Hydropower Breakout Session

Projections for the next century suggest climate change will have important impacts on Washington State's economy and natural resources. In order to both control the costs and maximize the benefits of a changing climate, we must begin preparing now. To stimulate discussion in this session, we summarize projected climate impacts from the conference white paper, enumerate previously suggested adaptation strategies, and provide case studies to illustrate planning techniques, vulnerabilities, and/or opportunities.

Prepared by Jennifer Kay, Joe Casola, Amy Snover, and the Climate Impacts Group (CIG) at the University of Washington for King County's October 27, 2005 Climate Change Conference.

Summary of projected climate change impacts on hydropower operations

Changes in the annual pattern of electricity demand.

Projected year-round temperature increases would increase electricity demand in the summer and decrease electricity demand in the winter.

Changes in the annual pattern of electricity production.

Projected higher winter, earlier peak- and lower summer streamflows would increase electricity production during the winter/spring but decrease production in the summer. As a result, it may be more difficult to satisfy competing summer in-stream flows demands for hydropower, fish, irrigation and recreation.

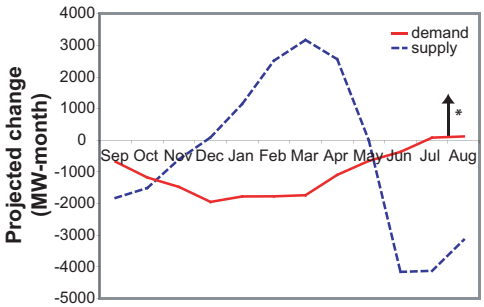

Figure data from NWPCC 2005 Report

Projected change in 2040s hydropower demand and supply

**** Summertime electricity demand may exceed projection if air conditioning use becomes more prevalent.***

Adaptation discussion starters

Guiding principles for planning:

1. Recognize that the past may no longer be a reliable guide to the future.
2. Integrate climate change projections into all planning processes.
3. Monitor regional climate and resources for ongoing change.
4. Expect surprises. Design policies and management practices to be flexible to changing conditions.

Could these strategies help Washington prepare for change?

Adjust reservoir operations for a changing climate. Project changes in electricity demand and basin-specific flows and adjust hydropower generation rule curves accordingly.

Conserve electricity to reduce overall demand. By 2025, the NWPCC estimates 2,800 avg. MW of cost-effective conservation potential for the PNW.

Use market forces to reduce electricity demand during critical periods. For example: use demand response incentives; connect consumer usage to electricity availability through wholesale prices; increase cooperation and coordination between different market players during shortages.

Increase capacity, diversity, and interconnectivity of hydropower generation. For example: encourage innovations to improve efficiency of hydropower operations; negotiate streamflow timing with upstream users; promote interconnectivity of hydropower transmission lines; build more dams.

Shift electricity production toward renewables, nuclear or thermal generation. Renewables (wind, solar) and nuclear do not contribute additional greenhouse gases to the atmosphere, but make up a small percentage of current electricity generation. Thermal generation (i.e., burning natural gas or coal) and nuclear power may be viable alternatives although the costs and benefits of such choices must be weighed carefully. Costs include additional greenhouse gases emissions (thermal) and longterm hazardous waste disposal (nuclear).

Sources: 1) Northwest Power and Conservation Council (NWPCC) 5th report: http://www.nwcouncil.org/energy/powerplan/plan/Default.htm 2) Snover, A., Miles, E. and B. Henry, OSTP/USGCRP Regional Workshop of the Impacts of Global Climate Change on the Pacific Northwest Annex D, NOAA Climate and Global Change Program, Special Report Number 11,1997.

Planning case study - Climate change stream flow scenarios: The CIG and the NWPCC evaluated the potential impacts of climate change on hydropower and in-stream flow management by developing climate change stream flow scenarios and incorporating them into existing NWPCC planning models. To facilitate the use of this research in PNW basin planning studies, climate change stream flow scenarios are available for locations on the Columbia River at no cost through the CIG website: http://www.cses.washington.edu/cig/fpt/ccstreamflowtool/sft.shtml.

Vulnerability case study – West Coast electricity markets: While many non-climatic factors contributed to the 2001 West Coast energy crisis, low 2000-2001 PNW snowpack and the resulting PNW energy shortage exposed the vulnerability of electricity markets to poor climate conditions. PNW power deficits contributed to high and volatile prices on the wholesale market, 25-50% increases in PNW retail prices, marked decreases in PNW energy available for export to California, and the threat of blackouts. Climate change is projected to alter streamflows and if not accounted for, could expose new vulnerabilities in West Coast electricity markets.

Prepared for King County Conference on Climate Change, October 27, 2005. Materials available at: http://www.cses.washington.edu/cig/outreach/workshops/kc2005.shtml