OERA
Leading Collaborative Energy Research

Request for Proposals

Direct Use of Heat Geothermal in Nova Scotia

RFP Release Date: May 19, 2021

Proposal Due Date: June 25, 2021 (5 pm ADT)

Contact

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1. Introduction

OERA is an independent, not-for-profit research organization that funds research aimed at reducing risk and encouraging the sustainable development of Atlantic Canada's energy resources. This RFP is issued by OERA on behalf of Nova Scotia's Department of Energy and Mines (NSDEM), Department of Agriculture (NSDA) and Department of Fisheries and Aquaculture (NSFA). This work supports the Province's energy policy objectives related to climate change, inclusive economic growth and sustainable development.

2. Objectives

A recent Phase 1 report commissioned by OERA on behalf of NSDEM and NSDA demonstrated Nova Scotia's geothermal resource potential and ranked the favourability for electricity generation and heat production across the province. The report also described geothermal projects in other jurisdictions and provided estimates of project development costs elsewhere. The geothermal resource types include:

1. deep aquifers that can be exploited for electricity generation;
2. mid depth aquifers (e.g., up to approximately 3km depth and <90°C subsurface temperatures) that can be developed for a variety of "direct use of heat" projects; and
3. water within abandoned mines that can be used for both heating and cooling.

As a next step to the Phase 1 report, the province is interested in the costs and economic outcomes of using mid-depth, direct use of heat for industrial activities in Nova Scotia. Such activities could include agriculture uses (e.g., greenhouses), aquaculture uses (e.g., onshore fish farms), industrial parks, universities, hospitals or other. Because only limited areas of the province were identified as having high potential for direct use of heat (see attached Map 2), the feasibility of using Enhanced Geothermal Systems (EGS) and Borehole Heat Exchangers (BHE) is an important component of this study.

The objective of this study is to help Nova Scotians understand the costs of typical direct use of heat geothermal projects that could be constructed in the province. The work will investigate the economic and technical constraints and opportunities and help identify where more information is needed to realize Nova Scotia's geothermal potential.

The primary expected outcomes of this study are:

1. a geo-economic model built with the parameters for the key geological, engineering, and economic factors[1] that dictate or control the economic viability of real projects;
2. identification of the critical unknowns that affect economic and technical viability, and an assessment of their importance in feasibility decisions.

[1] Example factors include *geological*: geothermal gradient, porosity, permeability, etc.; *engineering*: drilling technology, proximity to use, energy generated, etc.; and *economic*: capex, opex, etc.

3. Scope of Work

3.1 Model Development

As a first step, the proponent will create a core geo-economic model that can be applied to specific case studies later in the project. The proponent will review and describe the key controlling geological, engineering and economic parameters that affect direct use of heat geothermal project feasibility/viability and assign reasonable numerical values or distributions to these parameters. The Cumberland basin region, Stellarton basin region and Windsor-Kennetcook basin region will be modelled in this way.

The objective of this task is to understand the business logic that links these parameters when direct use of heat projects are considered and identify knowledge or data gaps that can affect project technical or economic feasibility.

3.2 Case Studies

Next, the proponent will identify three sites and develop three case studies to apply the geo-economic model to show how the different controlling factors work together to support an economic project. The case studies are:

1. New greenhouse build – minimum economically viable project size and maximum typical project size

2. New on-shore aquaculture operation - minimum economically viable project size and maximum typical project size

3. A proponent-defined scenario that may be economically and technically more viable than greenhouses or aquaculture operations. Such a scenario may describe, for example, district heating, institutional use (hospital, school) or other industrial application. The goal is to demonstrate a viable project scenario that can be further de-risked through additional data gathering.

The proponent is requested to develop and define generic but realistic project development scenarios and provide generalized costs to build and operate them. A key part of this will be to describe what general heating capability can be realized for different levels of capital expenditure and what profitability or payback time an end-user must realize to make mid-depth geothermal worthwhile.

The case studies will illustrate the economic characteristics necessary for successful projects. The term “economic characteristics” refers to a variety of project attributes (geological, engineering, or economic) that would be of interest to policy makers, project developers, and investors such as:

1. Infrastructure needs and order-of-magnitude development (CAPEX) and operational (OPEX) costs for each project development scenario;

2. Maturity and type of technology;

3. Opportunities for cascading, affiliated projects that might affect the economic viability;

4. Payback time and cost savings over project lifetimes in comparison to non-geothermal heat;

5. Jobs created over the lifetime of the project with reference to national or international examples if possible;

6. Greenhouse gas reduction in comparison to operation with non-geothermal heat;

7. Favourable subsurface geology; and

8. Costs and economic uplift related to the use of Enhanced Geothermal Systems (EGS) and Borehole Heat Exchangers (BHE) if the geological model and end use warrants this.

