Geothermal Potential in Baker Lake, Nunavut

Research to support enhanced geothermal systems in Northern remote communities

Ysaline Bacon

January 2026

CASCADE INSTITUTE

Acknowledgments

Institutional partners

Collaborating partners

Ysaline Bacon,[1,2,5] Mafalda M. Miranda,[1] Jasmin Raymond,[1] Juliet Newson,[2] Andrew Wigston,[3] Matthew Minnick,[4] Dave Lovekin,[5] David Mitchell,[5] Emily Smejkal,[5] Leighton Gall,[5] Alex Cook,[6] Scott Janzwood[5]

[1]Institut national de la recherche scientifique, Québec, Canada; [2] Reykjavík University, Reykjavík, Iceland; [3]Natural Resources Canada, Ottawa, Canada; [4]RESPEC, Rapid City, USA; [5]Cascade Institute, Victoria, Canada; [6]Qulliq Energy Corporation, Baker Lake, Canada

Author

Ysaline Bacon is a researcher with the Ultradeep Geothermal team at the Cascade Institute. Her research combines field studies, resource assessment, and reservoir modelling to support the energy transition in remote northern communities. She is a master's student in Earth Sciences and Renewable Energy at INRS (Quebec, Canada) and Reykjavík University (Iceland), focusing on the deep geothermal potential of Baker Lake (Qamani'tuaq) in Nunavut.

Sharing and permissions

Suggested citation: Bacon, Y. (2026). *Geothermal Potential in Baker Lake, Nunavut: Research to support enhanced geothermal systems in Northern remote communities*. Version 1.0. Cascade Institute. https://doi.org/10.5281/zenodo.18378955

ᐱᒋᐊᕐᓂᖓ

ᐅᓇ ᐅᓂᒃᑳᖅ ᓴᕿᑎᑦᑎᓯᒪᔪᖅ ᐊᒻᒪᓗ ᑭᖑᕙᖅᓯᒪᓇᑎᒃ ᖃᐅᔨᓴᕈᑎᖏᑦ ᓄᓇᐅᑉ ᐆᓇᕐᓂᖓ ᐊᑐᖅᑕᐅᔪᓐᓇᕐᒪᖔᑦ ᖃᒪᓂᑦᑐᐊᕐᒥ. ᐱᓯᒪᓂᖃᖅᑐᖅ ᐃᑲᔫᑎᓂᐊᖅᑐᓂᒃ ᑲᔪᓯᔪᓄᑦ ᐅᖃᖃᑎᒌᒍᑕᐅᔪᓄᑦ ᐱᔾᔪᑎᒋᓪᓗᒋᑦ ᓄᓇᓕᖕᓂ ᐊᑯᓂᐅᔪᒃᑯᑦ ᐆᒻᒪᕐᑯᑎᖃᕐᕕᐅᔪᓐᓇᕐᓂᖓ ᓯᕗᓂᒃᓴᑦᑎᓐᓂ. ᑕᐃᒫᒃ ᐱᑦᑎᐊᓚᓪᓗᒍ ᖃᐅᔨᓇᓱᑦᑎᐊᖅᓱᒍ ᖄᖓᑕ ᐃᑭᐊᖓ ᖃᓄᓇᑑᖕᒪᖔᑦ, ᐆᓇᖅᑎᑦᑏᑦ ᒪᓂᕋᖓ, ᐊᒻᒪᓗ ᐊᑕᔪᓂᒃ ᖃᐅᔨᒪᓇᖏᑦᑐᓂᒃ, ᐃᓚᑦᑎᓇᓱᒃᑐᑦ ᐊᑑᑎᖃᕈᓐᓇᕐᒪᖔᑕ ᑐᓐᖓᕕᐅᓗᑎᒃ ᑐᑭᓯᓂᐊᕋᑦᑎᒍᑦ ᓄᓇᐅᑉ ᐆᓇᕐᓂᖓ ᐆᒻᒪᕐᑯᑎᒋᔭᐅᔪᓐᓇᕐᒪᖔᑦ ᐃᓗᐊᒍᑦ ᐊᖏᓂᖅᓴᐅᔪᑦ ᓱᕈᖅᓴᐃᓐᖏᑦᑐᓂᒃ ᐆᒻᒪᕐᑯᑎᖃᐅᑎᒃᓴᓄᑦ ᐊᑐᖅᑕᐅᔪᓐᓇᖅᑐᓄᑦ.

