THE NATIONAL ACADEMIES

NATURAL DISASTERS AND ENERGY POLICY

A SUMMARY OF THE FORUM ON NATURAL DISASTERS AND ENERGY POLICY, JUNE 12, 2001, WASHINGTON, DC

A SUMMARY TO THE
NATURAL DISASTERS ROUNDTABLE

BY
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FOREWORD

The Natural Disasters Roundtable (NDR) seeks to facilitate and enhance communication and the exchange of ideas among scientists, practitioners, and policymakers concerned with urgent and important issues related to natural disasters. Roundtable meetings are held three times a year in Washington, DC. Each meeting is an open forum focused on a specific topic or issue selected by the NDR Steering Committee.

The NDR Steering Committee is composed of 5 appointed members and sponsoring ex officio members. Appointed members are: Rutherford H. Platt, Chair, University of Massachusetts, Amherst; James P. Bruce, Global Change Strategies International, Inc., Ottawa, Canada; Wilfred D. Iwan, California Institute of Technology, Pasadena; Stephen P. Leatherman, International Hurricane Center, Florida International University, Miami; and Mary Fran Myers, Natural Hazards Research and Applications Information Center, University of Colorado at Boulder. Ex officio members are: Frank Goodman, EPRI; Lloyd S. Cluff, Pacific Gas & Electric; Miriam Heller, NSF; Robert M. Hirsch, USGS; Margaret Lawless, FEMA; John LaBrecque, NASA; James Russell, Institute for Business and Home Safety, and Helen M. Wood, NOAA.

For more information on the Roundtable visit our website: http://national-academies.org/naturaldisasters or contact us at the address below.

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This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the NRC's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following individuals for their review of this report:

Malcolm Watts, Kennett Square, Pennsylvania

William Fulkerson, University of Tennessee

Although the reviewers listed above have provided many constructive comments and suggestions, they did they see the final draft of the report before its release. The review of this report was overseen by William L. Fisher, University of Texas, Austin . Appointed by the National Research Council, he was responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

NATURAL DISASTERS ROUNDTABLE

FORUM ON NATURAL DISASTERS AND ENERGY POLICY

INTRODUCTION

The Natural Disasters Roundtable (NDR)[1] held its second public forum on June 12, 2001 at the National Academy of Sciences Building in Washington, DC. The topic of this forum was natural disasters and energy policy—a session intended to facilitate the exchange of information and ideas and to stimulate discussion about the significance of natural disasters for energy policy. The topic was selected by the Roundtable steering committee partly in response to California's energy shortage during Summer 2001, which occurred simultaneously with the Bush Administration's development of a U.S. national energy policy. Specific topics discussed during this forum included earthquake risk management studies at energy facilities as well as energy and emergency management. It also included a panel discussion centered on legislative issues related to energy policy.

To address the scientific and political issues associated with natural disasters and energy policy, the NDR steering committee selected an interdisciplinary group of speakers and panelists from the United States and Canada (see Appendix A for the agenda). Due to the temporal limitations of a one-day meeting, this forum sought to identify a number of key issues for science and policy that may be addressed more comprehensively in the future. Approximately 75 attendees, including the steering committee members and speakers, attended this forum (see Appendix B for a list of attendees).

[1] The National Research Council defines a "roundtable" as a type of convening activity of the National Academies that provides a means for representatives of government, industry, and academia to gather periodically for the identification and discussion of issues of mutual concern. In contrast to National Research Council study committees and other committees of the National Academies, roundtables are intended solely to enable dialogue and discussion among key leaders and representatives on a particular issue. They provide a valuable forum for exchanging information and for the presentation of individual views. However, because roundtables are not subject to institutional requirements concerning conflicts of interest, composition, and balance that apply to NRC committees, roundtables are prohibited by the National Academies from providing any advice or recommendation.

