

**Summary Minutes of the  
U.S. Environmental Protection Agency  
Science Advisory Board  
Economy-Wide Modeling Panel  
Public Teleconference  
July 15, 2015**

Economy-Wide Modeling

Panel Members:

Dr. Peter Wilcoxon, Chair  
Dr. Edward Balistreri  
Dr. Richard Belzer  
Dr. Linda Bui  
Dr. Jared Carbone  
Dr. Francisco de la Chesnaye\*  
Dr. Karen Fisher-Vanden  
Dr. Alan Fox  
Dr. Don Fullerton  
Dr. Thomas Hertel  
Dr. Edward Leamer  
Dr. Gilbert Metcalf  
Dr. W. David Montgomery  
Dr. Nick Muller  
Dr. Sergey Paltsev  
Mr. Richard Revesz  
Dr. Lorenz Rhomberg  
Dr. Adam Rose  
Dr. Robert Shimer  
Dr. V. Kerry Smith  
Dr. Ian Sue Wing  
Dr. Mort Webster  
Dr. Robertson Williams

\* did not participate in teleconference.

Purpose: The Economy-Wide Modeling Panel received a briefing from EPA's National Center for Environmental Economics on its charge questions and forthcoming white papers.

Designated Federal Officer: Dr. Holly Stallworth, Designated Federal Officer

Other EPA Staff: Allen Fawcett, Chris Zarba, Al McGartland, Ann Wolverton, Alex Marten, Brett Snyder, Richard Garbaccio, Mark Dickie, David Evans, James McFarland, Carl Pasurka, Zekarias Hussein, Todd Goldman, Bryan Hubbell, Darryl Weatherhead, Alecia Cassidy, Jim DeMocker, Ann Ferris, Erika Sasser, Wendy Hoffman, Gloria Helfand, Michael McWilliams, Jared Creason, Tom Walton, Charles Rhodes, Joel Corona, Michael Shelby

Public: Jessie Levin (Rubber Manufacturers Association); Mary Martin (U.S. Chamber of Commerce); Jared Woollacott (RTI International); Amanda Peterka (E&E Daily, Greenwire, E&E News); Joe Johnson (U.S. Chamber of Commerce); Brittany Bolen (Senate Environment and Public Works Committee); Rachel Jones (National Association of Manufacturers); Tara Rothchild (House Committee on Energy and Commerce)

Meeting Materials and Meeting Webpage:

The materials listed below may be found on the meeting webpage at:

<http://yosemite.epa.gov/sab/sabproduct.nsf/a84bfee16cc358ad85256ccd006b0b4b/165f936e2001c2c485257dfd00602cfb!OpenDocument&Date=2015-07-15>

Dr. Stallworth gave her opening statement noting the compliance of the Panel with the Federal Advisory Committee Act. Dr. Stallworth also noted there were no requests for public comment but that written comments had been posted on the meeting webpage from the U.S. Chamber of Commerce and American Chemistry Council. Dr. Wilcoxon thanked the panelists and said he thought the Economy-Wide Modeling (EWM) Panel would be able to provide the Agency with guidance on the role of EWM in cost-benefit analysis, noting that the Panel would be charged with providing guidance prospectively rather than retrospectively.

Dr. Al McGartland, Director of EPA's National Center for Environmental Economics (NCEE), thanked the Panel for agreeing to participate in this review over the next couple of years. Dr. McGartland harkened back to the Executive Order that first required benefit-cost analysis (BCA) and noted the progress in the field that had brought NCEE to explore economy-wide modeling in this context. He expressed gratitude that the SAB's involvement would bring a great deal of scientific integrity to the process.

Dr. Ann Wolverton presented the slides entitled "Economy-Wide Modeling in Analyses of Air Regulations at EPA" posted on the meeting webpage. Following the slides, Dr. Wolverton covered the reasons why EPA did economic analysis, the nature of EPA's air quality regulations and gave an overview of regulatory analytic approaches. Dr. Wolverton said the SAB's response to charge questions may inform future updates to EPA's Guidelines for Preparing Economic Analyses and covered the basic economic concepts underlying EPA's benefit-cost analysis, including the damage function approach to benefits estimation that leads to monetization of benefits. On the cost side, Dr. Wolverton explained the approach EPA typically takes to abatement cost estimation and social cost estimation. Dr. Wolverton covered some examples where computable general equilibrium (CGE) models have been used, noting that they have only been used occasionally to evaluate the economic effects of large air regulations. To date, EPA has not attempted to estimate net effects on overall U.S. employment effects of air regulations using CGE or other types of economy-wide models. Dr. Wolverton noted that CGE models also had been used to prospectively analyze the Clean Air Act Amendments as well as proposed climate legislation.

