

1 **Prospectus for Synthesis and Assessment Product 4.5**

2
3 *Effects of Global Change on Energy Production and Use*

4
5 Lead Agency: Department of Energy (DOE)

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9 **1. Overview: Description of Topic, Audience, Intended Use, and Questions to be**
10 **Addressed**

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12 ***1.1. Introduction***

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14 In the *Strategic Plan for the U.S. Climate Change Science Program* (issued in July 2003), 21
15 Synthesis and Assessment Products (SAPs) were identified to be produced over a 4-year time
16 frame (2004-2007), in line with Climate Change Science Program (CCSP) Decision Support
17 Goal 1: “Prepare scientific syntheses and assessments to support informed discussions of climate
18 variability and change issues by decisionmakers, stakeholders, the media, and the general
19 public.” These products are to be prepared through processes that are open and public,
20 encouraging stakeholder participation in order to promote a consensus about the knowledge base
21 for climate change decision support.

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23 In April 2005, the Government Accountability Office (GAO) issued a report (GAO-05-338R,
24 Climate Change Assessment) which suggested that the 21 SAPs do not satisfy the scientific
25 assessment requirement of the Global Change Research Act of 1990 for periodic assessments of
26 implications of global change on various systems and resources in the United States, including
27 effects on energy production and use. On July 15, 2005, CCSP agreed to modify its SAP list to
28 incorporate coverage of all assessment areas listed under Section 106 of the Global Change
29 Research Act. One of these modifications was rescoping Product 4.5 to focus on “Analyses of
30 the Effects of Global Change on Energy Production and Use,” due in the second quarter of
31 FY2007 (i.e., March 31, 2007), with the Department of Energy (DOE) as the Lead Agency.

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33 SAP development must follow guidelines issued publicly on December 2, 2004, and employ five
34 general principles:

- 35 • Analyses structured around specific questions
36 • Early and continuing involvement of stakeholders
37 • Explicit treatment of uncertainties
38 • Transparent public review of analysis questions, methods, and draft results
39 • Adoption of a “lessons learned” approach, building on the ongoing CCSP analyses.

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41 Each SAP is assigned to a Lead Agency, working under the auspices of the CCSP Interagency
42 Committee. Lead and contributing authors of SAPs are to be “scientists or individuals with
43 recognized technical expertise appropriate to a product.” Expert reviewers will include
44 individuals with equivalent qualifications. Stakeholders will participate during the scoping
45 process (completed in September 2005 for SAP 4.5), provide comments on the prospectus, and
46 comment on the product during a public comment period.

1.2. The Topic

This product will summarize the current knowledge base about possible effects of global change on energy production and use in the United States. The process for producing the report will include a survey and assessment of the available literature, which is rather limited and in many cases in the form of reports that were not peer-reviewed, including attention to findings from research about implications of climate variability on energy production and use. It will also include identification and consideration of relevant studies carried out in connection with CCSP, the Climate Change Technology Program (CCTP), and other programs of CCSP agencies (e.g., the Energy Information Administration), and consultation with stakeholders such as the electric utility and energy industries, environmental non-governmental organizations, and the academic research community to determine what analyses have been conducted and reports have been issued.

SAP 4.5 is not expected to commission new analyses of data, although it is likely to include new syntheses of available knowledge and data. It will not develop climate change scenarios, instead drawing from the report of SAP 2.1 (“Scenarios of Greenhouse Gas Emissions and Atmospheric Concentrations and Review of Integrated Scenario Development and Application”) and other CCSP sources. Its focus will be on possible energy sector effects of global change, including a characterization of current uncertainties and research priorities for reducing uncertainties (where feasible through research) as a basis for informing decisionmaking. Its intention is to be policy relevant but not policy prescriptive. Although ideally it would report quantitative effects (both positive and negative) under different scenarios for regional climate change and associated uncertainties, given limited data and knowledge it may only be feasible to emphasize vulnerabilities to impacts and general levels of confidence for statements about such concerns. It will also identify where research could reduce uncertainties about vulnerabilities, possible effects, and possible strategies to reduce negative effects and increase adaptive capacity.