ᑖᒃᑯᓄᖓ ᓄᓇᓖᑦ ᑕᐅᑦᑐᖏᓐᓄᑦ, ᐊᑑᑎᓖᑦ ᐱᓕᓇᐊᓇᔭᑦᑎᓐᓄᑦ ᐱᔭᕐᓂᓐᖏᑦᑐᓕᓇᔭᓇᐊᓕᖏᓐᓂᒃ ᓇᓂᓯᓯᒪᑐᐃᓐᓇᓐᖏᑦᑐᒍᑦ ᑭᓯᐊᓂᑦᑕᐅᖅ ᐱᕕᖃᖅᑎᑦᑎᔪᖅ ᓴᕿᑦᑎᓗᑕ ᖃᐅᔨᒪᔭᑦᑎᓐᓂᒃ, ᐋᕿᑦᑎᐊᕈᑎᒃᓴᓂᒃ ᐃᓱᒪᒃᓴᖅᓯᐅᕈᑎᒃᓴᓄᑦ. ᖃᐅᔨᓇᓱᑦᑎᐊᖅᓱᒍ ᐃᑲᔫᑎᔪᖅ ᓇᓂᓗᒋᑦ ᐃᓂᖏᑦ ᓄᓇᒥ ᐆᓇᕐᓂᖏᑦ ᐆᒻᒪᕐᑯᑕᐅᔪᓐᓇᖅᑐᑦ ᐊᓯᖏᓪᓗ ᓄᑖᑦ ᐱᓕᓇᔾᔪᑕᐅᔪᓐᓇᖅᑐᑦ, ᓲᕐᓗ ᓯᕿᓂᕐᒥᑦ, ᐊᓄᓇᒥᑦ, ᐊᒻᒪᓗ ᐃᒫᓂᑦ ᐆᒻᒪᕐᑯᑎᖃᐅᑎᑦ, ᐊᔪᖏᑎᑦᑎᔪᖅ ᓄᓇᓕᖕᓂ ᐊᒻᒪᓗ ᐃᓱᒪᓕᐅᕆᔩᓂᒃ ᑐᑭᓯᑎᐊᒃᑲᓂᕐᓗᑎᒃ ᓇᓕᖄᑦᑎᐊᕐᓂᐊᕐᒪᑕ ᐊᑭᓕᓇᐊᓕᖕᓄᑦ, ᐱᔭᕐᓂᓐᖏᑦᑐᑦ ᐊᑦᑕᕐᓇᖅᑎᑦᑎᔪᓐᓇᖅᑐᓄᑦ, ᐊᒻᒪᓗ ᐊᔪᖅᑎᑦᑎᔪᓄᑦ. ᑐᑭᓯᓇᕐᓂᐊᕐᒪᑕ, ᐅᓇ ᐅᓂᒃᑳᖅ ᐃᑲᔫᑎᓗᓂ ᑕᑯᑎᑦᑎᓗᓂ ᐅᖃᖃᑎᒌᒍᑎᒃᓴᓄᑦ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᓂᒃ ᐊᑑᑎᖃᕐᓗᓂ, ᑲᔪᓯᔪᓐᓇᕐᓗᓂ, ᐊᒻᒪᓗ ᐃᑲᔫᑎᓗᓂ ᖃᒪᓂᑦᑐᐊᕐᒥᐅᓄᑦ ᐊᑯᓂᐅᔪᒃᑯᑦ.

ᑕᐃᑲᓂᑦᑕᐃᓐᓇᖅᑕᐅᖅ, ᐱᒻᒪᕆᐅᕗᖅ ᐃᓚᓴᖅᓯᓗᑕ ᑕᒪᒃᑯᐊ ᐱᔭᕐᓂᓐᖏᑦᑐᑦ ᐃᒻᒥᒍᑦ ᓈᒻᒪᓐᖏᓗᐊᖅᑐᑦ ᐃᓱᒪᒋᓪᓗᒋᑦ ᐊᖏᔪᑦ ᐆᒻᒪᕐᑯᑎᖃᐅᑎᑦ ᓇᐸᖅᑕᐅᒋᐊᓕᑦ ᓴᓇᔭᐅᓂᖏᓐᓄᑦ, ᐱᓗᐊᖅᑐᒥᒃ ᑕᒪᒃᑯᐊ ᓄᓇᐅᑉ ᐃᑭᐊᖓᓂᑦ ᐆᒻᒪᕐᑯᑎᖃᐅᑎᒃᓴᓄᑦ ᓴᓇᓂᖅ. ᓄᓇᕗᒻᒥᑦ ᐃᓄᐃᑦ ᑕᐅᑦᑐᖏᓐᓂᑦ, ᑕᒪᒃᑯᐊ ᐱᓕᓇᐊᖑᔪᑦ ᑎᑭᐅᑎᓂᐊᖅᑐᖅ ᖃᓄᐃᓕᐅᕈᑎᒃᓴᒥᖕᓂᒃ ᐃᓄᐃᑦ ᓇᖕᒥᓂ- ᒐᕙᒪᖃᕈᓐᓇᕐᓂᕐᒧᑦ, ᓄᓇᓕᖕᓂ ᓇᖕᒥᓂᓇᔭᐅᓗᓂ, ᐊᒻᒪᓗ ᑐᓂᓯᓯᒪᓂᐊᖅᑐᑦ ᐊᑯᓂ ᐃᓅᓯᓕᓇᓂᕐᒧᑦ ᐊᒻᒪᓗ ᑮᓇᐅᓕᐅᕈᑕᐅᓗᓂ ᐃᑲᔫᑎᓂᐊᖅᑐᑦ. ᑕᐃᒪᓗ ᐅᓇ ᐅᓂᒃᑳᖅ ᐅᖃᐅᓯᖃᕐᓂᐊᓚᐅᖏᑦᑐᖅ ᑐᑭᖁᐊᒃᑎᑦᑎᓂᕐᒥᒃ ᒐᕙᒪᖃᕐᓂᕐᒥᒃ ᐅᕝᕙᓘᓐᓃᑦ ᓇᖕᒥᓂᖃᕐᓂᕐᒥᒃ ᖃᓄᐃᓕᖓᓇᔭᖅᑕᖏᓐᓂᒃ ᓇᓗᓇᐃᑦᑎᐊᖅᓯᒪᓗᑎᒃ, ᑕᒪᒃᑯᐊ ᐃᓱᒪᒋᔭᓇᐊᓕᑦ ᐱᒻᒪᕆᐅᔪᑦ ᑕᐃᒪᓗ ᐅᖃᖃᑎᒌᒍᑎᖏᑦ ᓅᓂᐊᕐᒪᑕ ᓄᓇᒥᑦ ᐃᑲᔫᑎᓂᑦ ᖃᐅᔨᓇᓱᑦᑎᐊᕐᓂᖅ ᐃᒻᒪᖄ ᐊᑐᓕᖅᑎᑕᐅᓂᐊᕐᒪᑕ.

