

MH/NCN Redirect on Climate Change Science and Global Climate ModelsEXHIBIT # MH/NCN-1049
WUSKWATIM GENERATION
& TRANSMISSION PROJECT

MANITOBA ENVIRONMENT COMMISSION

References in Wuskwatim EIS to Climate Change Models and Science

There are numerous references to Global climate change science and global climate models including:

- Wuskwatim Generating Station EIS, Volume 4 Physical Environment, Section 2.3.3. Global Climate Change
- Wuskwatim Generating Station EIS, Volume 4 Physical Environment, Chapter 12. Environmental Monitoring & Follow-up
- Wuskwatim Generating Station EIS, Volume 10 Cumulative Effects Assessment
- Wuskwatim Transmission Line EIS, Volume 5 Forestry Environment, Appendix 9 – Effects of Climate Change on Wuskwatim Hydro-Electric Projects

Direct reference to climate change science can be found in EIS Gen-Vol.4; 2.3.3 – Global Climate Change. Direct reference to climate change models can be found in EIS Gen-Vol.4; 2.3.3.1 *Global Climate Models* and Section 2.3.3.2 *Regional Climate Models*. Section 2.3.3.3 – *Possible Range of Implications from Climate Change* goes on to discuss the range of temperature and precipitation trends projected by global climate models (GCMs) and regional climate models.

Background

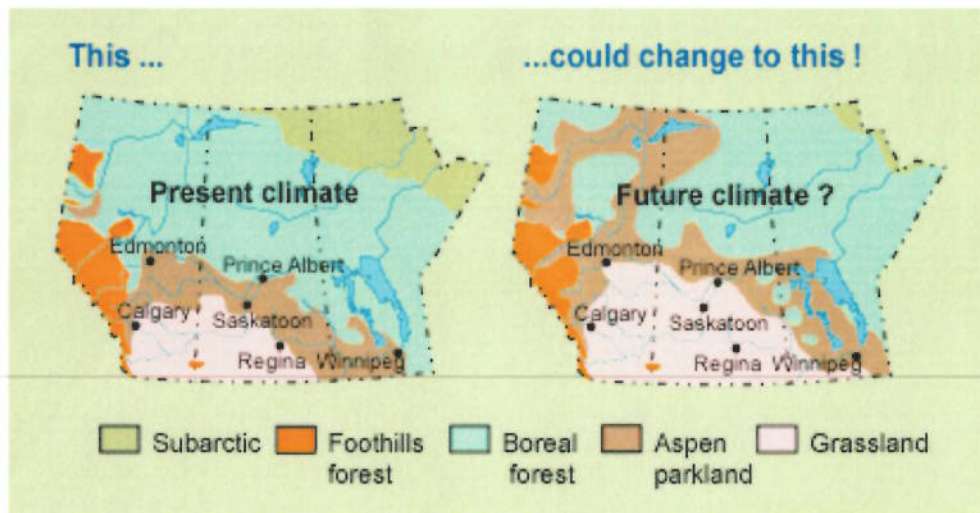
The single most important issue related to the impacts of climate change on the Wuskwatim project relates to the potential impact of climate change on the future water supply to Manitoba Hydro's system and the overall supply-demand balance. To address this, Manitoba Hydro has been and continues to work closely with scientists and climate change experts using global and regional climate models to develop plausible scenarios of future climate for the Nelson-Churchill basin and the impacts of various climate scenarios on precipitation and runoff.

Manitoba Hydro accepts the consensus that under all global climate model (GCM) scenarios, temperatures are projected to increase. GCMs vary in their projections of long-term precipitation trends with most of the models and scenarios projecting an increase in annual precipitation. For the Wuskwatim region most of the models project increased precipitation. However, GCMs are not intended to make accurate predictions of runoff. Therefore, the net effect of increased

precipitation on runoff and river flow is uncertain because of the complex interaction between precipitation at the atmospheric level and the processes that influence runoff such as evaporation, evapotranspiration, land cover and wind. Furthermore, there is uncertainty about the intensity, duration and seasonal variability of precipitation in the Wuskwatim, under changed climate conditions.

The following figure was extracted from the Wuskwatim Transmission Project Environmental Impact Statement - Volume 5 Forestry Environment Appendix 9 “Effects of Climate Change on Wuskwatim Hydro-Electric Projects” (Figure 1 - Predicted changes in Canada’s ecozones.

Source: Hogg and Hurdle, 1995).



Climate Models

Manitoba Hydro has been investigating global climate models (GCM) and regional climate models (RCMs) and their projections of possible ranges of temperature and precipitation for the Churchill Nelson Drainage Basin. This includes an ongoing analysis by International Institute for Sustainable Development (IISD), initiated in the Fall of 2002 to provide a detailed overview of global climate models and to identify the range in uncertainty in GCM projections. This work with IISD is still underway.