The content of SAP 4.5 will include attention to the following issues:

- Possible effects (both positive and negative) of climate change on energy *consumption* in the United States, for instance:
 - Effects on energy use for space warming, including regional differences
 - Effects on energy use for space cooling and other refrigeration, including regional differences
 - Overall effects on energy use, by delivery form and fuel type (e.g., electricity and natural gas)
 - Other possible effects, including energy demands and uses in key sectors of the economy
- Possible effects (both positive and negative) on energy *production and supply* in the United States, for instance:
 - Effects of changed energy requirements on energy institutions (e.g., on electricity system reliability)

- 1 – Effects (positive and negative) on renewable energy resources [e.g., hydropower and
- 2 biomass (from changes in precipitation patterns) and windpower (from extreme
- 3 weather events)]
- 4 – Effects on other energy production facilities (e.g., availability of water for cooling,
- 5 offshore oil production impacts associated with storm behavior)
- 6 – Effects on energy transmission and distribution (e.g., on electricity transmission
- 7 networks, bridges and rivers that move petroleum products, storm impacts on storage
- 8 facilities)
- 9 • Possible indirect effects on energy consumption and production through:
 - 10 – Possible effects on energy production and use *technologies*, including technology
 - 11 research and development investments and technology preferences and choices
 - 12 – Possible effects on energy production and use *institutions* (e.g., possible impacts on
 - 13 fossil fuel industries and contexts for policymaking and regulation)
 - 14 – Possible effects on energy-related dimensions of *regional economies* (see regional
 - 15 variations above), including changes in regional comparative advantage regarding
 - 16 energy availability and cost
 - 17 – Possible relationships with *other energy-related issues*, including energy prices,
 - 18 energy security, environmental emissions, and energy technology and service exports.
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21 **1.3. The Audience**

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23 The audience for SAP 4.5 includes scientists in related fields, decisionmakers in the public sector
24 (Federal, State, and local governments), the private sector (energy companies, electric utilities,
25 energy equipment providers and vendors, and energy-dependent sectors of the economy), energy
26 and environmental policy interest groups, and the general public. In many cases, it is expected
27 that SAP 4.5 will be unable—based on existing knowledge—to answer all relevant questions that
28 might arise from this diverse array of stakeholders, but it is hoped that the product will inform
29 discussions about the issues raised in Section 1.5 below and clarify priorities for research to
30 reduce uncertainties in answering such questions. The product will be designed to communicate
31 with the informed public as well as with identified decisionmakers.
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34 **1.4. Intended Use**

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36 A SAP has three end uses: (1) informing the evolution of the research agenda; (2) supporting
37 adaptive management and planning; and (3) supporting policy formulation. This product will
38 inform policymakers, stakeholders, and the general public about issues associated with climate
39 change implications for energy production and use in the United States, increase awareness of
40 what is known and not yet known, and support discussions of technology and policy options at a
41 stage where the knowledge base is still at an early stage of development.
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1.5. *Questions To Be Addressed*

The central questions to be addressed by SAP 4.5 follow:

- How might climate change affect energy consumption in the United States?
- How might climate change affect energy production and supply in the United States?
- How might climate change affect various contexts that indirectly shape energy production and consumption in the United States, such as energy technologies, energy institutions, regional economic growth, energy prices, energy security, and environmental emissions?

SAP 4.5 may not produce definitive quantitative answers to these questions, beyond broad qualitative generalizations; however, the process of addressing the questions is expected to be informative.