KEY ISSUES IDENTIFIED BY FORUM PARTICIPANTS

Throughout the course of the forum, various participants suggested key natural disasters issues that relate to energy policy. First and foremost, it is apparent that the issue of natural disaster impacts on energy policy is interdisciplinary. Strong partnerships among the natural disaster community, energy policymakers, and stakeholders (the public) are needed to effectively address the problem. Such alliances facilitate the understanding of such complexities as the effects of deregulation on vulnerability to natural disasters and the uncertainties of extreme natural events. For instance, is it important for all groups to realize that scientific uncertainties exist, and this likely will continue. However, even though predictions of natural disasters are not always possible, utility companies can use qualitative forecasts to substantially minimize the impacts of natural disasters. Finally, partnerships provide direct, quick, and clear communications before, during, and after natural disasters, which promote efficient recovery actions and minimize chaos.

Natural disaster preparedness and emergency planning can be improved by incorporating lessons learned from past disasters. A prime example is the admirable performance of Hydro-Québec during its worst ice storm in history, and its subsequent identification of key success factors and areas of improvement. Such lessons learned are extremely useful in highlighting necessary short-term objectives for long-term energy policy. In establishing long-term policies, several speakers stressed the need to identify and implement new technologies to improve and create resilient and redundant energy systems for use during and immediately following natural disasters. However, there are associated challenges that must be overcome, including the massive costs to the power companies to develop such systems. Finally, in addressing both short and long-term goals of global warming policy, an alternative approach was proposed that focuses predominantly on minimizing societal vulnerability to possible extreme weather events. Although the issues raised during the forum are not comprehensive, they warrant further attention by policymakers as national energy policy continues to be developed. We hope that this summary provides a useful starting point from which industry, government, and society can work together on developing economical, effective responses to future natural disasters.

PRESENTATIONS

LINKING NATURAL DISASTERS AND ENERGY POLICY

PRESENTATION BY ROGER A. PIELKE, JR., UNIVERSITY OF COLORADO, BOULDER

Pielke commented on societal vulnerability to climate-related phenomena (e.g., hurricanes, floods, tornadoes, and other extreme weather events). He suggested that policies focusing on land use, insurance, engineering, warnings and forecasts, and risk assessments will be the most effective means of addressing the future impacts of climate on society.

Pielke used hurricanes as a prime example of societal-climate interactions. He noted that economic damage related to hurricane landfalls in the United States increased dramatically over the last several decades, yet scientists have not observed commensurate trends in hurricane frequency or intensity over the same period. Rather, hurricane activity was variable during this period with considerably less activity during the 1970's and 1980's compared to previous decades. Yet despite decreased activity, damage increased. This may be explained by factors other than climate changes, most notably, an increased potential for economic damage due to population growth and high value real estate development in high risk, coastal locations.

Accordingly, Pielke and colleagues performed two sensitivity analyses of projected losses from hurricanes due to climate changes versus societal changes; their study used projections from the 1995 report of the Intergovernmental Panel on Climate Change (IPCC) (Pielke et al., 2000). They concluded that future hurricane losses and damages primarily were due to societal growth and development. In developed countries, this is because of population growth and increased wealth. In developing countries, it also is due to population growth as well as poverty, inappropriate development, and environmental degradation. Based on the spectrum of conservative to aggressive assumptions, the relative ratio of the sensitivity of societal changes to climate changes for projected losses ranges from 22 to 1 to 60 to 1, respectively. Thus, Pielke et al. offered the alternatives of adaptation and mitigation of societal vulnerability to climate rather than solely focusing on climate change prevention. They suggested that policies intended to moderate future climate fluctuations, such as reducing greenhouse gases, would address only a small portion of the increasing damage caused by tropical cyclones. Pielke noted that this does not imply that such policies are not appropriate for other reasons; rather, addressing societal factors should be the predominant role in

responses to changes in climate, and it likely will lead to greater payoffs. Pielke suggested that policy related to societal impacts of climate has important and under-appreciated dimensions that are independent of energy policy. While hurricanes only are one associated example, similar results have been found for health, water resources and inland flooding.

Pielke made a strong case for a new perspective on the ways in which energy and climate policies are viewed. Climate policy refers to the actions that organizations and individuals take to reduce their vulnerability to natural and anthropogenic climate changes, while energy policy refers to such actions as air pollution reduction, conservation, and increasing energy efficiency. Pielke suggested that the two policies should be viewed as overlapping and complementary, rather than independent and conflicting.