- a) Monitoring development of GCMs - Over the past 2 to 3 years, Manitoba Hydro has been monitoring the progress of GCM development and investigating the model outputs through

research and workshops (e.g. National Workshop on Development of Scenarios of Climate variability & Extreme – October 2003, Victoria).

- b) Canadian Climate Impacts Scenarios - The Canadian Institute for Climate Studies (CICS) at the University of Victoria provides a web-based tool for evaluating a range of possible climate scenarios for specific regions, using the results of all GCMs currently in use. The website illustrates a broad range of possible temperature and precipitation trends for the Wuskwatim region, ranging from “warmer, wetter” scenarios, which indicate annual precipitation may increase as the average annual temperature increases, to some “warmer, drier” scenarios, which show a decrease in precipitation for a similar temperature increase. Manitoba Hydro utilized this University of Victoria information in its assessment of climate change impacts on Wuskwatim and in preparation of the EIS.

For illustration, two sample scatterplots generated from the CICS website (<http://www.cics.uvic.ca/scenarios>) are included below. These illustrate the range of model projections of precipitation from all 20 GCMs for the region of the Wuskwatim G.S. at two future time periods, the 2020's and the 2080's. These two plots indicate that:

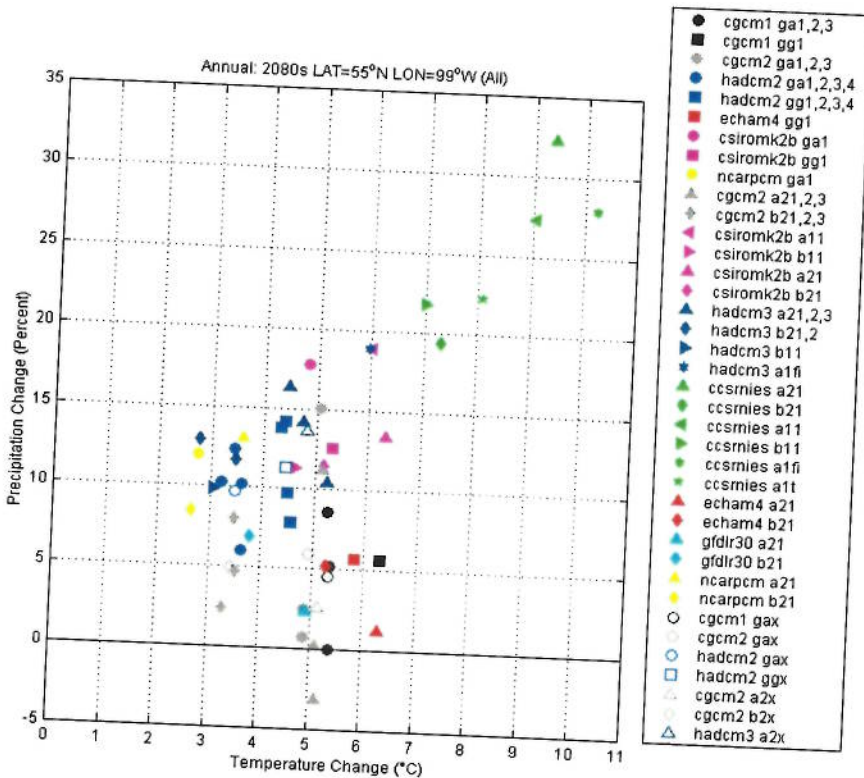
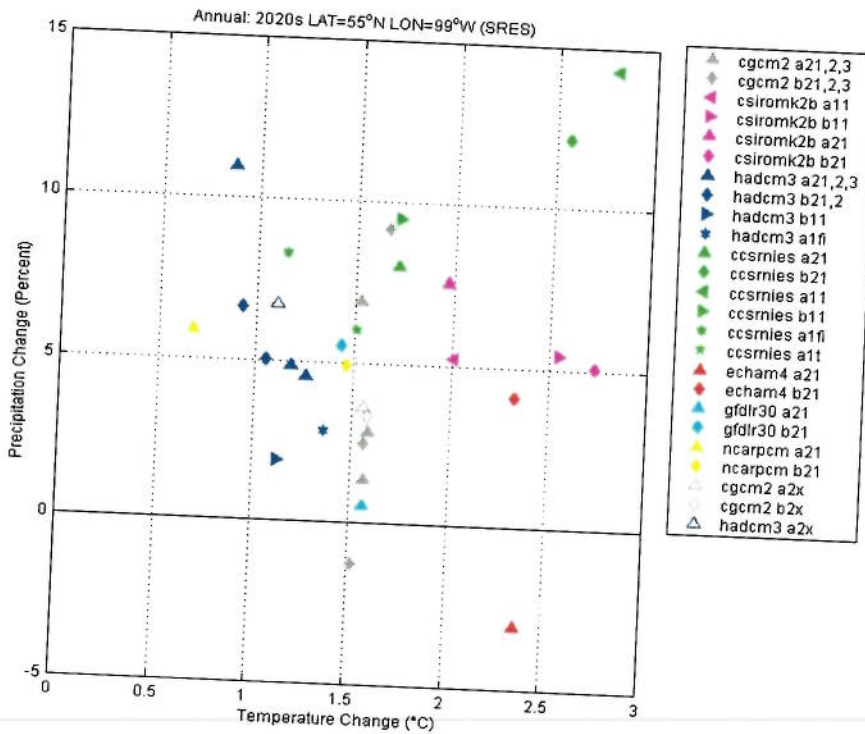
On the 2020 time frame

