

INFORMATION

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- Ontario Power Generation

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Photo : Site de recherche de Nergica

### CONTEXT

The Canadian wind power industry, which has been expanding since the 1990s, is undertaking a process to repower its large-scale wind farms by the end of the 2020s. This repowering process is aimed at modernizing the wind turbines currently in operation with a view to improving wind farm efficiency and performance. The effects of climate change on wind regimes and icing events will have to be taken into account in order to optimize the planning of wind farm repowering in a cold climate context. This will make it possible to anticipate changes in wind energy production and their effects on wind farm profitability. To date, very few studies have been done on Canada's future wind energy potential that take climate change into account.

### OBJECTIVES

- Evaluate the impacts of climate change on wind energy potential and analyze its consequences for energy production in the coming decades.
- Analyze how Canadian wind farms should adapt to these changes, on both technical and economic levels.

### METHODOLOGY

- Produce two new climate simulations using CRCM5 (Canadian Regional Climate Model, version 5) for the 1950-2100 horizon, under two greenhouse gas emissions scenarios, one optimistic and one pessimistic (RCP4.5 and RCP8.5).
- Model icing using climate simulations as input.
- Calculate future wind energy production based on wind regimes and icing episodes.
- Perform technical and economic analyses of the impacts on a large scale for the entire country and on a smaller scale for specific wind farms.

### EXPECTED RESULTS

This project will enhance our knowledge about future wind regimes (wind maps, behaviour and variability) and icing events (intensity and frequency) in Canada over the coming decades, in a climate change context. Adaptation strategies will be proposed for the repowering of wind parks based on future wind potential and projected energy losses.

### BENEFITS FOR ADAPTATION

This project will help Canadian electricity providers such as Hydro-Québec, Manitoba Hydro and Ontario Power Generation to improve the long-term planning and reliability of wind power generation.

A deeper understanding of the vulnerabilities of wind farms to climate hazards will support the development of technological and operational adaptation measures, helping to improve the performance and reliability of wind power generation equipment.