2. **Contact Information: E-mail and Telephone Numbers for Responsible Individuals at the Lead Agency**

Jerry Elwood
Director, Climate Change Research Division
Office of Biological and Environmental Research
Office of Science
Department of Energy
Jerry.Elwood@science.doe.gov
Telephone: 301-903-3281

3. **Lead Authors**

Lead and contributing authors of SAPs are to be “scientists or individuals with recognized technical expertise appropriate to a product.” The technical content of SAP 4.5 will require expert knowledge about:

- Economic and engineering aspects of energy demand and supply
- Available climate change scenarios for the United States and its regions
- Relationships between weather and climate variables and energy demand and supply
- Sensitivities of renewable and other energy sources to climate variation
- Relationships between energy conditions and other economic sectors
- Regional differences in energy conditions and institutions
- Institutional structure of the U.S. energy system and recent or current climate-related (or equivalent) stresses on that system (e.g., the experience of the recent California energy crisis, in which one of the causes was climate variability in the Northwest)
- Climate change technology research and development directions and possible determinants of technology market penetration.

SAP 4.5 will be prepared and authored by staff from the DOE national laboratories, drawing on their own expertise and knowledge bases and also upon other knowledge bases, including those

1 within energy corporations and utilities, consulting firms, non-governmental organizations, State
2 and local governments, and the academic research community. Authorship by DOE national
3 laboratory staff will in no way exclude any relevant research or knowledge, and every effort will
4 be made to identify and utilize all relevant sources.

5
6 Authors are expected to include the following leaders and experts from DOE national
7 laboratories, who will interface with appropriate experts from their own and other institutions as
8 appropriate (see Appendix A for brief bios):

- 9 • Thomas J. Wilbanks, Oak Ridge National Laboratory, Coordinating Lead Author
- 10 • Marilyn A. Brown, Oak Ridge National Laboratory
- 11 • Stan Bull, National Renewable Energy Laboratory
- 12 • James Ekmann, National Energy Technology Laboratory
- 13 • William Horak, Brookhaven National Laboratory
- 14 • Mark Levine, Lawrence Berkeley National Laboratory
- 15 • Doug Rotman, Lawrence Livermore National Laboratory
- 16 • David Schmalzer, Argonne National Laboratory
- 17 • Michael Scott, Pacific Northwest National Laboratory.

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19 Further DOE national laboratory staff will also contribute to chapter authorship according to
20 their individual expertise related to topics of the SAP.

21 22 23 **4. Stakeholder Interactions**

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25 Stakeholders have participated during the scoping process, will provide comments on the
26 prospectus, and will comment on the product during a public comment period. Besides the
27 stakeholders workshop on September 27, 2005, to provide input to scoping this draft prospectus,
28 and the review processes described in Section 6, SAP 4.5 will include:

- 29 • Active networking by authors with counterparts in other institutions, in part identified
30 through the workshops, to ensure that the process is fully informed about their knowledge
31 bases and viewpoints. This is likely to include a variety of site visits to key parties and
32 selected interactions at annual meetings or conferences of peer communities.
- 33 • A web site for SAP 4.5 will contain full information about the assessment and the
34 process, including the prospectus, information about the authors and workshops, and as
35 appropriate draft materials under review.

36 37 38 **5. Drafting Process**

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40 According to the *Guidelines for Producing Synthesis and Assessment Products*, the SAP process
41 includes the following steps:

- 42 • Summarize the proposed process and product in a draft prospectus, with inputs from
43 users and other stakeholders, including a description of processes for soliciting
44 stakeholder input
- 45 • CCSP review and a public comment period of at least 30 days
- 46 • Prospectus revision and approval

- 1 • Preparation of a first draft by Lead Authors, including a technical section plus a summary
- 2 for interested non-specialists
- 3 • Expert peer review organized by the Lead Agency
- 4 • Preparation of a second draft
- 5 • Second draft posted for public comment for at least 45 days
- 6 • Preparation of a third draft
- 7 • Review by the CCSP Interagency Committee
- 8 • National Science and Technology Council (NSTC) approval.
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10 In general, the approach for preparing SAP 4.5 will be consistent with the practices of other
11 SAPs, shaped to some extent by the current scarcity of peer-reviewed research literature that can
12 be cited as a basis for statements about this subject. Author teams will be selected for the major
13 chapters of the product, working under the oversight of an SAP 4.5 Coordinating Team. The
14 Coordinating Team and chapter authors will utilize professional networks, bibliographic
15 information sources, and stakeholder input to identify relevant knowledge bases, direct and
16 indirect; compile all available data in consultation with other experts in the public sector, the
17 private sector, non-governmental organizations, and the academic research community; assess
18 the available knowledge base using established analytic-deliberative practices, also in
19 consultation with other experts; develop a summary of what is known and what is not yet known,
20 along with possible priorities for improving the knowledge base; and produce a summary
21 statement of conclusions as supported by the research evidence, along with an evaluation of
22 levels of confidence represented by each statement.