NATURAL DISASTERS CONSTRAINTS AND IMPACTS ON ENERGY FACILITIES: EARTHQUAKE RISK MANAGEMENT CASE STUDIES

PRESENTATION BY LLOYD S. CLUFF, PACIFIC GAS & ELECTRIC, SAN FRANCISCO

Cluff cited several case studies where the performance of energy facilities was compromised during earthquakes, and he called for a national energy policy that incorporates the potential for disruption to power systems due to natural disasters. He noted that the effects of earthquakes do not differ greatly from the effects of other natural hazards; hence, lessons learned from dealing with earthquakes can be applied to other hazards. Various earthquake risk management case studies that Cluff described are highlighted below.

The Teton Dam in Idaho is located on a fault system in the Sierra Nevada foothills. On June 5, 1976 a five-hour progressive failure occurred due to water induced piping in the dam's earthfill embankment. The dam had been completed the year before and failed during the reservoir's initial impoundment. The resultant major flooding in Idaho caused the loss of 11 lives and property damage of approximately 400 million (1976) dollars. This failure and disruption to the hydroelectric power system set the stage for controversies over the siting of energy facilities in earthquake-prone areas.

A power plant siting study in the Western Sierra foothills of California, completed in 1974 by PG&E, concluded that the Foothills fault system was capable of producing moderate earthquakes. A portion of this system traversed near California's Oroville Reservoir, and in 1975 an earthquake measuring 5.7 on the Richter scale occurred along a branch of the system near the Oroville Dam. . At the time of the Oroville earthquake, two other dams, the Auburn and New Melones, were in the

beginning stages of construction, both with sites along the Foothills fault system. With the recent activity of the Foothills fault system and the controversy over reservoir-induced earthquakes, both dams came under close scrutiny. Because the proposed Auburn dam was a thin-arch design sited across the fault system, it would not accommodate the faulting without failure, hence, the dam was not completed. However, the New Melones Dam, a proposed rock-fill dam, was determined able to accommodate the potential faulting despite being sited across a branch of the Foothills fault, thus the dam was completed as scheduled.

In 1981 a magnitude 5.4 earthquake occurred beneath the reservoir of the Aswan High Dam in Egypt, resulting in concern about larger magnitude reservoir-induced earthquakes and the safety of the dam. The Aswan High Dam supplies 60 percent of Egypt's electric energy, and the dam impounds one of the world's largest reservoirs to 50 million people living downstream in the Nile Valley. Seismic studies revealed a potential for even larger earthquakes in the region. A detailed seismic stability evaluation of the dam was completed, and minor structural improvements were made to the upstream face of the dam, which now is considered stable to future earthquakes.

The 1989 Loma Prieta earthquake caused extensive damage to critical substations near the epicenter region 60 miles from San Francisco. It left 1.4 million Pacific Gas and Electric customers without electrical power (NRC 1994) and resulted in a flurry of California seismic safety policy activity based on the State Seismic Safety Commission's plan to reduce earthquake losses.

Cluff noted that the implementation of strategic long-term risk management policies improves the safety and reliability of energy systems. He also stated that public/private partnerships serve to accelerate the implementation of collective experience and research, and he highlighted the American Lifeline Alliance (ALA) as an example. The goal of the ALA, which was organized under a cooperative agreement between the Federal Emergency Management Agency (FEMA) and the American Society of Civil Engineers (ASCE), is to reduce the risks to lifelines (utility and transportation systems) from natural hazards. In addition to FEMA and ASCE, other partners include the Federal Highway Administration (FHWA) and Pacific Gas & Electric Company. Further information on the ALA can be found at www.americanlifelinesalliance.org.

KEEPING THE LIGHTS ON: MANAGING AND PLANNING FOR DISASTERS

PRESENTATION BY JACQUES RÉGIS, TRANSÉNERGIE, QUÉBEC

On January 5-9, 1998, southwestern Québec was hit by the worst ice storm in its history. Until then, accumulation of ice from freezing rain had never exceeded 40 mm. The 1998 storm blanketed

some areas southeast of Montréal with 75 mm or more of ice, severely affecting the power system. At the end of the second day of the storm, 700,000 customers were without power. By the end of the fourth day of the storm, more than 1 million customers were without power, and by the last day, most of Montréal was completely blacked out. Short days and January's cold weather drove up the peak demand for power making restoration a top priority.