3.3 Sensitivity Analysis and Recommendations to Close Knowledge Gaps

The study will describe the assumptions used in the geo-economic assessment and provide the confidence level of the assumptions and cost estimates as well as their importance to model outcomes. This sensitivity analysis will identify the critical unknowns that affect economic and technical (including geological) feasibility and describe their importance in feasibility decisions.

Drawing on the review and model of the geological, engineering and economic parameters and technology, the study will provide recommendations on how best to address the most critical knowledge gaps and ultimately de-risk potential direct use of heat greenhouse projects through further geoscience work or economic study.

Finally, the report will describe the geothermal energy costs from this study within the broader context of current renewable energy costs. Geothermal energy costs are not well known to policymakers so this contextual discussion will permit readers to place geothermal energy on the renewable energy cost spectrum.

4. Deliverables

The proponent will provide:

1. An interim presentation of the core geo-economic model to the OERA/NSDEM/NSDA review committee. The purpose of the presentation is to provide an opportunity for the committee to view initial results and discuss next steps with the proponent.

2. At project end, a draft report for review by the committee. Presentation of the draft report to the committee is recommended but not mandatory.

3. A final report incorporating comments received from the committee.

5. Timelines

The proponent is requested to host the kickoff meeting and subsequent project status meetings and presentations via video conference. The following timeline outlines OERA's current expectations with respect to timing.

RFP release date:	May 19, 2021
Proposal due date:	June 25, 2021 (5 pm ADT)
Draft Final Report:	October 1, 2021

6. Funding

Funding available for this project is capped at a maximum of CAN $105,000 excluding taxes. Proposals that exceed this amount will not be considered. Note that proposals will be rated first in terms of team experience and second in terms of study approach. Please also include hourly or daily rates in the proposal. Please note that OERA reserves the right not to proceed with project award.

7. Proposal Requirements

1. The proposal should be concisely worded with clearly described objectives, methods, budget, schedule, and deliverables. Maximum 12 pages excluding appendices, title page, and cover letter. Please assemble all components into a single PDF document.

2. The proposal should include a description of the Respondent's organization and its relevant experience with similar projects. The Respondent must also describe the relevant work experience of the key staff assigned to this project and their roles on the project. This material should be summarized in the body of the RFP and can be presented in more detail, if needed, in appendix.

3. Please provide a project organizational chart showing the roles and reporting hierarchy of staff and project partners, and reporting lines to the OERA review committee.

4. As a minimum, the study team must include a person licensed to practice geoscience in Nova Scotia. Proof of licensing is not needed for the RFP.

5. A single electronic document is sufficient – hard copies are not needed. Please ensure the proposal is signed by an officer or equivalent with authority to bind the Respondent to the statements made in the proposal.

6. The electronic copy should be uploaded in PDF format to the OERA FTP site at https://oera.sharefile.com/r-r898e4fa76c7e4e06aad6228e522bdf92. The file name should include the Respondent's name.

