Climate Change Impacts & Adaptation in Ontario: The Energy Sector

Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR) 2015

Observed Impacts

Climate change has impacted both the demand and supply of energy in Ontario. Between 2004 and 2010, extreme heat events and higher temperatures generally resulted in visible spikes in energy demand as air conditioner use increased (Lemmen et al., 2014; PHO, 2015; Davidson, 2012). Ontario is the only province or territory where annual peak load occurred during the summer months (NERC, 2012). Furthermore, summer cooling largely draws upon electricity, whereas winter heating stems predominantly from natural gas and oil. Thus climate change will affect shifts in seasonal demand and the associated type of source.

Hydroelectricity accounts for 24 percent of electricity generated in the province, providing approximately 2 million kilowatts to Ontario consumers (Teare, 2013). Rising temperatures and changing precipitation patterns have affected surface water levels, directly influencing the production of hydroelectricity (Kowalski, 2013). In addition, extreme weather events such as storms, heat waves, floods and strong winds have disrupted energy transmission by damaging essential infrastructure. Major ice storms in 1998 and 2013 downed power lines and damaged substations, resulting in weeks-long outages for many consumers. Flooding in Toronto (2005) damaged underground infrastructure, resulting in loss of power in the area.

Expected Impacts

Ontario is gradually becoming 'warmer and wetter'. Average annual surface air temperatures in Ontario are projected to increase between 2.5 and 3.7°C by 2050 (from a baseline average 1961-1990) (CCDS, 2009; MOE, 2011). Warming temperatures are likely to cause a rise in demand for energy to cool homes and businesses, and extreme heat may damage energy infrastructure through overheating and cause inefficiencies in power lines. Annual precipitation is expected to increase in Ontario, with the largest changes in the northeast and the lowest changes in the western part of the province, which could lead to infrastructure damage and service interruptions (CCDS, 2009) (Figure 1).

The majority of simulations project that water levels in the Great Lakes will decline (though higher water levels are also a possibility). Projections for water levels in Lakes Michigan and Huron for the 2050-2064 period range from a decline of around 1.5m to a possible increase of more than 1m (Bush et al., 2014). Declining water levels could have significant impacts on hydroelectric power generation in Ontario. For example, the Mowat Centre (Shlozberg et al., 2014) estimates that lower water levels in the Great Lakes - St. Lawrence watershed could results in losses of up to $951M by 2030, and $2.93B by 2050 for hydroelectric generation. Ontario also relies heavily on nuclear energy, which accounts for 38 percent of generation capacity (IESO, 2015). Cooling as part of nuclear power production may become less efficient as water temperatures increase (Chiotti and Lavender, 2008). Variability in wind speeds could reduce the efficiency of wind turbines, thus affecting generation (although projections of wind speeds at the hub-height of a turbine are currently not available) (Schaeffer et al., 2012). Finally, extreme weather events such as storms and floods will pose a continuing risk for Ontario's stock of aging or under-designed generation and transmission infrastructure.

Adaptation Measures

There are several examples of adaptation underway in Ontario's energy sector. Actions that improve resiliency such as the installation of smart grids and policies to reduce extreme heat such as Toronto's Green Development Standard signal a move toward reducing climate change risks (IESO, 2013; City of Toronto, 2015). Toronto Hydro has undertaken a vulnerability assessment to better identify, understand and manage climate-related risks, while information campaigns and outreach programs are available in many Ontario municipalities to help users manage their energy use more efficiently and prepare themselves for power outages. The international Carbon Disclosure Project allows energy companies around the globe to report on material risks resulting from climate change and the action they are taking to address those risks.

In addition to these efforts, there is ongoing research into better building materials and designs for energy infrastructure, techniques to address both GHG mitigation and adaptation needs, end-user climate data needs, and promotion of sector-level resilience. Groups like the Toronto-based WeatherWise Partnership, enlist representatives from key electricity stakeholders to discuss climate change impacts and facilitate adaptation opportunities, and can help motivate and support adaptation efforts.

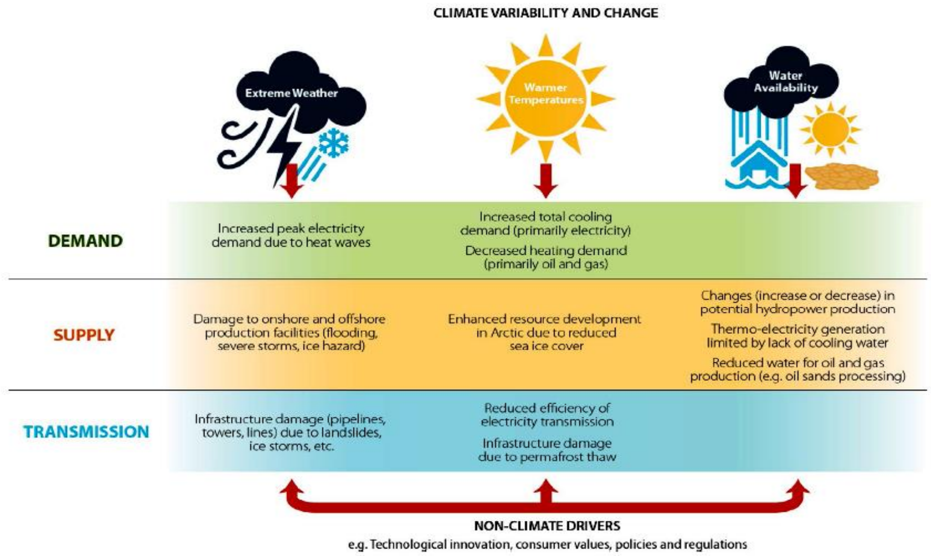

Figure 1: Climate change impacts in the electricity sector, recognizing the importance of non-climate drivers in determining adaptation actions (Lemmen et al., 2014).

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The information presented is based on Chapter 3 of NRCan's 2014 National Climate Assessment titled **Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation** with additional Ontario-specific information. For more information on the National Assessment, please visit: www.nrcan.gc.ca/environment/resources/publications/10766

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