The enormity of the power outage was due to the power system sustaining very serious damage. Canadian power transmission structures are required to be built to withstand 13 mm of ice buildup. In the areas affected by the storm, the average ice accumulation of 75 mm was much too great, and the power system buckled, requiring a tremendous effort to repair. All told, the storm resulted in needed repairs of 1500 transmission towers, 3000 km of transmission and distribution lines, and approximately 400 km of high-voltage lines. For three weeks, Hydro-Québec, other utility companies, contractors, and others labored 12-16 hours per day to repair the transmission towers and lines. They succeeded in their efforts (evidenced by a survey giving a 98% satisfaction rate in crisis management), and within two weeks, power was restored to approximately 90% of residents. By November 1998, the system was completely repaired. However, Hydro-Québec faced the challenge of ensuring that it could deal with another storm of similar magnitude should it occur.

TransÉnergie, a division of Hydro-Québec, identified the following lessons learned and key success factors from the 1998 ice storm to be utilized in the event of future disasters.

- There was cooperation among different parts of the utility community, including transmission and distribution people.
- They had a preparedness/emergency plan in place (although not to the level of severity of the 1998 storm).
- Hydro-Québec had strong leadership early in the event and managed the event effectively.
- Communication with the public and customers was direct, quick, and transparent. This was a major success factor, because people want to know what is happening and what actions the companies in charge are taking.
- Hydro-Québec immediately put a resolution strategy with four phases into place. The first phase consisted of getting 50% of the community back into their homes; the second phase increased the requirement to 100% of the community; the third phase entailed completion of the permanent reconstruction; and the fourth phase resided in developing additional measures to strengthen the system to handle better future storms of this magnitude.

?? Short-term and daily objectives were set and adapted as the situation changed.

As a result of lessons learned from the 1998 ice storm, Hydro-Québec reviewed its emergency plan and updated the design criteria. Based on this experience, Hydro-Québec developed the following guidelines for an effective emergency response plan, which also is applicable to other disasters.

?? Use the current organizational structure to develop a plan that enables crisis management.

?? Set short-term objectives that are precise, realistic, and measurable.

?? Communicate quickly, directly, and transparently.

?? Quickly identify what resources can help.

?? Coordinate with other groups as necessary.

?? Plan and evaluate an alternative crisis management approach.

?? Keep in touch with field operations.

?? Organize simulated response effort so everyone knows what to do.

?? Review the emergency plan continuously and make changes as necessary.

?? Conduct a post-mortem review to identify what worked and what needs improvement.

?? Identify logistical support needs.

ENERGY AND EMERGENCY MANAGEMENT

PRESENTATION BY ELLIS M. STANLEY, SR., CITY OF LOS ANGELES

Stanley noted that several factors contributed to the California energy crisis, the most important being deregulation of the utility companies. Additional factors included demand exceeding supply, old and failing systems, and failure to make changes necessary to meet the power demands. The California power supply is threatened by planned power outages, unplanned failures of the power grids, and extended outages.

In order to ease the energy crisis, the state of California is supporting a conservation effort, including a “lights out” after dark policy, which entails turning off non-critical lights. However, this effort presents its own challenges to public safety and in identifying what lighting is deemed non-critical. In making such determinations, the state of California engaged in rotating power outages and defined essential use customers. As a result, all utility companies now have websites that post information on where and when outages are planned. For essential use customers, it is assumed that they have developed a back-up energy plan, regardless of the power outages.

One problem encountered during natural disasters is the challenge of communicating with the public. Technology is now available that is capable of monitoring systems and then affecting key operations, such as turning off elevators or transit systems, ringing bells at schools, and opening the doors to firehouses.

Stanley also noted the city of Los Angeles' Panel of the Future, which was formed to anticipate future energy issues in the city.

VIABLE LONG-TERM POLICIES: SEARCHING, SEARCHING...

PRESENTATION BY WALTER R. LYNN, CORNELL UNIVERSITY

Lynn noted that, in order for long-term policies to be viable, a sustainable and unfaltering level of commitment to the implementation of the policy must exist. He likened the search for such long-term, optimal policies to the search for the Holy Grail. However, Lynn cautioned against labeling every problem a crisis, as this diverts attention from real crises and acts as a hindrance to developing long-term solutions. Crises have become routine matters of political expediency, he noted, fueling individuals and governments into action.