ᓯᕗᓂᒃᓴᑦᑎᓐᓂ ᕿᓂᕐᓂᖅ ᓄᓇᒥ ᐆᓇᖅᑐᖏᓐᓂᑦ ᐆᒻᒪᕐᑯᑎᖃᐅᑎᖃᕐᓂᖅ ᖃᒪᓂᑦᑐᐊᕐᒥ ᑕᐃᒪᐃᒻᒪᑦ ᑐᑭᓯᐊᒃᑎᑕᐅᓗᓂ ᐃᓄᖕᓂᑦ ᓯᕗᓕᐅᖅᑎᓂᑦ ᐊᒻᒪᓗ ᒪᓕᑦᑎᐊᕐᓗᓂ ᓄᓇᓕᖕᓂ ᓯᕗᓪᓕᐅᑎᕐᔭᐅᔪᓂᒃ, ᐃᓚᒋᔭᐅᓗᑎᒃ ᓄᓇᓖᑦ ᓇᖕᒥᓂᖃᖅᑐᑦ ᓇᐸᖅᑕᐅᓯᒪᔪᒥᒃ, ᐊᑯᓂ ᐃᖅᑲᓇᐃᔮᖃᑎᑦᑎᓂᐊᖅᑐᖅ ᐊᒻᒪᓗ ᐱᔭᓇᐅᖅᓴᑎᑦᑎᓗᓂ ᐃᓄᖕᓂᒃ, ᐊᒻᒪᓗ ᖃᑭᒋᐊᒃᑲᓂᕈᑎᒋᓗᒍ ᐃᑲᔫᑎᒃᓴᓄᑦ ᓄᓇᓕᖕᓂ ᐱᓕᑦᑎᕋᐅᑎᖏᓐᓄᑦ ᐊᒻᒪᓗ ᖃᓄᐃᖏᑦᑎᐊᕈᑎᒃᓴᖏᓐᓄᑦ.

Foreword

This report provides an insightful and timely assessment of geothermal resource potential in Baker Lake. It also represents an essential contribution to ongoing discussions about the community's long-term energy future. By carefully evaluating subsurface conditions, temperature gradients, and associated uncertainties, the study offers a valuable technical foundation for understanding geothermal energy as one option within a broader portfolio of clean energy solutions.

From a community perspective, the value of this work lies not only in its technical findings but also in the opportunity it creates for informed, grounded decision making. The analysis helps situate geothermal energy alongside other technologies, such as solar, wind, and hybrid systems, enabling the community and decision makers to better understand relative levelized costs, technical risks, and practical constraints. In that sense, the report supports an evidence-based discussion of which pathways are most appropriate, feasible, and beneficial for Baker Lake over the long term.

At the same time, it is essential to recognize that technical feasibility alone is not sufficient when considering major energy infrastructure projects, particularly those involving subsurface resource development. From a Nunavut Inuit perspective, such projects must ultimately be framed around Inuit self-determination, community ownership, and the delivery of long-term social and economic benefits. While this report was not intended to address governance or ownership models in detail, those considerations are essential as discussions move from resource assessment toward potential implementation.

Future exploration of geothermal energy in Baker Lake should therefore be guided by Inuit leadership and aligned with community priorities, including local ownership of infrastructure, long-term employment and training opportunities for Inuit, and reinvestment of benefits into community services and well-being. Significant capital investments in energy

ᐊᖏᔪᒥᒃ ᐊᑭᑐᔪᒥᒃ ᖃᑭᐟᔪᑎᒃᓴᓕᐅᕐᓗᑎᒃ ᐆᒻᒪᕐᑯᑎᖃᐅᑎᒃᓴᓂᒃ ᐃᓱᒪᒋᔭᐅᔭᕆᐊᓕᒃᑕᐅᖅ ᓴᓇᔭᐅᑎᓪᓗᒍ ᐊᑕᑦᑎᐊᕐᓗᓂ ᖃᑭᐟᔪᑎᒃᓴᓕᐅᕈᑎᒋᓗᒍ ᐃᒡᓗᒃᓴᓄᑦ, ᓂᕿᒃᓴᖃᕐᑎᑦᑎᓂᕐᒧᑦ, ᐋᓐᓂᐊᖃᖅᑕᐃᓕᑎᑦᑎᓂᕐᒧᑦ, ᐊᒻᒪᓗ ᐊᓯᖏᓐᓂᒃ ᐊᑑᑎᖃᒻᒪᕆᒃᑐᓂᒃ ᐃᓅᓯᓕᕆᓂᕐᒧᑦ ᓇᐸᕆᐊᓕᖕᓄᑦ, ᖃᐅᔨᒪᑦᑎᐊᕐᓗᑕ ᐆᒻᒪᕐᑯᑎᖃᐅᑎᒃᓴᒧᑦ ᓴᓇᔭᐅᔪᑦ ᐃᖏᕋᕚᓕᐊᓂᖓ ᐊᔪᙳᖅᑎᑦᑎᓯᒪᓂᐊᖅᑐᖅ ᐊᖏᓂᖅᓴᑎᒍᑦ ᓄᓇᓕᖕᓂ ᓴᐱᓕᔾᔪᖏᒻᒪᑕ ᐋᕿᒃᓯᒪᔾᔪᑕᐅᓐᖏᓛᕐᓗᓂ ᐃᒻᒥᒍᑐᐊᖅ ᓇᐸᓂᖓᓄᑦ ᐱᔭᕐᓂᓐᖏᑦᑑᑎᒃᓴᓄᑦ ᐋᕿᒃᓯᒪᔾᔪᑎᒃᓴᓄᑦ.

