Institut nordique du Quebec

NORTHERN GEOTHERMAL POTENTIAL RESEARCH CHAIR

MISSION

The mission of the Northern geothermal potential research chair is to assess the performance of geothermal systems in cold climates, to adapt technologies with northern realities, and to root green energy in northern Québec. Access to clean and affordable energy is critical for the development of communities and natural resources north of the 49th parallel.

BACKGROUND

Hydrocarbons transported by truck, train and boat are the main source of heat and electricity in the North, a situation that comes at a high financial and environmental cost. For example, Hydro-Québec's off-grid systems run on diesel generators that produce electricity at a cost of over $0.40/kW. This represents an annual loss of more than $125 million and results in exceedingly high greenhouse gas emissions. Moreover, northern businesses additionally use fossil fuels to operate, even though they can be connected to the Hydro-Québec grid.

Ground-source heat pump systems running at very low temperatures could be used in the short term to produce heat for northern communities. On the other hand, hot aquifer resources could be tapped to generate electricity and heat using power plants and urban districts looking at the medium term. However, the extent of geothermal resources available in the North is still largely unknown. The region is vast and the thermohydraulic properties characterizing shallow and deep geothermal resources vary greatly. Thereby, research is required to demonstrate the potential of northern geothermal resources to help developing this renewable energy sector.

CHAIRHOLDER

A trained hydrogeologist, Jasmin Raymond obtained his PhD at Université Laval and performed postdoctoral research at INRS through a Banting Fellowship. Professor Raymond has a keen interest in geothermal energy and conducts research at INRS on low to medium temperature resources, including heat pump systems. Mr. Raymond works with designers, operators, and manufacturers from the geothermal sector and draws on field testing and numerical modelling to conduct his research, which aims to spur scientific and technological innovation to optimize the efficiency, and profitability of geothermal systems. Professor Raymond co-directs an international geothermal energy research group supported by UNESCO and sits on the Canadian Standards Association geothermal heat pump task group and the Geoscience BC Geothermal Technical Advisory Committee. He co-authored a report for the Geological Survey of Canada on Canada's geothermal energy resource potential and was selected to give the Canadian Geotechnical Society's 2016 Colloquium. The graduate courses he teaches cover geothermal energy basics.

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OBJECTIVES

The Northern geothermal potential research chair evaluates strategies to reduce hydrocarbon consumption in two northern regions with distinct energy supply profiles: the mines and villages connected to a distribution system, primarily in the James Bay area, and the aboriginal villages deserved by off-grid systems in Nord-du-Québec region.

How can we adapt technology and harness local resources by fostering the use of geothermal energy in northern communities and businesses so that they have access to a clean, more affordable energy alternative? To achieve this goal, we must:

- Better understand the heat transfer processes involved in developing thermal resources in northern Québec
- Identify northern geological environments with high geothermal potential
- Improve the design and operating procedures of northern geothermal systems installed in a permafrost area
- Develop technologies to facilitate geothermal development in the North
- Raise awareness about this energy source among northern communities

PARTNERS

The Chair was created with financial support from Institut nordique du Québec. Grants are also provided by the Natural Sciences and Engineering Research Council of Canada and Fonds de recherche du Québec – Nature et technologies.

BENEFITS

The Chair seeks to innovate by developing underused geothermal resources and technologies, one of very few local alternatives for continuous heat production in northern climates. With the acquisition of new knowledge, use of these resources and technologies can be extended to northern Québec and new simulation approaches can be tested to determine if geothermal technology is a viable alternative in this harsh environment. Anticipated positive spinoffs from the Chair include:

- Improving the performance of geothermal systems in northern communities
- Contributing to the diversification of energy sources in the North
- Developing new activities of interest to northern communities
- Reducing greenhouse gas emissions
- Training graduate students and leaders able to tackle the North's energy and environmental challenges

INFORMATION

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