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24 If quantitative analytic data are limited, as seems possible based on preliminary surveys of the
25 current knowledge base, the author teams will explore the degree to which qualitative statements
26 of possible effects may be valid as outcomes of expert deliberation, utilizing the extensive
27 review processes built into the SAP process to contribute to judgments about the validity of the
28 statements.

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30 SAP 4.5 is subject to provisions of the Information Quality Act, which requires that authors
31 independently verify the accuracy and reliability of findings, data, results, and conclusions in
32 cited documents that have not been peer-reviewed and published in the open literature.

33 34 35 **6. Review**

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37 SAP guidelines call for the following steps in reviewing the approach and draft materials
38 associated with SAP 4.5 before its completion (see timeline):

- 39 • Opportunities for public comment on the draft SAP 4.5 prospectus (at least 30 days)
- 40 • Expert review of first draft materials, organized by DOE with candidate reviewers invited
41 from other CCSP agencies as well
- 42 • Opportunities for public comment on second draft materials, posted on the CCSP web
43 site (at least 45 days)
- 44 • Final reviews by the CCSP Interagency Committee and NSTC.
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7. Related Activities

Unlike some of the other sectoral assessment areas identified in the Global Change Research Act—such as agriculture, water, and human health—energy was not the subject of a sectoral assessment in the *National Assessment of Possible Consequences of Climate Variability and Change*, completed in 2001. As a result, SAP 4.5 draws upon a less organized knowledge base than these other sectoral impact areas. On the other hand, by addressing an assessment area not covered in the initial national assessment, SAP 4.5 will provide new information and perspectives.

The subject matter associated with SAP 4.5 is incorporated in the Working Group II contribution to the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (Impacts, Adaptation, and Vulnerability), namely Chapter 7, “Industry, Settlement, and Society.” This chapter is summarizing the global knowledge base about possible impacts of climate change on energy production and use in less than two pages within a chapter limited to a total of 30 pages, reporting relevant research from the United States but not assessing impacts on the United States.

8. Communications

Communications associated with SAP 4.5 include proposed stakeholder interactions, provisions for reviews of draft materials, and dissemination of SAP results and products.

After completion of the reviews and consequent responses to comments, production and distribution of the final SAP 4.5 report will be arranged by DOE in accordance with established practices for Federal government dissemination. SAP 4.5 will be printed, with hard copies made available through the CCSP Office. It will also be made available electronically on both the CCSP and SAP 4.5 web sites.

The web site will make a wide variety of information about SAP 4.5 available to stakeholders and the general public, inviting comments and questions about the process, draft materials, and ways to make such a process more useful in the future.

Opportunities for providing information about SAP 4.5 and its results will be sought in various appropriate scientific and other public venues, such as professional conferences and workshops, and one or more summaries of the results may be published in an appropriate professional journal.

9. Proposed Timeline

The due date for SAP 4.5 is the second quarter of FY 2007 (March 31, 2007). A timeline that meets all of the requirements of the *Guidelines for Producing Synthesis and Assessment Products* follows:

- Stakeholder workshop to help scope the prospectus: September 2005
- Drafting of prospectus: October-November 2005
- CCSP review of prospectus and a public comment period of at least 30 days: December 2005 – February 2006
- Prospectus revision and approval: March 2006
- Preparation of a first draft by Lead Authors, including a technical section plus a summary for interested non-specialists: March-June 2006
- Expert peer review organized by the Lead Agency: July-August 2006
- Preparation of a second draft: September-November 2006
- Second draft posted for public comment for at least 45 days: December 2006 – January 2007
- Preparation of a third draft: February-March 2007
- Review by the CCSP Interagency Committee: April 2007
- NSTC approval: June 2007

