 22, 2010

Discussions and decisions on joint recommendations. Planning the workshop's final report. Assignments of remaining work.

WEEK 10. November 29, 2010

Draft final report completed, circulated within the workshop for comment, and discussed.

WEEK 11. December 6, 2008

Revisions to draft final report. Provide draft report to clients for comment.

WEEK 12. December 13, 2008

Rehearsal of PowerPoint presentation to client and panel of experts.

Work on revisions in response to comments received from clients.

Early January: Presentation of draft final report to DoE EPA and panel of experts.
Friday January 7, 2011.

Final report due to instructor and EPA clients by end of semester.

SUPPLEMENTARY MATERIAL

Some Web Sites on Climate Change, Black Carbon, Energy, Mitigation strategies, etc.:

Intergovernmental Panel on Climate Change. Includes all of the 2007 reports on Science, Adaptation and Mitigation as well as a variety of special reports <http://www.ipcc.ch/> . These reports come from the flagship international assessment effort of climate change which shared the Nobel Peace Prize with Al Gore in 2007.

Tyndall Center for Climate Change Research. <http://www.tyndall.ac.uk/index.shtml>

International Energy Agency. www.iea.org

U.S. Environmental Protection Agency, Global Warming.
<http://yosemite.epa.gov/oar/globalwarming.nsf/content/index.html>

U.S. Department of Energy, Energy Information Administration, Independent statistics and analysis <http://www.eia.doe.gov/emeu/iea/contents.html>

BP. Statistical Review of World Energy 2010.
<http://www.bp.com/productlanding.do?categoryId=6929&contentId=7044622>

U.S. Department of Energy, Energy Information Agency. International Energy Outlook, 2010. <http://www.eia.doe.gov/oiaf/ieo/index.html>

Climate Change Futures: Health, Ecological and Economic Dimensions.
<http://www.climatechange-futures.org/>

An Inconvenient Truth movie web site. <http://www.climatecrisis.net/>

The Energy Foundation. <http://www.ef.org/programs.cfm?program=climate>

Pew Center for Global Change. <http://www.pewclimate.org/>

CERES, Investors and Environmentalists for Sustainable Prosperity (coalition of investors, environmental and public interest organizations addressing climate change). <http://www.ceres.org/>

Environmental Defense. Global Warming Undo It campaign.
<http://www.undoit.org/home.cfm> and Fight Global Warming campaign.
<http://fightglobalwarming.com/>

Natural Resources Defense Council. Solving Global Warming.
<http://www.nrdc.org/globalwarming/solutions/now.asp>

Climate Compass. European-based local climate protection initiatives.
<http://www.climate-compass.net/>

Real Climate web site (real science from climate scientists). <http://www.realclimate.org/>

IEA Greenhouse Gas R&D Programme. <http://www.ieagreen.org.uk/publications.html>

National Oceanic & Atmospheric Administration. <http://www.noaa.gov/>

Investor Network on Climate Risk. <http://www.incr.com/>

CERES, Investors and Environmentalists for Sustainable Prosperity.
<http://www.ceres.org/>

Climate Institute. http://www.climate.org/climate_main.shtml

Clinton Global Initiative.
http://www.clintonglobalinitiative.org/home.nsf/pt_cmt_topic?open&cat=climate

Heinz Center for Science, Economics and the Environment.
<http://heinzctr.org/index.shtml>

Subscribe to CLIMATE-L list serve (moderated, world-wide submissions on climate change issues, about 2-3 per day on average):
<http://www.iisd.ca/email/subscribe.htm>

Another useful list serve to consider is Climate Change Information Service, for various daily news clippings. Register at: <http://www.climatewire.org/login.cfm>

Additional Material on Reserve in Stokes Library:

Andersen, SO; Sarma KM; Taddonio, KN. Technology Transfer for the Ozone Layer: Lessons for Climate Change. EarthScan, 2007.

Flannery, Tim. The Weather Makers: How Man Is Changing the Climate and What It Means for Life on Earth. New York: Atlantic Monthly Press, 2006. ISBN 10: 0-87113-935-9.

Gore, Al. An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do About It. Emmaus, PA: Rodale, 2006. ISBN 13:978-1-59486-567-1

Tester, Jefferson W., Elisabeth M. Drake, Michael J. Driscoll, Michael W. Golay, and William A. Peters. Sustainable Energy: Choosing Among Options. MIT Press. 2005. This tome is a comprehensive quantitative introduction to energy technologies, with extensive discussion of non-technical issues

Deutch, John and Richard K. Lester, Making Technology Work: Applications in Energy and the Environment. Cambridge: Cambridge University Press, 2004. Deutch and Lester have written a set of case studies dealing with energy and environmental topics. The emphasis is on teaching the techniques of the policy analyst to the undergraduate engineer.

Speth, James Gustav. Red Sky at Morning: America and the Crisis of the Global Environment. New Haven: Yale University Press, 2002.