Lynn discussed the issues of safety and made the important distinction between making the world a *safe* place, which he considers impossible, versus making it a *safer* place, which he feels is possible. The idea of safety raises expectations that a safe world can be provided, for example, via building codes, labels, and guarantees.

Lynn discussed two examples of longer-term concerns that will require long-term policies—global warming and sea level rise, both of which are ambiguous as to when and where they will occur and the degree to which they will impact society. In addressing such long-term concerns, Lynn suggested that incremental strategies need to be devised to ensure protection of human health and the environment. Benefits of acting incrementally include giving a sense of accomplishment and providing a milestone from which to move on to the next step.

DISASTERS CONSIDERATIONS IN ENERGY POLICY

PRESENTED BY RICHARD T. SYLVES, UNIVERSITY OF DELAWARE

Sylves related Presidential Disaster Declarations and their history to matters of energy policy and disaster policy. He observed that the National Energy Policy Report to the President of the United

States (National Energy Policy Development Group, 2001), acknowledged that some natural disasters pose serious threats to the U.S. energy production and consumption system. As such, the report advocates the following energy policy measures, many of which are relevant to natural disaster management:

- ?? Develop and advance a long-term energy strategy.
- ?? Use cutting-edge technologies, such as Geographic Information Systems (GIS) to plan for and manage energy problems caused by disasters.
- ?? Promote public/private partnerships in energy and disaster contingency planning.
- ?? Integrate energy, environmental, and economic policy.
- ?? Increase energy production reliability.
- ?? Encourage production and consumption of "clean energy" in a way that protects the environment.
- ?? Improve centralized production of energy more than distributed systems.
- ?? Modernize energy conservation.
- ?? Augment national energy supplies and enhance national energy security.
- ?? Stimulate further development of renewable energy technologies.

Sylves explained that, since May 1953 when Eisenhower was in his first term, presidents have possessed authority to issue declarations of "major disaster." By 1974, they could issue declarations of "emergency" as well. From the beginning, governors have asked for, and usually received, approvals of their requests for either presidential declaration. Presidents are especially likely to issue approvals if the event is of national concern, if state and local officials maintain that they are unable to meet the challenges posed by the event without federal help, or if the federal government is presumed to have necessary money and resources to help save lives and protect property before, during, and after an event. Natural disasters are public events that can produce massive losses, thus they draw massive news media attention. Over the past 20 years, state and local emergency managers have become better educated and more professional than their civil defense era predecessors. They now are better able to assess and measure natural disaster losses in order to prove need for a presidential declaration. Media coverage and emergency management professionalism, plus vulnerabilities in the nation's electricity and natural gas systems are helping increase the number of presidential disaster declarations.

Laws and policy changes since 1953 gradually have expanded the range of presidential discretion in deciding whether to approve a governor's request for a disaster declaration. The Stafford Act of 1988, in particular, gave the president a broad grant of authority to decide what calamities are worthy

of presidential declarations. For this reason, future presidents may choose to include energy shortfalls or disruptions as disasters eligible for a declaration.

Sylves suggested that urban hot weather emergencies threatening the young, old, and poor, compounded by the reported overloaded, outmoded electricity transmission and distribution systems, common in the United States, may trigger more governor requests for presidential declarations. The combination of unexpectedly high demand and natural hazard vulnerability on the electric system may produce massive public hardship and economic dislocation. Sylves remarked that electricity and natural gas utility deregulation over the past 10-20 years has fragmented these power systems so much that federal and state governments will be hard-pressed to effectively aid in reconstituting these systems after major natural disasters.

Sylves believes that energy policy may aid disaster mitigation if it promotes system redundancy, advances local or regional distributed power production, maintains and modernizes infrastructure, continues low-income home weatherization programs (as advocated in the report), realizes fuel mix advantages, diminishes demand through better energy efficiency, and considers public safety in land use, zoning, and building regulation. A concern of Sylves is that the report does not adequately address disaster international vulnerability, therefore, he posed the following questions:

- ?? How disaster-safe is the proposed Caspian Sea oil pipeline system?
- ?? How disaster-safe are U.S. oil concessions in seismically active zones of the newly independent Central Asian nations?
- ?? How disaster-safe are massive oil production platforms operating miles out to sea?