Appendix A. Bios for Potential Lead Authors

Thomas J. Wilbanks, Oak Ridge National Laboratory, Coordinating Lead Author

Thomas J. Wilbanks is a Corporate Research Fellow at the Oak Ridge National Laboratory and leads the Laboratory's Global Change and Developing Country Programs. He conducts research and publishes extensively on such issues as sustainable development, energy and environmental policy, responses to global climate change, and the role of geographical scale in all of these regards. Wilbanks is a past President of the Association of American Geographers (AAG), a member of the Board on Earth Sciences and Resources of the U.S. National Research Council (NRC), Chair of NRC's Committee on Human Dimensions of Global Change, a member of the Panel on Earth Science Applications and Societal Needs of the NRC "decadal study" of Earth Science and Applications from Space: A Community Assessment and Strategy for the Future, and a member of two other current NRC panels related to environmental assessment and decision support. He is also a member of the Scientific Steering Group for the U.S. Carbon Cycle Research Program and serving as Coordinating Lead Author for the IPCC's Fourth Assessment Report, Working Group II, Chapter 7: Industry, Settlement, and Society, which includes energy sector vulnerabilities, impacts, and adaptation potentials.

Marilyn A. Brown, Oak Ridge National Laboratory

Dr. Brown is the Interim Director of Oak Ridge National Laboratory's Engineering Science and Technology Division. Dr. Brown is an internationally recognized expert on issues surrounding the commercialization of new energy and environmental technologies and the evaluation of government programs and policies. She is currently working with the multi-agency Climate Change Technology Program, led by the U.S. Department of Energy, to assess its R&D portfolio by identifying any major technology gaps and opportunities. Prior to coming to Oak Ridge, she was a tenured Associate Professor in the Department of Geography at the University of Illinois, Urbana-Champaign. She has authored more than 140 publications and has been an expert witness in hearings before Committees of both the U.S. House of Representatives and the U.S. Senate. Dr. Brown serves on the boards of directors of several nonprofit energy organizations and on the editorial boards of several journals. She is also a member of the National Commission on Energy Policy and is a Certified Energy Manager. Her PhD is in Geography from Ohio State University and her Masters Degree is in Resource Planning from the University of Massachusetts.

Stan Bull, National Renewable Energy Laboratory

Dr. Bull is the Associate Director for Science and Technology at the National Renewable Energy Laboratory (NREL) and Vice President, Midwest Research Institute. Stan has more than 35 years of experience in energy and related applications including renewable energy, energy efficiency, transportation systems, bioenergy, medical systems, and nondestructive testing. He has experience in leading energy research and development, managing and developing programs, and planning and evaluating technical programs. He leads NREL's RD&D, which emphasizes

1 renewable energy and energy efficiency technologies in support of DOE programs. Dr. Bull has
2 also held university faculty and private sector responsibilities. He has authored approximately 85
3 publications in diverse fields and technical journals, and presented more than 100 papers at
4 international, national, and other meetings. Dr. Bull has a Ph.D. and M.S. from Stanford
5 University and a B.S. from the University of Missouri-Columbia in Chemical Engineering and
6 Mechanical Engineering. Professional recognition and honors include a Senior Fulbright-Hays
7 Professorship in Grenoble, France, the Faculty-Alumni Award from the University of Missouri-
8 Columbia, and the Secretary of Energy Outstanding Program Manager Award.