ᐅᓇ ᐅᓂᒃᑳᖅ ᕿᒥᕐᕈᐊᖅᑕᐅᑦᓯᐊᓕᒃ ᐱᒋᐊᕐᓂᖓᓂ ᑐᓂᓯᓯᒪᔪᖅ ᐊᑑᑎᖃᒻᒪᕆᒃᑐᓂᒃ ᓄᓇᐅᑉ ᐆᓇᕐᓂᖓᓂᒃ ᐊᑐᖅᑕᐅᔪᓐᓇᖅᑐᒥᒃ ᐊᒻᒪᓗ ᑎᑭᐅᑎᓗᐊᕆᐊᖃᓐᖏᑕᖏᓐᓂᒃ, ᐱᓗᐊᖅᑐᒥᒃ ᐃᒃᐱᒋᑦᑎᐊᖅᓱᒍ ᐆᓇᕐᓂᖓ ᐊᑐᖅᑕᐅᔪᓐᓇᖅᑐᖅ ᐊᐟᔨᒋᓐᖏᑕᖓ ᖃᐅᒻᒪᕐᑯᑎᓄᑦ ᐅᐊᔭᑎᒍᑦ. ᐃᓂᖃᖅᑎᑦᑎᔪᖅ ᑐᑭᓯᓇᓱᖃᑎᒌᒍᑕᐅᒃᑲᓂᕐᓗᓂ, ᓇᓗᓇᐃᑦᑎᐊᒃᑲᓂᕐᓗᒍ ᐱᔭᕐᓂᓐᖏᑦᑐᖏᑦ-ᑮᓇᐅᔭᓕᐅᕈᑕᐅᔾᔭᕐᓂᖓᓄᑦ ᖃᐅᔨᓴᕐᓗᒍ, ᐊᒻᒪᓗ ᓄᓇᓕᖕᓂᑦ-ᐃᖏᕐᕋᑎᑕᐅᓗᑎᒃ ᐅᖃᖃᑎᒌᒍᑎᒃᓴᑦ ᖃᓄᖅ ᑭᖑᓪᓕᕐᒥᒃ ᐱᓕᕆᓂᐊᕐᒪᖔᑦᑕ. ᐱᔾᔪᑎᒋᓪᓗᒍ, ᑐᓂᓯᓯᒪᔪᖅ ᐊᑑᑎᖃᒻᒪᕆᒃᑑᓪᓗᓂ ᖃᒪᓂᑦᑐᐊᕐᒥᐅᓄᑦ ᐃᑲᔫᑎᔪᖅ, ᐃᓱᒪᒋᑦᑎᐊᕐᓗᒋᑦ ᐊᕈᖅᓴᐃᓐᖏᑦᑐᒥᒃ ᐆᒻᒪᕐᑯᑎᖃᕈᓐᓇᕐᓂᖅ ᐱᓯᒪᔪᖅ ᑕᒪᐃᓐᓂᒃ ᐱᔭᕐᓂᓐᖏᑦᑑᖃᑦᑕᕐᒪᑕ ᐊᑐᖅᑕᐅᔪᑦ ᐅᑭᐅᖅᑕᖅᑐᒥ ᐊᒻᒪᓗ ᓄᓇᓖᑦ ᐊᑐᑎᖏᑦ, ᓯᕗᓪᓕᐅᑎᕐᑯᔭᖏᑦ, ᐊᒻᒪᓗ ᐱᔪᒪᔭᖏᑦ.

ᐋᓕᒃᔅ ᑯᒃ ᐆᒻᒪᕐᑯᑎᖃᐅᑎᓂᒃ ᖃᐅᔨᒪᔨᒻᒪᕆᖕᒑᑦ ᖃᒪᓂᑦᑐᐊᖅ, ᓄᓇᕗᑦ

infrastructure should also be considered alongside complementary investments in housing, food security, health, and other critical social infrastructure, ensuring that energy projects function as enablers of broader community resilience rather than stand-alone technical solutions.

This report should be viewed as a starting point that provides valuable insight into geothermal potential and its limitations, particularly with respect to heat applications versus electricity generation. It creates space for further dialogue, more detailed techno-economic analysis, and community-led discussion about next steps. In that regard, it offers real value to Baker Lake by supporting informed, thoughtful consideration of clean energy options that reflect both the technical realities of the North and the community's values, priorities, and aspirations.

Alex Cook

Energy Champion for Baker Lake, Nunavut

House overlooking the river in Baker Lake, Nunavut. Photo by Ysaline Bacon (CC BY 4.0).

Baker Lake, Nunavut. © Jane M / Adobe Stock.

ᐊᐅᓚᑦᓯᔾᔨᓂᑦ ᓇᐃᓈᖅᓯᒪᔪᖅ

ᓄᓇᕗᑦ ᐊᖏᓂᖅᐹᖑᕗᖅ, ᓇᖕᒥᓂ-ᒐᕙᒪᖃᖅᑐᖅ ᓄᓇᕗᑦ ᑎᐅᓕᑐᐊᓕ, ᐊᖏᕐᕋᕆᔭᐅᔪᖅ 25 ᐃᓄᐃᑦ ᓄᓇᓖᑦ. ᐅᑯᐊ ᓄᓇᓖᑦ ᓅᑦᑎᓯᒪᖃᑦᑕᖅᑐᑦ ᐊᖏᔪᒥᒃ ᐆᒻᒪᕐᑯᑎᖃᐅᑎᒃᓴᓄᑦ ᐱᔭᕐᓂᙱᑦᑐᖅᓯᐅᖅᖢᑎᒃ. ᐊᑕᓂᖃᙱᑦᑎᐊᖅᑐᑦ ᐊᓯᒥᙵᓄᑦ ᓄᐊᑦ ᐊᒥᐊᓕᑲᒥ ᐊᕐᑯᑎᑕᖃᙱᑦᑐᖅ, ᓄᓇᓯᐅᑎᑯᑖᒃᑕᖃᙱᑦᑐᖅ, ᐅᕝᕙᓘᓐᓃᑦ ᐅᐊᔭᓂᒃ ᐊᑕᔪᖃᙱᑦᑐᑦ ᐊᓯᒥᙵᓄᑦ, ᐊᑐᖅᓯᔪᑦ ᓇᖕᒥᓂᖅ ᒌᓯᓂᒃ ᐅᖅᓱᐊᓗᙳᓂᒃ, ᑎᑭᑎᑕᐅᕙᒃᑐᑦ ᐅᒥᐊᕐᔪᐊᒃᑯᑦ ᐊᑕᐅᓯᐊᖅᖢᑎᒃ ᐊᕐᕌᒍᒥ, ᑕᒪᕐᒥᒃ ᐅᕐᑰᑎᑦᑎᔪᑦ ᐃᒃᑲᒃᓴᐅᓯᕐᑎᑦᑎᒍᑦ ᐊᒻᒪᓗ ᖃᐅᒻᒪᕐᑯᑎᖃᖅᑎᑦᑎᓗᓂ. ᐅᑯᐊ ᑭᓯᐊᓂᐅᕙᒃᑐᑦ ᐊᓯᖃᙱᑦᑐᖅ ᐊᑭᑐᔫᓗᓂ, ᐱᔭᕐᓂᙱᑦᑐᖅ ᑎᑭᑎᓐᓇᓱᒃᖢᒍ, ᐆᒻᒪᕐᑯᑎᖃᐅᑎᓄᑦ ᐊᑐᖅᑕᐅᔪᑦ, ᐊᒻᒪᓗ ᐊᖏᔪᒥᒃ ᓯᓚᑦᑎᓐᓂᒃ ᓱᑲᖅᓴᐃᔪᑦ.

