UNIVERSITÉ DE NEUCHÂTEL

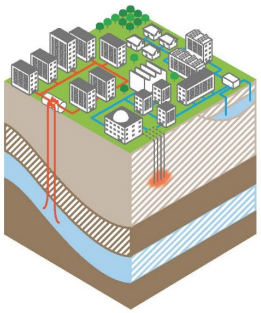
CHYN
Centre d'hydrogéologie et de géothermie

INRS
UNIVERSITÉ DE RECHERCHE

M.Sc. in Hydrogeology and Geothermics

Thesis topic proposal 2020

SHALLOW GEOTHERMAL ENERGY IN OFF-GRID ARCTIC COMMUNITIES



Context and objectives

Remote communities of **Nunavik** (Northern Québec, Canada) are not connected to the national grid and strongly rely on **fossil fuel** to provide both electricity and heating. Around 12,000 people live in Nunavik, divided in 14 local communities including 10s to 1,000s people. **30 million litres of diesel** are burned annually to heat buildings, resulting in emissions of **75,000 tons of eq.CO_2**, without considering transportation by boat. To this regard, the study of possible alternatives is of utmost importance to reduce the costs and environmental impacts of energy production in these communities.

Nunavik villages show **subarctic to arctic climate** with average annual air temperature from -4 °C at the southern border to -8 °C in the northernmost community. Shallow underground temperature ranges between 0 °C and -5 °C. Strongly heating dominated buildings and **permafrost conditions** are therefore the main challenges to face in this region.

The aim of the project is to evaluate the technical and financial feasibility of **ground source heat pumps** (GSHP) and **underground thermal energy storage** (UTES) technologies to evaluate the potential contribution of shallow geothermal energy to provide space heating and domestic hot water to buildings as well as greenhouses for local food production.

Research approach and methodology

In this project, a geological and hydrogeological characterisation of one of the communities will be carried out to highlight the local shallow geothermal energy resource. Further detailed analyses will be performed to define the technical performance of GSHP and/or UTES and the environmental/financial savings compared to the current scenario.

The project might include the following activities: (a) mapping the GSHP and/or UTES potential, (b) numerical simulations of GSHP and/or UTES in permafrost conditions to evaluate the long-term performance as well as the local impact, (c) processing of thermal response tests data to evaluate in-situ underground thermal conductivity and heat capacity with oscillating heat injection.

Partners and collaboration

The project will be supervised at the CHYN by Dr. R. Sohrabi (UniNE) and Prof. Dr. B. Valley (UniNE); and at the Institut National de la Recherche Scientifique (INRS) in Québec (Canada) by Dr. N. Giordano (INRS) and Prof. Dr. J. Raymond (INRS).

Contact for further information:

UniNE: reza.sohrabi@unine.ch or benoit.valley@unine.ch

INRS: nicolo.giordano@ete.inrs.ca or jasmin.raymond@ete.inrs.ca