Overall, Sylves gave the full report a grade of B- alleging that it was a good start on many counts, but it had too few bold policy initiatives in energy conservation, energy efficiency, and renewable energy.

LEGISLATIVE AND POLICY ISSUES PANEL DISCUSSION

PANELISTS: PETER F. FOLGER, AMERICAN GEOPHYSICAL UNION AND NATURAL HAZARDS CAUCUS AND BRYAN J. HANNEGAN, SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES

Folger noted that the Congressional Natural Hazards Caucus is co-chaired by senators Ted Stevens (R-AK) and John Edwards (D-NC) and currently includes 15 other senators. The goal of the caucus is to develop a wider understanding within Congress that reducing the risk and costs of natural disasters is of public value. It also seeks to provide ways in which the local, state and federal

governments can prepare better and help mitigate the costs of natural disasters. (For more information on the caucus, see their website at http://www.senate.gov/~edwards/cnhc.)

The caucus was launched in Summer 2000 at a forum on Capitol Hill, during which members of the hazards community testified before the caucus co-chairs on challenges and issues that Congress should address to make the country more resilient to natural hazards. One challenge the caucus faces is demonstrating that natural disasters need not necessarily translate into human suffering and cost.

The coordinators of the caucus are Peter Folger, of the American Geophysical Union (AGU), and David Applegate of the American Geological Institute (AGI). Together they chair the Natural Hazards Caucus Work Group, which supports the activities of the caucus. The work group is an information network of over 50 professional, scientific, and engineering societies, relief organizations, higher education associations, institutions of higher learning, trade associations, and private companies. The work group has come together with a common desire to reduce the human and financial toll of natural hazards and to enhance the nation's ability to recover from such events. For more information on the work group, see their website at http://www.agiweb.org/workgroup .

In relation to natural hazards and energy policy, Folger raised the following questions for consideration:

- ?? Presuming that restructuring of the power industry will be optimized and hence, more efficient, are the potential impacts of natural hazards to the newly deregulated industry being considered?
- ?? From a scientific perspective, are the current scientific understanding and uncertainties of events inherent to a forecast or hazard assessment captured in current energy policy? As an example, Folger noted that drought in the northwest U.S. will put an added strain on the power system there. What scientific information about the drought or other weather systems would be useful to managers of the power system? How will utility managers cope with scientific uncertainties?
- ?? Can the scientific community provide useful information to add to the resilience and redundancy systems of power networks?
- ?? Are climate forecasts on the scale of El Niño helpful?

The Natural Hazards Caucus asked the work group to identify a specific set of recommendations to be addressed in the 107th Congress. The work group's main recommendation was that federal agencies should be required to support geophysical, oceanic, and atmospheric research and

instrumentation that would increase lead-time accuracy in warning systems. The scientific community must assess whether it is asking the right questions to help power system managers.

The AGU issues policy statements on different topics and recently reissued its statement on natural hazards. It states that the organization strongly endorses fundamental research on Earth, space, and natural hazards; dissemination of the relevant results to the public, especially vulnerable communities; and implementation of multidisciplinary efforts needed to apply effective mitigation strategies worldwide. (For more information, see AGU's website at http://www.agu.org/sci_soc/policy/naturalhaz.html.)

Hannegan then commented on several issues related to energy policy, beginning with the difference between reacting to climate change versus reacting to climate and the resulting vulnerability.

Furthermore, he suggested that a quantum leap in scientific understanding may not be required, rather that utility companies can benefit from qualitative as opposed to quantitative forecasts. For example, knowing that El Niño was likely to produce 2-3 times the average rainfall in the San Diego area, utility managers moved transmission lines closer to the coast. The move resulted in zero power outages.

Hannegan also noted that there is value to be gained from incremental improvements of forecasts.

Energy production in the future may rely more heavily on renewable resources. Consequently, Hannegan posed the question, "What would the effect of home power generators, such as solar-powered systems, have on the utility industry?"

The scientific community can play an important role in helping policy makers make decisions regarding uncertainties by assessing what is known. Reducing uncertainty usually calls for more scientific research, which, in turn, calls for more appropriations to federal science agencies.