ᑕᐃᒪᓐᓇᐃᓕᖓᑎᓪᓗᒍ, ᓄᓇᓕᖕᓂ ᓯᕗᓕᐅᖅᑎᑦ ᖃᓂᖅᑐᑦ ᖃᓄᖅ ᐱᕚᓪᓕᕈᑎᒃᓴᓂᒃ ᐆᒻᒪᕐᑯᑎᖃᐅᑎᒃᓴᓄᑦ ᐃᒃᑲᒃᓴᐅᑎᒃᓴᖅ ᓇᓗᓇᐃᖅᓯᓗᑎᒃ ᓄᓇᓕᖕᓂ ᐊᒻᒪᓗ ᑕᒪᐅᖔᑐᐃᓐᓇᙱᑦᑐᒥᒃ ᐆᒻᒪᕐᑯᑎᖃᐅᑎᖃᖅᑎᑦᑎᔾᔪᑎᒃᓴᑦ ᐅᑯᐊᓗ ᐃᑲᔫᑎᓂᐊᖅᑐᑦ ᐅᑭᐅᖅᑕᖅᑐᖅ ᐊᕙᑖᓂᒃ. ᓄᓇᒥᑦ ᐆᒻᒪᕐᑯᑎᖃᐅᑎᒃᓴᖏᓐᓄᑦ, ᐅᑯᐊᓗ ᐅᕐᑰᑎᑦᑎᔫᓐᓇᖅᑐᑦ ᐆᓇᕐᓂᖓᓂᑦ ᐃᑎᓂᖅᐹᖓᓂᑦ ᓄᓇᐅᑉ ᐊᑐᖅᓯᓗᑎᒃ, ᖃᐅᒻᒪᕐᑯᑎᕐᑎᑦᑎᕕᐅᓗᓂ ᐃᒃᑲᒃᓴᐅᑎᕐᕕᐅᓗᓂ, ᐅᕝᕙᓘᓐᓃᑦ ᑕᒪᕐᒥᒃ, ᐅᑯᐊ ᐊᔪᕐᓇᙱᑦᑐᑦ ᐊᑐᖅᑕᐅᔫᓐᓇᕐᒥᔪᑦ.

ᐅᑯᐊ Hᐋᒻᓚᒃᑯᑦ ᖃᒪᓂᑦᑐᐊᖅ (ᑕᐃᔭᐅᔫᑦ ᐸᐃᑯ ᓚᐃᒃ), ᐅᑯᐊᓗ ᓄᓇᒪᕆᖕᒦᑦᑐᑦ ᖃᓇᑕᒥ ᕿᑎᑦᑎᐊᖑᓂ, ᑖᓇᑐᐊᖅ ᓯᖅᔭᒥᐅᑕᐅᓇᖏᑦᑐᖅ ᓄᓇᓕᒃ ᓄᓇᕗᒻᒥ. ᐃᓂᖃᖅᑐᖅ ᖄᖓᓂ ᑲᓇᑕᐅᑉ ᐊᐅᒍᓐᓇᖏᑦᑐᐊᓂ ᖁᓕᐋᓗᐊᓂ, ᐊᕕᒃᑐᖅᓯᒪᔪᑦ ᐱᑕᖃᖅᑐᑦ ᓄᑕᐅᖏᓐᓂᖅᐹᓂᒃ ᐅᔭᖃᓂᒃ ᓄᓇᖁᐊᓕᒦᒥ. ᒪᓕᒃᖢᒍ ᖃᐅᔨᒪᔾᔪᑎᑕᖃᙱᓐᓂᖓᓄᑦ, ᐅᖃᖅᑐᖃᖃᐅᔪᖅ ᑲᓇᑕᒥ ᖃᐅᔨᓴᖅᑕᐅᓇᓱᒃᖢᓂ ᐊᑦᑎᒃᑐᐊᓃᑦᑐᖅ ᓄᓇ ᐆᓇᕐᓂᖓ ᑕᐅᕙᑦᓯᒪ ᓄᓇᖓᓂ, ᐊᑦᑎᒃᑐᒦᓪᓕᑦ ᓄᓇᒥᐅᑕᑕᖃᐅᖅᑐᖅ. ᖃᐅᔨᓴᕈᑎᕗᑦ, ᑕᐃᒪᓐᓇᐅᓚᐅᖅᑎᓪᓗᒍ, ᓇᓂᓯᓯᒪᓕᑦ ᖃᒪᓂᑦᑐᐊᖅ ᐃᓂᖃᖅᑎᑦᑎᔪᓐᓇᖅᑐᖅ ᓄᓇᐅᑉ ᐃᑭᐊᖓᓂᑦ ᐆᒻᒪᕐᑯᑎᖃᐅᑎᖃᕈᓐᓇᖅᑐᒥᒃ.