- all the models and scenarios indicate an increase in annual temperature of approximately 1 C to 3 C with most indicating an increase of about 1.5 C.
- all but two of the models and scenarios indicate an increase in precipitation. Most of the results range from about 0% to +10%.

On the 2080 time frame

- all the models and scenarios indicate an increase in annual temperature of approximately 3 C to 10 C with most indicating an increase of about 5 C.
- all but one of the models and scenarios indicate an increase in precipitation. Most of the results with a range of about +5% to +15%.

Figure 1 Projected Change in Temperature vs. Precipitation for Wuskwatim Region
 (extracted from the Canadian Institute for Climate Studies website
 (<http://www.cics.uvic.ca/scenarios>))



Regional Climate Models

Manitoba Hydro is also investigating regional climate models. Regional climate models are numerical models capable of achieving higher spatial resolution than is technically feasible with global climate models. For example, the modeling of complex interactions between the atmosphere and local geographic features such as mountains, water bodies and forests will become possible with regional climate models. Manitoba Hydro has met with the research team in Quebec (OURANOS) undertaking the development of Canadian regional climate scenarios and will continue to monitor their progress.

Other Climate Change Research Activities

Manitoba Hydro has funded over \$600,000 in research and contract work over the past 10 years aimed at better understanding climate change science:

- a. Defining the **probability of a system-wide drought** greater in magnitude than the current drought-of-record. (MH funded \$150,000 for a University of Manitoba Master's student)
- b. Investigating **climate extremes and hydrologic conditions of past centuries** with techniques that employ paleo-environmental data such as tree-rings and lake sediments. Currently Manitoba Hydro is funding projects in several portions of it's basin including the Upper Churchill River, Winnipeg River and Red River basins.
- c. Manitoba Hydro recently funded two Climate Change Research Chairs under PARC (Prairie Adaptation Research Collaborative); one at University of Winnipeg (Dr. Danny Blair) and one at University of Regina (Dr. Dave Sauchyn) for a total funding of \$250,000 over 3 years.

Manitoba Hydro also has representatives serving on various national and regional committees dealing with climate change impacts and adaptation strategies. These include:

- a. Board of Directors for ArcticNet research project – a 4-year \$25M project investigating the impacts of climate change on the Arctic and the Hudson Bay watershed.
- b. Canadian Climate Change Impacts & Adaptation Research Network Water Resource Advisory Panel.
- c. Review panel for Manitoba Climate Change Action Fund.
- d. Steering Committee for PARC Climate Change Research Chair at University of Winnipeg and University of Regina.
- e. Participating on development of a proposed Canadian Prairie Drought Network at U of M.

Manitoba Hydro's Emission Management Activities

Manitoba Hydro's emission management objectives are guided by Manitoba Hydro's Vision, Mission, Goals and Operating Principles and are presented in the Corporate Strategic Plan. The following goals are particularly relevant to climate change:

- Be proactive in protecting the environment and be a recognized leader in doing so.
- Be a leader in implementing cost effective energy conservation and alternative energy programs.

Manitoba Hydro has been a leader in the development of voluntary and mandatory GHG reporting, management and emission trading systems (e.g. Voluntary Challenge and Registry and the Chicago Climate Exchange). Manitoba Hydro staff have been involved in and continue to participate in numerous other activities related to the development of greenhouse gas management approaches within Canada and internationally including activities with the following organizations:

Canadian National Process on Climate Change
National Round Table on the Environment and the Economy
Government of Canada
Government of Manitoba
United Nations

World Commission on Dams

World Bank

Canadian Electricity Association

Canadian Hydropower Association

International Hydropower Association

International Energy Agency

While the net impact of Manitoba Hydro's operations is to reduce global emissions, Manitoba Hydro also manages emissions from its own operations. These actions include actions to reduce emissions from its own facilities, produce energy from low emissions resources like hydropower and wind and pursuing emission reduction opportunities such as methane capture from the Brady Road Landfill and Hog Waste facilities.

Manitoba Hydro's GHG management activities are documented in its VCR Report available as appendix CNF/MH/NCN I – JNFAAT – CLIM CHG – 375d.