In light of the current move toward deregulation of utility companies, Hannegan raised the following questions relevant to natural hazards in the context of energy policy:

- What would a Gulf of Mexico hurricane mean for oil and gas production in the Gulf?
- What would an earthquake in California mean for the already high gas and electrical energy prices?
- Are there ways to get excess power to California?

?? How much redundancy needs to be built into the power system, how should this be done, and who is going to pay for it?

Hannegan concluded by saying that Congress still needs to be convinced on the issues of deregulation of utility companies and recognizing that there is some public benefit to having redundancy and reserve in the power system.

CONCLUDING REMARKS

Ralph Bernstein, Lloyd Cluff, and Stuart Nishenko joined Folger and Hannegan in the panel discussion. Each gave brief comments on the forum discussion.

Ralph Bernstein, of EPRI, noted the following common themes of the forum:

?? Anticipating future problems from past events.

?? Implementing long-term strategy and law.

In the area of preparedness:

?? Data analysis and modeling.

?? Emergency planning.

?? Public/private partnership.

?? Operating plans.

In the area of reaction/response/recovery:

?? Better design, mitigation.

?? Communicating with the public and customers.

?? Damage assessment.

?? Lifeline support.

?? Emergency response teams.

In the area of leadership:

?? Vision.

?? Challenge conventional wisdom.

?? Advance disaster preparation by incremental policy steps.

Stuart Nishenko gave the perspective of FEMA's Federal Insurance Administration/Mitigation Directorate. FEMA is taking incremental steps toward developing lifeline reliability in the United States in energy, transportation, and communication. He also mentioned the American Lifeline Alliance, of which FEMA is a member. The ALA is looking at the current status of lifelines in the United States and trying to determine what standards and guidelines are needed.

Patricia Stahlschmidt, director of FEMA's Strategic Planning in the Office of the Director, gave the agency's response and recovery perspective. FEMA was a member of the Vice President's task force on the energy report, and although the report did not deal directly with natural disasters, the organization looked at the consequences of management in the short term. She also noted that FEMA is using the structure of the federal response plan to work with the state of California to see what FEMA, other federal agencies, and the state can do to anticipate short-term problems caused by the energy crisis.

Lloyd Cluff discussed three main ideas heard at the forum. He reiterated the importance of keeping long-term goals in mind, with short-term strategies for carrying them out. Drawing on experience with the corporate world at PG&E, he noted that management must see the value of additional capital spent and rapid recovery of costs in increased revenue.

He noted that land-use planning has been a failure due to the misuse of the idea of land use control by those in charge. A more balanced way is needed of using land-use planning that is not so highly regulated . Folger noted that the Natural Hazards Caucus might be a vehicle for discussion about land-use planning.

Finally, Cluff stated that spending more money on research to increase information and knowledge does not necessarily decrease uncertainty. However, it does provide more options and helps to understand the problem better.

REFERENCES

Pielke, Jr., R.A., R. Klein, and D. Sarewitz, 2000. Turning the Big Knob: An Evaluation of the Use of Energy Policy to Modulate Future Climate Impacts. Energy and Environment. Vol. 11. Pp. 255-276. Online at http://www.esig.ucar.edu/knob/index.html.

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Sylves, Richard T. In press. Declaring Disaster: The Politics and Policy of Presidential Disaster Declarations. State University of New York Press, NY.

APPENDIX A

Tuesday, June 12, 2001
National Academy of Sciences
2100 C Street, NW
Washington, DC 20037
Lecture Room

AGENDA

9:00 A.M. Welcome and introductions
Rutherford H. Platt, Chair

9:05 A.M. Overview: Linking energy policy and natural disasters
Roger A. Pielke, Jr., NCAR

9:50 A.M. Natural disaster constraints and impacts on energy facilities: Earthquake risk management case studies
Lloyd S. Cluff, PG&E

10:50 A.M. Keeping the lights on: Managing and planning for disasters
Jacques Régis, TransÉnergie, Quebec

11:50 P.M. Recess for lunch

1:00 P.M. Energy and Emergency Management: LA Case Study
Ellis M. Stanley, Sr., City Los Angeles