ᖃᐅᔨᓇᓯᑦᑎᐊᕐᓗᒍ ᖃᒪᓂᑦᑐᐊᑉ ᓄᓇᖓ ᐆᓇᕐᓂᓕᒃ ᐃᑲᔫᑎᒃᓴᖅ, ᖁᓕᖅ ᐆᒻᒪᕐᑯᑎᓕᕆᔨᖕᒋᑕ ᑎᒥᖁᑖ, ᓄᓇᕗᒻᒥ ᐃᓄᖕᓂᒃ ᐃᑯᒪᓕᕆᕝᕕᖃᖅᑐᑦ, ᐱᓕᕆᖃᑎᒋᓪᓗᒋᑦ RESPEC-ᑯᑦ, ᐅᑯᐊ ᖃᐅᔨᒪᔨᒋᔭᐅᔪᑦ ᐊᒻᒪᓗ ᐊᐅᓚᐅᓯᕆᔨᐅᔪᑦ ᐱᔨᑦᑎᕋᕐᔫᑦ ᑎᒥᐅᔪᑦ, ᓂᐅᖅᑐᓚᐅᖅᓯᒪᔪᑦ 500-ᒦᑕ ᐃᑎᔪᒧᑦ ᓄᓇᒧᑦ ᖃᓂᒋᔭᖓᓂ ᖃᒪᓂᑦᑐᐊᖅ 2022-ᒥ. ᐅᓇ ᐱᓕᕆᐊᖑᔪᖅ ᑐᕌᖅᑐᖅ ᖃᐅᔨᓴᑦᑎᐊᒃᑲᓂᕐᓗᒋᑦ ᓄᓇᐅᑉ ᐆᓇᕐᓂᖓ ᑭᓱᖃᕐᓂᖓ. ᖃᐅᔨᓴᕈᑎᓂᒃ ᓄᐊᑦᑎᓗᑎᒃ ᑕᒪᒃᑯᐊᓗ ᐃᓗᐊᑕ ᐆᓇᕐᓂᖓ ᖃᓄᖅ ᑕᐅᑦᑐᖃᕐᒪᖔᑦ ᐊᒻᒪᓗ ᐊᒥᓱᑦ ᓄᓇᐅᑉ ᐃᑭᐊᖓᓂᑦ ᓂᐅᖅᑐᖅᓯᒪᔪᑦ ᖃᐅᔨᓴᕈᑎᑖᑦ, ᐅᑯᐊᓗ ᐅᐊᑦᑎᐊᕈᓯᖅᐸᑦ ᖃᐅᔨᓇᓱᒃᑕᐅᑦᑎᐊᕐᓂᐊᖅᑐᑦ ᐃᓚᓐᓂᐊᕐᕕᐊᓂ ᖃᐅᔨᓴᖅᑎᑦ, CanmetENERGY, ᐊᒻᒪᓗ RESPEC ᐊᖏᓇᖅᑐᓄᑦ ᖃᐅᔨᓴᕈᑎᖏᓐᓂ.

ᐅᑯᐊ ᓄᓇᒥᑦ ᐱᔭᐅᔪᑦ ᓂᐅᖅᑐᖅᑕᓂᑦ, ᐱᓕᕆᓚᐅᖅᑐᖓ ᓄᓇ ᐆᓇᕐᓂᖓᓂ ᖃᐅᔨᓴᖅᖢᖓ ᐃᑲᔪᖅᑎᒋᓪᓗᒋᑦ ᑕᒪᕐᒥᒃ CanmetENERGY, ᖁᓕᖅ ᐆᒻᒪᕐᑯᑎᓕᕆᔨᖕᒋᑕ ᑎᒥᖁᑖ, ᐊᒻᒪᓗ RESPEC. ᓇᓚᐅᑖᓚᐅᖅᐳᒍᑦ

Executive summary

Nunavut is a vast, self-governed Inuit territory, home to 25 Inuit communities, where energy sovereignty remains a key challenge. Not connected to the rest of North America by road, rail, or electricity transmission line, people rely entirely on fossil fuels, shipped in once a year by boat, for both space heating and electricity. This dependency leads to high costs, logistical vulnerabilities, and environmental risks, while limiting local control over energy decisions.

In this context, Inuit leaders and local organizations are seeking to bolster their energy security by identifying local and sustainable energy alternatives that are adapted to the Arctic environment. Geothermal energy, which harnesses heat from deep within the Earth to generate renewable heat, electricity, or both, is one promising option.

The hamlet of Baker Lake (also known as Qamani'tuaq), which marks the geographic centre of Canada, is the only inland community in Nunavut. It sits on the Canadian Shield, a region made up of some of the oldest rocks on Earth. Based on limited data, earlier national assessments suggested a low geothermal potential for this area, due mainly to low average geothermal gradients. Our research, however, reveals higher-than-expected subsurface temperatures, opening possibilities for a deep geothermal development.

To assess this potential, Qulliq Energy Corporation, Nunavut's public power utility, partnered with RESPEC, a consulting and engineering services firm, to drill a 500-metre-deep borehole near Baker Lake in 2022. This project aimed to better evaluate the geothermal resource. The data collected include a downhole temperature profile and numerous core samples, which were later analyzed at the Institut National de la Recherche Scientifique (INRS), CanmetENERGY, and RESPEC laboratories.

Using these borehole data, I conducted a geothermal resource assessment in collaboration with CanmetENERGY, Qulliq Energy Corporation, and RESPEC. We estimated underground temperatures down to 10 km using statistical methods. Our results, summarized here and presented in detail in Bacon et al. (2024), show that subsurface temperatures are higher than previously expected, suggesting that Baker Lake could host a deep geothermal system.