8. Questions and Clarifications

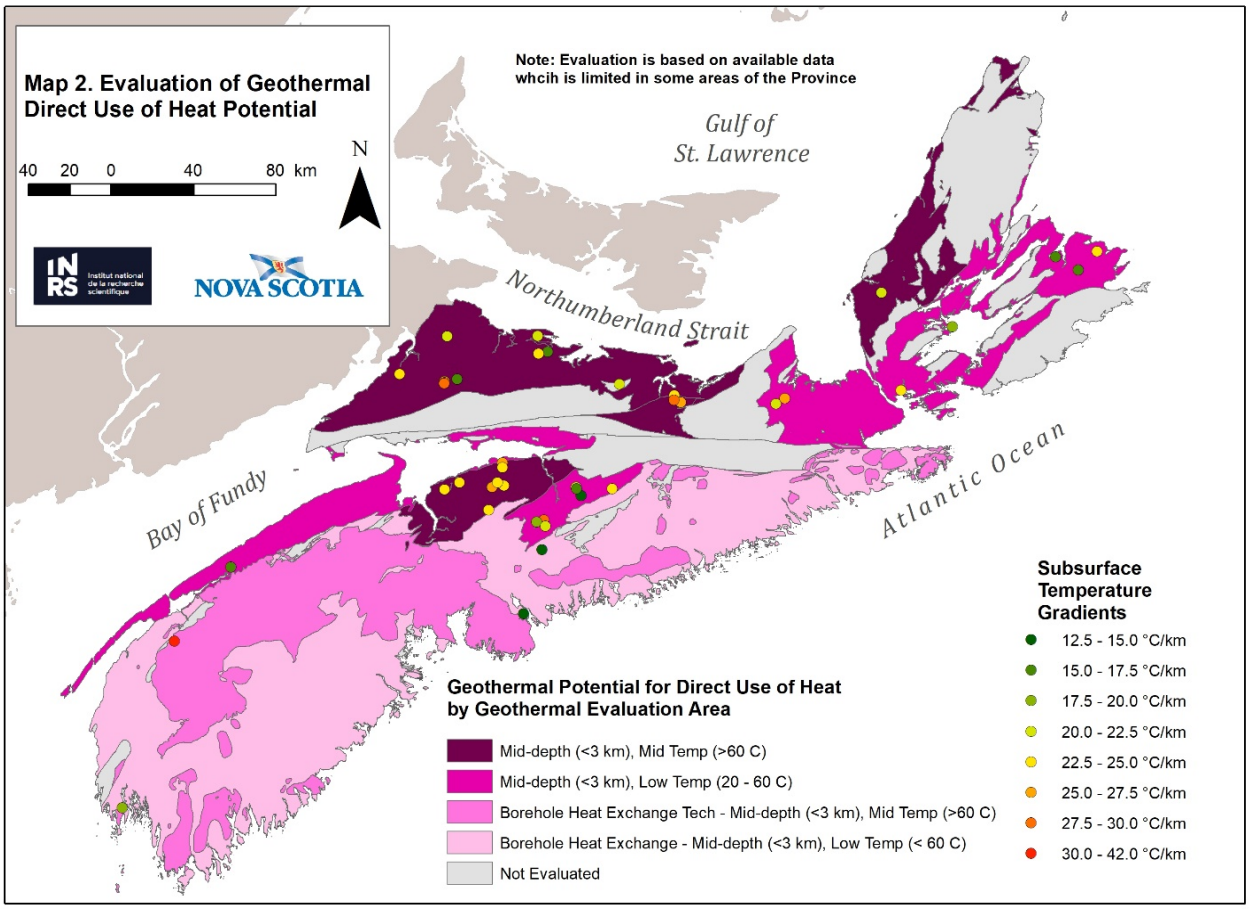
OERA will accept questions from interested Respondents on an ongoing basis until 5 pm ADT, Friday June 18, 2021. Questioners will receive a direct email response from OERA and all questions and answers will be posted anonymously on the OERA website https://oera.ca/opportunities/request-proposals/rfp-direct-use-heat-geothermal-nova-scotia. Respondents are encouraged to check the website for updates to the Q&A document. Please note the Q&A page will only be posted if content-related questions have been received.

Please submit your questions by email to Russell Dmytriw (rdmytriw@oera.ca). Please do not contract the NSDEM or NSDA with questions.

9. Evaluation

This project will be administered through OERA on behalf of NSDEM and NSDA. Proposals will be reviewed by a committee consisting of OERA, NSDEM, NSDA and NSFA staff. As shown below, proposals will be quantitatively evaluated against a set of criteria.

Factor	**Weight**
Experience and Knowledge: Qualifications, experience and capabilities of the company and delivery team; demonstration of local knowledge and information sources relevant to this study. Team organisation and scale is appropriate for this project.	30%
Project Plan, Approach and Methodology: Proponent demonstrates an understanding of the project service requirements and has outlined a clear and effective work plan. Proposal describes the objectives, methodology, milestones and deliverables, and a sound approach in undertaking this project. Communication format and frequency between the proponent and OERA are clearly described. Proponent describes an achievable schedule with well-defined milestones and demonstrates the ability to complete the work on or before the desired completion date.	35%
Proposal Presentation and Organization: The proposal includes all RFP requirements, demonstrates attention to clarity, grammar, and presentation.	15%
Value: The project will offer good value for the proposed budget. The budget is clear, convincing, and well-described.	20%
Total:	100%


Map 2. Evaluation of Geothermal Direct Use of Heat Potential
40 20 0 40 80 km
N
INRS Institut national de la recherche scientifique
NOVA SCOTIA
Note: Evaluation is based on available data whcih is limited in some areas of the Province
Gulf of St. Lawrence
Northumberland Strait
Bay of Fundy
Atlantic Ocean
Geothermal Potential for Direct Use of Heat by Geothermal Evaluation Area
Mid-depth (<3 km), Mid Temp (>60 C)
Mid-depth (<3 km), Low Temp (20 - 60 C)
Borehole Heat Exchange Tech - Mid-depth (<3 km), Mid Temp (>60 C)
Borehole Heat Exchange - Mid-depth (<3 km), Low Temp (< 60 C)
Not Evaluated
Subsurface Temperature Gradients
12.5 - 15.0 °C/km
15.0 - 17.5 °C/km
17.5 - 20.0 °C/km
20.0 - 22.5 °C/km
22.5 - 25.0 °C/km
25.0 - 27.5 °C/km
27.5 - 30.0 °C/km
30.0 - 42.0 °C/km