1:45 P.M. Viable long-term policies--Searching, searching!
Walter R. Lynn, Cornell University

2:40 P.M. Disasters considerations in energy policy
Richard T. Sylves, University of Delaware

3:45 P.M. Legislative and policy interests panel discussion and questions from the floor
Peter F. Folger, AGU and Bryan J. Hannegan, Senate Committee on Energy and Natural Resources

4:45 P.M. Concluding remarks

5:00 P.M. Adjourn

APPENDIX B

LIST OF ATTENDEES

Anderson, William, World Bank/National Science Foundation
Auclair, Allan, RAND
Bernstein, Ralph, EPRI and Witten Technologies
Beinkiewicz, Bo, American Association for Wind Engineers
Bierley, Eugene W., American Geophysical Union
Blanchard, B. Wayne, Federal Emergency Management Agency/National Emergency Training Center
Brandon, Nora, National Research Council
Chaker, Amar, American Society of Civil Engineers
Chartrand, Robert L., National Academy of Public Administration
Cluff, Lloyd S., Pacific Gas and Electric
Cruz, Ana Maria, Tulane University
D'Aguanne, Jane, National Oceanic and Atmospheric Administration/National Environmental Satellite, Data, and Information Service
David, Shelia, Heinz Center
Devine, Jim, U.S. Geological Survey
Dobson, Craig, National Aeronautics and Space Administration
Drummond, Bob, National Oceanic and Atmospheric Administration/Office of the Federal Coordinator for Meteorology
Eisinger, Chris, American Geological Institute
Elliot, Karen, National Research Council
Findley, John, U.S. Geological Survey
Folger, Peter, American Geophysical Union
Gallagher, Steve, National Weather Service
Gaynor, John, National Oceanic and Atmospheric Administration/USWRP
Gird, Ron, National Oceanic and Atmospheric Administration/National Weather Service
Gohn, Kathleen, U.S. Geological Survey
Hamilton, Robert M., National Research Council
Hammill, Jim, KPMG
Hannegan, Bryan, Senate Energy Committee
Hays, Walter, American Society of Civil Engineers
Heller, Miriam, NSF
Hirsch, Robert M., U.S. Geological Survey
Holman, Amy, National Oceanic and Atmospheric Administration/National Weather Service
Holsinger, Heather, NRC
Ingram, John, National Oceanic and Atmospheric Administration/NWS
Iwan, Wilfred D., California Institute of Technology
Kershaw, Patricia J., National Research Council
LaBrecque, John, National Aeronautics and Space Administration
Leatherman, Stephen P., Florida International University
Little, Richard, National Research Council
Lopes, Rocky, American Red Cross
Lynn, Walter R., Cornell University
Manchester, Katie, GRS Solutions, Inc.
McCarthy, Jill, U.S. Geological Survey
McLaughlin, David J., University of Massachusetts, Amherst
Mockler, Susan B., National Research Council
Moore, Keri, National Research Council
Murphy, Jim, Michael Baker Corp.
Navarro, Juan-Patricio, Organization of American States
Newsome, Angel, National League of Cities
Nishenko, Stuart, Federal Emergency Management Agency
Ogren, John, National Oceanic and Atmospheric Administration/National Weather Service
Paige, Jim, RAND
Parker, Stephen D., National Research Council
Pielke, Jr., Roger A., University of Colorado

Platt, Rutherford H., University of Massachusetts, Amherst
Pogue, Pam, RIEMA
Régis , Jacques, TransÉnergie
Robinson, Kristin, National Emergency Management Association
Rubin, Claire, EPA
Russell, James, Institute for Business and Home Safety
Showstack, Randy, American Geophysical Union
Spaulding, Scott, National Research Council
Speidel, David, Queens College
Stahlschmidt, Patricia, Federal Emergency Management Agency
Stanley, Ellis, City of Los Angeles
Starchville, Amy, IAEM
Swanson, John, Michael Baker Corp.
Sylves, Richard, University of Delaware
Wang, Yunei, Senator Kennedy's Office
Watts, Malcolm L.
White, Patrice, D.C. Emergency Management Agency
Wiley, Edward, Michael Baker Corp.
Wood, John, KPMG
Woodward, Nick, U.S. Department of Energy