ᐃᑭᐊᖓ ᓄᓇᐅᑉ ᐆᓇᕐᓂᖓ ᐊᑦᑎᒃᓯᓯᒪᔪᖅ 10 ᑭᓚᒦᑐᒥ ᐊᑐᖅᓯᓪᓗᑕ ᓈᓴᐅᖅᓯᒪᔪᓂᒃ. ᑐᑭᓯᓇᖅᓯᔪᑦ, ᓇᐃᓈᖅᓯᒪᕗᑦ ᑖᒃᑯᓂ ᐊᒻᒪᓗ ᐅᖃᐅᓯᐅᔪᑦ ᓇᓗᓇᐃᔭᑦᑎᐊᖅᓯᒪᓪᓗᑎᒃ ᑕᒪᕐᒥᒃ ᑕᐃᑲᓂ ᐸᐃᑲᓐ ᐊᓯᙱᓪᓗ (2024), ᑕᑯᑎᑦᑎᔪᑦ ᖃᖓᑕ ᐃᑭᐊᖓ ᐆᓇᕐᓂᖓ ᐆᓇᕐᓂᖅᓴᐅᓚᐅᖅᑐᖅ ᓂᕆᐅᒋᔭᐅᔪᒥᑦ, ᐃᓱᒪᓕᖅᓯᒪᕗᖅ ᖃᒪᓂᑦᑐᐊᖅ ᐃᓂᖃᖅᑎᑦᑎᕕᐅᔪᓐᓇᖅᑐᖅ ᐃᑎᔪᒥᑦ ᓄᓇᒥ ᐃᑭᐊᖓᓂ ᐃᒃᑲᒃᓴᐅᑎᒃᓴᖅ.

ᑕᐃᒪᐃᓕᖓᔪᖅ, ᓄᓇᐅᑉ ᐃᑭᐊᖓᓂ ᐃᑯᐊᒃᓴᐅᑎᒃᓴᖅ ᐱᓯᒪᔪᖅ ᐅᕐᑰᑎᑦᑎᔪᓐᓇᖅᑐᖅ ᑐᕐᑯᖅᓯᒪᓗᓂ ᐊᒥᓲᓄᑦ ᑭᓚᒦᑕᔅᓄᑦ ᓄᓇᐅᑉ ᐃᑭᐊᖓᓂᑦ, ᐃᑎᓂᖅᓴᐅᖃᑦᑕᖅᑐᖅ 3 ᑭᓚᒦᑕᔅ. ᐅᓇ ᑎᑎᕋᖅ ᑐᓂᓯᓯᒪᔪᖅ ᑐᑭᓯᓇᖅᓯᑎᓯᒪᓪᓗᓂ ᖃᓄᐃᓕᖓᓂᖓᓂᒃ ᑕᒪᓐᓇ ᐃᓕᓐᓇᓱᒃᑕᕗᑦ ᓇᓂᔭᕗᑦ ᐊᑐᓚᒃᓴᐅᓂᐊᕐᒪᑕ ᐅᓄᕐᓂᖅᓴᓄᑦ.

ᑭᓱᒥᑦ ᐊᓂᐊᓇᔪᓐᓇᙱᑦᑐᖅ, ᐃᒪᕈᓲᖅ ᐅᔭᕋᖓ ᑲᓇᑕᐅᑉ ᖁᓕᐊᓗᐊᓂ ᐊᐅᒍᓐᓇᙱᑦᑐᒥ, ᐊᐅᓪᓗᑎᔪᒍᑦ ᐱᐅᓯᕚᓪᓕᖅᑎᓪᓗᒍ ᓄᓇᐅᑉ ᐃᑭᐊᖓᓂ ᐃᒃᑲᒃᓴᐅᑎ, ᑕᐃᒪᓗ ᖃᖓ ᐃᒪᖃᕐᓗᓂ ᐃᒥᓂᒃ ᐊᐅᓚᐅᑎᖃᖅᑐᖅ ᐃᒪᖓᓄᑦ ᐊᒻᒪᓗ ᐅᕐᑰᑎᑦᑎᔾᔭᑎᖓᓄᑦ. ᑕᐃᒪᓗ ᓄᑖᑦ ᓴᕿᑉᐸᓪᓕᐊᑎᓪᓗᕆᑦ ᖃᓇᓴᐅᔭᖅᑎᒍᑦ ᐱᓕᓇᔾᔪᑕᐅᓕᖅᑐᖅ, ᐱᐅᓯᕚᓪᓕᖅᐸᓪᓕᐊᑐᐃᓐᓇᕐᓂᐊᖅᑐᖅ ᓄᓇᐅᑉ ᐃᑭᐊᖓᓂ ᐆᓇᕐᓂᖓ ᐊᑐᕈᓐᓇᖅᓯᓗᒍ ᐆᒻᒪᖅᑯᑎᖃᐅᑎᓄᑦ ᓄᓇᖓᓐᓂ ᓄᓇᕗᑦ, ᐃᓱᒪᒋᔭᐅᓚᐅᖅᓯᒪᔪᖅ ᐋᖅᑎᖃᕋᔭᙱᓐᓂᖓᓂᒃ.

ᐅᓇ ᐃᓚᑕᐅᓇᓱᒃᑐᖅ ᓇᓂᓯᓯᒪᔪᖅ 4-ᑭᓚᒦᑕᔅ ᐃᑎᑎᒋᔪᖅ ᐊᑐᕈᓐᓇᖅᑐᖅ ᐆᒻᒪᖅᑯᑎᖃᐅᑎᓄᑦ ᓄᑖᖑᓗᓂ ᐃᒃᑲᒃᓴᐅᑎ ᐊᑐᖅᑕᐅᔪᓐᓇᕐᓂᐊᕐᒪᑦ ᐅᕐᑰᑎᑦᑎᔪᓐᓇᕐᓗᓂ ᓄᓇᓕᖕᓂᒃ. ᓂᐅᖅᑐᖅᑕᐅᓂᖓ ᑎᑭᐅᒪᔪᖅ 7-8 ᑭᓚᒦᑕᔅ, ᐆᒻᒪᖅᑯᑎᖃᕐᑎᑦᑎᔪᓐᓇᖅᑐᖅ ᐃᒃᑲᒃᓴᐅᑕᐅᔪᓐᓇᖅᑐᖅ ᑕᒪᐃᓐᓂᒃ ᓄᓇᓕᖕᓂᒃ ᐊᔪᕐᓇᖃᔭᕐᑰᙱᑦᑐᖅ.