Dr. Wilcoxon said it didn't seem possible to have a single economy-wide model that could be used for every rule and the model would probably have to be tailored or chosen uniquely for each rule.

In response to a question from a panelist, Dr. Wolverton distinguished between short-run and long-run impacts. Dr. Wolverton also responded to a question about whether EPA takes a more formalized approach to evaluating uncertainty for rulemakings. She responded that EPA is required by Executive Order to conduct formal uncertainty analysis for rules with greater than \$1 billion in expected annual economic impacts. In the specific context of CGE models, a representative from the Office of Air and Radiation noted the analysis of multiple scenarios and sensitivity analyses when analyzing proposed climate legislation.

A panelist asked whether EPA had done retrospective analysis to see whether baseline predictions from CGE models used in past studies had performed well. A representative from EPA said that no such studies have been done to date.

NCEE representatives said the SAB review would focus on traditional air pollutants, not carbon, given that the National Academy of Sciences would be reviewing the recent social cost of carbon report.

One panelist said that it may be more important to compare assumptions between engineering and partial equilibrium models than to compare partial equilibrium to general equilibrium models. Dr. Wolverton noted that the choice of modeling tool(s) is likely rule-specific, that the specific attributes of a regulation may make some types of models more or less appropriate. She also said it was important to be consistent about the baseline or counterfactual across models and that CGE modeling may approach that question differently.

Panelists also asked about the methods EPA uses to identify the most appropriate modeling tools to use to analyze a regulation at the onset. Another panelist asked about the challenges involved in representing spatial variation in benefits. Dr. Wolverton noted the challenge of mapping them to a relatively coarse regional representation in most CGE models.

Dr. Wolverton then turned her attention to the “Overview of Economy-Wide Charge, White Papers and Memos” presentation posted on the meeting webpage. Dr. Wolverton noted that the charge was posted in the Federal Register for a 60 day comment period and that the current version reflects public comments received by EPA. She also explained the different approach that would be taken in this SAB review: namely, that white papers and memos would be provided as background material and that the Panel would be asked open-ended questions designed to elicit their guidance on priorities for the Agency as it sought to develop next steps on economy-wide modeling. Dr. Wolverton noted that the aggregate nature of CGE models may miss details about compliance and benefits or short-run effects and thus the Panel would be asked for guidance on these questions and how to interpret CGE model results that may only partially represents costs and/or benefits. Dr. Wolverton noted that OMB guidance on the use of macroeconomic models indicates they are best for capturing very large policy changes while individual air regulations fall far below that threshold. Moving forward, Dr. Wolverton noted the two broad questions facing the Panel: the challenges of using CGE models and priorities for future research.

One panelist said there was a great deal to learn from the so-called “Second Prospective,” or, more formally, the *Benefits and Costs of the Clean Air Act: 1990 to 2020* and the huge gap between the partial equilibrium (PE) results and the general equilibrium results when benefits were considered. Another panelist noted, however, the potential complication of trying to evaluate its accuracy or in thinking of it as a predictive study due to the way the counterfactual is typically defined in a CGE model and the focus in CGE models on differences instead of levels. An NCEE representative added one of the white papers will discuss what was learned from the Second Prospective Study and that NCEE was certainly interested in learning from past analyses.