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11 **James Ekmann**, National Energy Technology Laboratory

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13 Mr. Ekmann currently serves as Director of the Office of Systems, Analyses and Planning at the
14 National Energy Technology Laboratory of the United States Department of Energy. His Office
15 focuses on studies of the benefits of accelerated technology deployment and system analysis of
16 energy technologies. Technology benefits studies are focused on assessing the impact of
17 technology options for reducing greenhouse gas emissions from both mobile and stationary
18 sources; and, costs and benefits of deploying advanced, ultra-low emission energy systems. He
19 has extensive research experience in combustion and holds several patents for emission control
20 technologies and diagnostic devices applicable to boilers. Mr. Ekmann is the U.S. coordinator for
21 collaboration on environmental control technologies (Annex IV) under the U.S. – China Protocol
22 between the Office of Fossil Energy within USDOE and the Ministry of Science and Technology
23 of the People’s Republic of China. He and his staff have worked under USAID funding in India
24 on the Greenhouse Gas Pollution Prevention (GEP) Project with tasks focused on the utility
25 sector, distributed generation and, in partnership with the DOE Clean Cities International
26 program, on clean transportation. He has participated in negotiating research collaborations
27 focused on new technologies under bilateral agreements between the United States and India,
28 China, Italy, Norway, and the European Commission. Mr. Ekmann represented NETL in the
29 development of two Department of Energy studies dealing with climate change mitigation
30 technologies: *Technology Options to Reduce U.S. Greenhouse Gas Emissions* and *Carbon*
31 *Sequestration: State of the Science*. He is author or co-author of numerous papers and
32 presentations in the areas of combustion, multiphase flow, complex systems and climate change
33 mitigation technologies. He has organized numerous technical meetings dealing with greenhouse
34 gas mitigation technologies and with issues reshaping the power industry including organizing a
35 special session at the American Association for the Advancement of Science annual meeting in
36 2003 and at the Electric Power 2004 and 2005 conferences. He organized the first meeting in
37 China, in August of 2001, focused exclusively on greenhouse gas mitigation technologies. He
38 was Co-chairman of the International Program for the Power India 2005 conference.

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41 **William Horak**, Brookhaven National Laboratory

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43 William Horak was appointed Chair of Brookhaven National Laboratory's Energy Sciences &
44 Technology Department (EST), on September 15,2000. He has a B.S. in Aeronautical and
45 Astronautical Engineering, and a M.S. and Ph.D. in Nuclear Nuclear Engineering from the
46 University of Illinois. He is an internationally recognized expert on energy issues and has served

1 on numerous boards, committees and panels, both in the United States and for international
2 organizations, such as the European Bank for Reconstruction and Development. Since coming to
3 Brookhaven he has had a lead role in DOE's activities responding to the Chernobyl accident,
4 including evaluations of Soviet designed facilities. He has implemented and managed numerous
5 programs in nuclear safety, international safeguards, and energy system development. He has
6 received numerous commendations including the American Nuclear Society's Mark Mills Award
7 and the Nuclear Regulatory Commission's Special Achievement Certificate.
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10 **Mark D. Levine**, Lawrence Berkeley National Laboratory

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12 Mark Levine is Director of the Environmental Energy Technologies Division at Lawrence
13 Berkeley National Laboratory. He received a bachelor's degree *summa cum laude* in chemistry
14 from Princeton University and his doctorate in chemistry from UC Berkeley. Before joining
15 LBNL in 1978 he was a staff scientist for the Ford Foundation Energy Project and a senior
16 energy policy analyst at SRI International. From 1983 until his appointment as Division Director
17 in 1997, Dr. Levine served as Head of LBNL's Energy Analysis Program, which analyzes
18 domestic and international energy demand and efficiency issues. He is a co-founder of the
19 Beijing Energy Efficiency Center and has expertise in energy modeling, appliance energy
20 efficiency policy, and other aspects of energy efficiency and climate change policy analysis. Dr.
21 Levine sits on the boards of several energy policy organizations and co-lead the report
22 "Scenarios for a Clean Energy Future," which analyzed U.S. energy efficiency and renewable
23 energy technologies and policies. He has authored several reports for international bodies,
24 including the Intergovernmental Panel on Climate Change (IPCC) and the World Energy
25 Council.
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28 **Doug Rotman**, Lawrence Livermore National Laboratory

