

Climate Change and Energy in California

Date: April 7th, 2008
2:30 – 5 p.m.

Location: Hearing Room A
California Energy Commission
1516 9th St. Sacramento, CA

You are cordially invited to an informal seminar hosted by the California Energy Commission's Public Interest Energy Research (PIER) climate change research subprogram on the effects of climate change on energy consumption and production in California. A primary focus of the PIER climate change research subprogram is to determine future challenges to supplying California's growing energy demands. The PIER climate change program is funding projects consistent with this need through collaborations with universities, national labs, and other federal and state agencies. This seminar will describe the research activities of PIER-funded researchers from U.C. Davis, U.C. Berkeley, U.C. San Diego, and Lawrence Berkeley National Laboratory. Gary Freeman from Pacific Gas & Electric (PG&E) will also discuss the likely impacts of climate change for both hydro operations and generation production for the PG&E units. The topics will range from describing future climate change scenarios in California, to the potential effects of these scenarios to energy demand and hydropower supply. This seminar is open to the public and will provide California citizens and decision makers with current information on emerging improvements in climate and hydrologic modeling that will help protect the state's electricity resources.

Agenda

- 2:30 – 2:40 p.m.** **Introductions**
Kelly Birkinshaw or Guido Franco, California Energy Commission, PIER
- 2:40 – 3 p.m.** **Climate Change Scenarios for California**
Dan Cayan - Division, Scripps Institution of Oceanography, UC San Diego

Early symptoms of greenhouse warming have been noticed in western North America, but so far the warming has been quite modest and mostly confined to winter and spring. However, the latest generation of global climate model (GCM) projections, used in the recent IPCC Fourth Assessment, indicate that considerably more warming could be in store and will likely envelope all seasons, particularly in summer. While the GCM's are calculated on coarse grid cells which are too large to reveal the level of detail needed for California's complex terrain, a set of downscaling techniques can be used to

consider regional scale changes that may affect energy supply and demand in the state. This talk will review a set of the climate model simulations over the 21st century and how California's climate would be affected, with attention toward the rates and magnitude of warming, its seasonality, the occurrence of heat waves, and how precipitation may be affected

Dan Cayan is heading up the PEIR efforts to understand how climate change will impact California resources and ecosystems. This work is using GCM simulations, a large set of historical observations, and much finer scale regional models to help us understand how climate change will occur over the California landscape.

3:00 – 3:20 p.m. *Climate Change and Electricity Demand*
Maximilian Auffhammer, UC Berkeley

Prof. Max Auffhammer will give a presentation regarding his research on impacts of extreme heat days in California on peak electricity demand due to a rapidly increasing population and a resulting increase in energy demand. His analysis uses atmosphere-ocean general circulation models and simulated projections of temperature over the coming century. The relationship between high temperature and electricity demand for air-conditioning, presents future challenges when population and income growth are taken into account.

Break 3:20 – 3:30 p.m.

3:30 – 3:40 p.m. *Introduction: Impacts of Climate Change in Low and High Elevation Hydropower*
John Dracup, UC Berkeley

Low and high elevation reservoirs will be impacted by climate change – flow timing may change, flow variability may change and energy prices may be affected. The size of these impacts will depend on how well operators manage changes in the hydrograph timing. This in turn depends on the size of reservoir storage and the degree of flexibility in system operations. In this introductory talk, Prof. Dracup will discuss these issues and other factors that influence the impacts of climate change on hydropower generation in California.

3:40 – 3:55 pm *Case studies in American and Merced River Basins*
Larry Dale, Lawrence Berkeley National Laboratory

Dr. Dale will present two case studies of the impacts of climate change on hydropower generation in California. The first case study focuses on a high elevation system, the Upper American River Project operated by Sacramento Municipal Utility District (SMUD). This study indicates that hydropower generation is closely related to the changes in reservoir inflows and the ability of operators to maintain high summer period storage levels. The second case study focuses on a low elevation system in the

Merced Basin. This study describes adaptation strategies available for maximizing reservoir system benefits and for adapting to the effects of climate change.

3:55 – 4:15 p.m. **Climate Warming on the Long-term Performance and Management of California's Hydropower Sector**
Jay Lund and Kaveh Madani (UC Davis)

Policy and operational adaptations are examined for California's hydropower system, particularly for potential climate warming impacts. Optimization models are employed, CALVIN (CALifornia Value Integrated Network) for low-elevation and EOM (Energy-based Optimization Model) for high-elevation hydropower. The CALVIN results examine hydropower adaptation together with water supply adaptations for California's complex and extensive water delivery. The results are examined both for implications for climate change research and for California water policy with major long-term population and climate changes. CALVIN suggests how low-elevation hydropower system should be operated under climate change. The EOM was used to examine more than 150 high-elevation hydropower plants in California and its results show how high-elevation hydropower generations in California change with climate warming.

4:15 – 4:35 p.m. **PG&E's Mountain Hydroelectric System and the Changing Climate**
Gary Freeman, Pacific Gas & Electric

Gary Freeman of Pacific Gas and Electric (PG&E) will present a brief description of PG&E's hydroelectric system and how climate change is regionally anticipated to impact runoff. He will describe likely impacts for both hydro operations and generation production by region and the reasons why. Implications for FERC re-licensing will also be addressed. This will be followed by some of PG&E's current plans for adaptive management of anticipated impacts and risks.

4:35 – 4:45 p.m. **On-going and Future PIER Studies**
Guido Franco, PIER/CEC

4:45 – 5 p.m. **Open Discussion**

For more information please contact:

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