Panelists discussed the possibility of recommending an enhanced effort like the Stanford Energy Modeling Forum (EMF) that compares model results across a wide range of economy-wide models evaluating the same policy. A representative from the Office of Air and Radiation said EPA had been involved with the EMF 22 exercise when analyzing the economic effects of climate legislation. A suggestion was made that EPA might be more productive if it were to design some modeling exercises that could be conducted in the near-term, though it was noted that a full EMF-like exercise could not be conducted within such a short timeframe. Dr. Wolverton noted that it may be possible to conduct a small number of modeling exercises over the next two years to inform the SAB discussion. Dr. McGartland noted that one outcome of the SAB Panel deliberations could be the suggestion that EPA pursue a full EMF-like comparative approach as a next step in evaluating the usefulness of economy-wide modeling tools for evaluating air regulations.

In response to a question regarding whether it is useful for the Panel to suggest specific economy-wide models for EPA to consider, Dr. Wolverton noted that we are most interested in understanding what criteria to use for identifying the suite or class of models most appropriate for evaluating particular types of regulations or what attributes of a model are most important in particular contexts.

Dr. Wolverton covered the four white papers that would be delivered to the Panel, on social cost, social benefits, economic impacts and uncertainty. Further details may be found in the presentation slides posted on the meeting webpage.

One panelist asked about the bounds on uncertainty that will be covered in the white paper and whether it would cover parametric and stochastic uncertainty and an NCEE representative said the memo on alternative macroeconomic models would cover those issues. The white papers would also discuss the ways in which dynamic stochastic general equilibrium models consider decision making under uncertainty.

Another panelist asked for a matrix to relate the charge questions to the white papers and the memos. Dr. Wolverton said NCEE would provide such a mapping between the charge questions and the background materials so that panelists could target the appropriate sections related to their assigned charge questions.

Another panelist suggested the Panel would be looking at the benefits of CGE modeling versus the cost relative to partial equilibrium models and identify any obvious tradeoffs. Dr. McGartland said EPA would likely find itself first using a partial equilibrium model and then

having to make a decision about whether to deploy a CGE model. Dr. Wolverton said NCEE was hoping to delineate the circumstances under which it made sense to deploy a CGE model.

Some panelists expressed confusion about the vocabulary being used, e.g. the use of the term, macroeconomic model. One panelist said CGE models are generally calibrated, not econometrically estimated; and that North American Free Trade Agreement (NAFTA) models were highly detailed in terms of sector dynamics. One panelist suggested the distinction between structural and reduced form models was another helpful way of differentiating between models. Dr. Wolverton said she didn't know how feasible it would be to circulate a glossary of terms far in advance of the white papers but that they could certainly provide a glossary.

Dr. McGartland said he was under the impression that outside groups who analyzed macroeconomic effects of EPA's regulations were generally using input-output models. Dr. Wilcoxon said the Panel should weigh in on how to classify the models and when they are appropriate to use.

One panelist said he would not have reached for a CGE model when thinking about how to expand beyond a PE model. He would, instead, think about adding to his PE model, depending on what important general equilibrium features were missing.

One panelist noted another distinction: models that include an income constraint, a budget constraint and income endowments versus a PE model which assumes price is fixed and therefore supply is inelastic (such as an input-output model). The former kind of model can produce better results on employment effects, it was noted.

Dr. Wilcoxon said a short memo outlining the basic types of models and definitions based on their key features or attributes would be helpful to the Panel prior to the October 22 – 23, 2015 meeting. Dr. Wolverton assured him NCEE would provide such a glossary as well as a mapping between charge questions and background materials for the October meeting. The Panel debated whether to require preliminary written comments prior to the meeting or to defer writing after the October meeting. Dr. Wilcoxon suggested panelists could e-mail their input to Dr. Stallworth on this issue.

Dr. Stallworth thanked everyone and adjourned the meeting.

Holly Stallworth, Ph.D. /s/  
Designated Federal Officer  
Certified as Accurate:

Peter Wilcoxon, Ph.D. /s/  
Chair, SAB Economy-Wide Modeling Panel

**NOTE AND DISCLAIMER:** The minutes of this public meeting reflect diverse ideas and suggestions offered by committee members during the course of deliberations within the meeting. Such ideas, suggestions, and deliberations do not necessarily reflect definitive

consensus advice from the panel members. The reader is cautioned to not rely on the minutes to represent final, approved, consensus advice and recommendations offered to the Agency. Such advice and recommendations may be found in the final advisories, commentaries, letters, or reports prepared and transmitted to the EPA Administrator following the public meetings.