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**EFFECTS OF CLIMATE CHANGE ON  
ENERGY PRODUCTION AND USE IN  
THE UNITED STATES**

**U.S. CLIMATE CHANGE SCIENCE PROGRAM  
Synthesis and Assessment Product 4.5**

**August 29, 2007**

## EXECUTIVE SUMMARY

Climate change is expected to have noticeable effects in the United States: a rise in average temperatures in most regions, changes in precipitation amounts and seasonal patterns in many regions, changes in the intensity and pattern of extreme weather events, and sea level rise. Some of these effects have clear implications for energy production and use. For instance, average warming can be expected to increase energy requirements for cooling and reduce energy requirements for warming. Changes in precipitation could affect prospects for hydropower, positively or negatively. Increases in storm intensity could threaten further disruptions of the sorts experienced in 2005 with Hurricane Katrina. Concerns about climate change impacts could change perceptions and valuations of energy technology alternatives. Any or all of these types of effects could have very real meaning for energy policies, decisions, and institutions in the United States, affecting discussions of courses of action and appropriate strategies for risk management.

This report summarizes what is currently known about effects of climate change on energy production and use in the United States. It focuses on three questions, which are listed below along with general short answers to each. Generally, it is important to be careful about answering these questions for two reasons. One reason is that the available research literatures on many of the key issues are limited, supporting a discussion of issues but not definite conclusions about answers. A second reason is that, as with many other categories of climate change effects in the U.S., the effects depend on more than climate change alone, such as patterns of economic growth and land use, patterns of population growth and distribution, technological change, and social and cultural trends that could shape policies and actions, individually and institutionally.

The report concludes that, based on what we know now, there are reasons to pay close attention to possible climate change impacts on energy production and use and to consider ways to adapt to possible adverse impacts and take advantage of possible

1 positive impacts. Although the report includes considerably more detail, here are the  
2 three questions along with a brief summary of the answers:

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- 4 • How might climate change affect energy consumption in the United States? The  
5 research evidence is relatively clear that climate warming will mean reductions in  
6 total U.S. heating requirements and increases in total cooling requirements for  
7 buildings. These changes will vary by region and by season, but they will affect  
8 household and business energy costs and their demands on energy supply  
9 institutions. In general, the changes imply increased demands for electricity,  
10 which supplies virtually all cooling energy services but only some heating  
11 services. Other effects on energy consumption are less clear.  
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  - 13 • How might climate change affect energy production and supply in the United  
14 States? The research evidence about effects is not as strong as for energy  
15 consumption, but climate change could affect energy production and supply (a) if  
16 extreme weather events become more intense, (b) where regions dependent on  
17 water supplies for hydropower and/or thermal power plant cooling face reductions  
18 in water supplies, (c) where temperature increases decrease overall thermoelectric  
19 power generation efficiencies, and (d) where changed conditions affect facility  
20 siting decisions. Most effects are likely to be modest except for possible regional  
21 effects of extreme weather events and water shortages.  
22
  - 23 • How might climate change have other effects that indirectly shape energy  
24 production and consumption in the United States? The research evidence about  
25 indirect effects ranges from abundant information about possible effects of  
26 climate change policies on energy technology choices to extremely limited  
27 information about such issues as effects on energy security. Based on this mixed  
28 evidence, it appears that climate change is likely to affect risk management in the  
29 investment behavior of some energy institutions, and it is very likely to have some  
30 effects on energy technology R&D investments and energy resource and  
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1        technology choices. In addition, climate change can be expected to affect other  
2        countries in ways that in turn affect U.S. energy conditions through their participation  
3        in global and hemispheric energy markets, and climate change concerns could interact  
4        with some driving forces behind policies focused on U.S. energy security.

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6        Because of the lack of research to date, prospects for adaptation to climate change effects  
7        by energy providers, energy users, and society at large are speculative, although the  
8        potentials are considerable. It is possible that the greatest challenges would be in  
9        connection with possible increases in the intensity of extreme weather events and  
10       possible significant changes in regional water supply regimes. But adaptation prospects  
11       depend considerably on the availability of information about possible climate change  
12       effects to inform decisions about adaptive management, along with technological change  
13       in the longer term.

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15       Given that the current knowledge base is so limited, this suggests that expanding the  
16       knowledge base is important to energy users and providers in the United States.

17       Examples of research priorities – which call for contributions by a wide range of partners  
18       in federal and state governments, industry, nongovernmental institutions, and academia –  
19       are identified in the report.

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