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30 Doug Rotman is Program Leader for Earth Systems Science and Engineering at Lawrence
31 Livermore National Laboratory, where he manages programs in carbon management, climate
32 and carbon cycle, water and environment, and energy systems. He began his career at LLNL in
33 1985 and holds a Ph.D. in Mechanical Engineering from the University of California at
34 Berkeley. Doug's research interests include the dynamical formulation of chemical species
35 transport, atmospheric physics, and links between the distribution of atmospheric species and
36 climate change. He has held several management positions, including Group Leader for
37 Atmospheric Chemistry and Deputy Division Leader in the Atmospheric Science Division. Doug
38 has been the PI on a DOE-NSF-NASA collaborative effort to enable advanced chemistry-climate
39 simulations and also served as program manager and PI of a multi-institution NASA project to
40 develop a framework for community wide use in chemical transport modeling. He has served on
41 various advisory panels for NSF and NASA, including serving as Chair of the DOE User group
42 committee developing input to a DOE Office of Science 5-year computing plan and
43 Subcommittee Chair of a NASA committee laying out future NASA Earth System Science
44 activities. He is a member of the NASA/NSF/NOAA Earth System Modeling Framework
45 Advisory Panel, and a member of the Bay Area air quality management district Modeling
46 Advisory Committee.

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3 **David Schmalzer**, Argonne National Laboratory
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5 Dr. Schmalzer is Manager of Fossil Energy Research at Argonne National Laboratory and acting
6 manager for carbon management and sequestration research. Active studies relevant to the SAP
7 4.5 include engineering studies of carbon dioxide capture in conventional PC power plants,
8 Oxyfuel plants and IGCC plants of varying configurations, studies of transport options for
9 captured carbon dioxide, and studies of geologic and mineral sequestration options. Additionally,
10 technical/econometric modeling studies are being performed in collaboration with NETL looking
11 at the interactions of transportation technology, alternate fuels technologies, and electrical
12 generation technologies in a carbon-constrained economy. Prior to joining Argonne, Dr.
13 Schmalzer worked for Gulf Oil Corporation and affiliates for some years and served as Manager
14 of Alternate Fuels Research and as Vice President and Managing Director of Solvent Refined
15 Coal International, Inc., a joint venture of Gulf, Mitsui, and Ruhrkohle. Dr. Schmalzer received a
16 PhD in Chemical Engineering from the University of Pittsburgh and BES and MS degrees in
17 Chemical Engineering from the Johns Hopkins University. He is a licensed professional engineer
18 in Pennsylvania, the author of three US patents and several publications.
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21 **Michael Scott**, Pacific Northwest National Laboratory
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23 Dr. Scott received his Ph.D. in economics from the University of Washington in 1975. He is
24 currently a Staff Scientist in the Energy Science and Technology Directorate at the Pacific
25 Northwest National Laboratory (PNNL). Over the last 20 years, Dr. Scott has specialized in
26 studying the effects of global environmental change on natural resources and the economy,
27 particularly impacts on human systems and the effects of uncertainty. He has managed a series of
28 projects analyzing the effects of global warming on water supply and utilization of the Columbia
29 River system by hydropower, irrigation, and fisheries interests, the impact of climate change on
30 energy use in buildings, and policies for limiting greenhouse gas emissions. He has also
31 contributed to PNNL's Second Generation Model, used to estimate the effects of economic
32 development and policy on greenhouse gas emissions. He was a convening lead author for the
33 Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report *Climate Change*
34 *1995* in the topic area of Human Settlements; was a contributing author to the IPCC Special
35 Report *The Regional Impacts of Climate Change*; and was a coordinating lead author for the
36 IPCC's Third Assessment Report *Climate Change 2001: Impacts, Adaptation, and Vulnerability*.
37 He is a lead author on the North American Chapter in IPCC's Fourth Assessment Report,
38 currently in preparation. He has published in the journals *Climatic Change*, *Journal of the*
39 *American Water Resources Association*, *Global Environmental Change*, *Environmental*
40 *Management*, and *Energy Policy*, among others. His current research is on the impacts of climate
41 change and variability, emissions trading, and uncertainty in integrated assessment models.
42