ᑕᐃᒪᓐᓇᐅᒐᓗᐊᖅᑎᓪᓗᒍ, ᐊᒥᓱᑦ ᑐᑭᓯᐊᓂᒃᑕᐅᖏᑦᑐᑦ, ᐱᓗᐊᖅᑐᒥᒃ ᓄᓇ ᑕᐃᒪᓐᓇᐃᑎᑦᑎᓲᖑᓕᖓ ᐊᒻᒪᓗ ᐊᐅᓚᐅᓯᓇᔫᑦ ᖃᖓᓂ ᐃᒪᖅᑲᕈᓐᓇᖅᑐᖅ ᐃᑎᔫᔪᖅ, ᓴᙱᔪᓂᒃ ᐃᓂᑐᖅᑲᖓᓂᑦ ᓴᙱᔪᐋᓗᒃ ᐃᖏᕐᖁᓂᖓ. ᓱᓕ. ᖃᐅᔨᓴᖅᑕᐅᒃᑲᓐᓂᕆᐊᖃᖅᑐᖅ ᑐᑭᓯᓇᙱᑦᑐᑦ ᐊᒻᒪᓗ ᑮᓇᐅᔭᓕᐅᕈᑕᐅᔪᓐᓇᕐᒪᖔᑦ ᓄᓇᐅᑉ ᐆᓇᕐᓂᖓ ᖃᒪᓂᑦᑐᐊᕐᒥ. ᐅᓇ ᐃᓚᖃᖅᑐᖅ ᖃᑦᑕᖅ ᐊᑐᖅᑕᐅᔪᓐᓇᖅᑐᖅ, ᓄᓇᓕᖕᓂ ᑐᑭᓯᓇᓱᒃᑎᖃᕐᓗᑕ, ᐊᒻᒪᓗ ᓄᐃᑦᑎᓗᑕ ᐃᓂᖓᓂᑦ ᖃᐅᔨᓴᕈᑎᑖᒃᓴᓂᒃ ᐊᑐᖅᓯᓗᑕ ᖃᓄᐃᓕᐅᕈᑕ ᐅᓕᖅᑐᒃᓂ ᓲᕐᓗ ᖃᓇᓴᐅᒃᑯᑦ ᑕᑯᓐᓇᑦᑎᐊᕐᓗᒋᑦ, ᐳᓚᓕᖕᒧᑦ ᖃᐅᔨᓴᕐᓗᒍ, ᐃᑎᔪᒥᒃ ᓂᐅᖅᑐᕐᓗᒍ, ᐅᑯᐃᓪᓗ ᓄᓇᖓᑕ ᑕᐅᑦᑐᖓ ᐊᔾᔨᖑᐊᓕᐊᖑᓗᑎᒃ ᖃᓇᓴᐅᔭᒃᑯᑦ.

ᖃᑭᔾᔪᑎᒃᓴᑦ ᐱᐅᓯᕚᓪᓕᖅᑎᓪᓗᓂ ᓄᓇᖓᓂ ᐆᓇᕐᓂᖅᑲᕐᓂᖓ ᐊᒻᒪᓗ ᐃᑎᔪᒥᒃ ᓂᐅᖅᑐᕐᓗᒍ ᖃᐅᔨᓴᖅᑕᐅᓗᓂ ᑲᓇᑕᐅᑉ ᖁᓕᐋᓗᐊ ᐊᐅᒍᓐᓇᙱᑦᑐᒥ, ᑕᒪᓐᓇᓗ ᒥᑭᔪᒥᒃ ᑲᔪᓯᔪᓐᓇᖅᓯᒪᓕᖅᑎᑦ ᑲᔪᓯᔪᓐᓇᐅᖏᓐᒪᓕᖅᑎᑦ ᐱᓕᓇᐊᖅᑲᓐᑎᒃ, ᐃᑲᔪᕈᓐᓇᖅᑐᑦ ᐅᖓᓯᒃᑐᒦᑦᑐᓂᒃ ᓄᓇᓕᖕᓂᒃ ᐃᓱᒪᓕᐅᕆᓗᑎᒃ ᐃᒻᒥᖕᓄᑦ ᓄᓇᒥᑦ ᐆᓇᕐᓂᖓᓂᑦ ᐃᒃᑲᒃᓴᐅᑎᖃᕈᓐᓇᖅᓯᒪᓕᖅᑎᑦ ᑎᑭᐅᑎᑦᑎᐊᕈᓐᓇᐅᓂᐊᕐᒪᑦ ᐆᒻᒪᖅᑯᑎᖃᕐᑎᑦᑎᔪᓐᓇᖅᑐᖅ.

In this context, *deep geothermal* refers to systems accessing heat stored several kilometres below the surface, typically deeper than 3 km. This document provides a non-technical overview of that study to make its findings accessible to a broader audience.

Given the low-porosity, low-permeability crystalline rocks of the Canadian Shield, we focus on enhanced geothermal systems (EGS), which increase rock permeability through hydraulic stimulation to circulate water and extract heat. While still an emerging technology, enhanced geothermal systems could make it possible to tap into geothermal energy in regions like Nunavut, previously considered unfeasible.

This study finds that a 4-km-deep well pair to power a new district heating system could meet the space-heating needs of the community. If drilling reached 7-8 km, electricity generation sufficient to power the entire community may also be possible.

For Baker Lake, this could mean more than energy alone: a community-owned geothermal system could strengthen local governance over energy resources, create long-term jobs in operations and maintenance, and reinvest savings into priorities like housing or cultural infrastructure.

However, many uncertainties remain, especially regarding naturally occurring and engineered subsurface permeability in a deep, high-pressure in-situ regime. Further research is needed to assess the technical and economic feasibility of a geothermal system in Baker Lake. This includes reservoir modelling and collecting more site-specific data using techniques such as scanline fracture surveys, hydraulic testing, deeper drilling, or geophysical imaging. To ensure alignment with Inuit values and priorities, further research must integrate community-led approaches such as collaborative community consultation to incorporate local knowledge and priorities. Geothermal pilot projects should be community designed, led, and owned to ensure skills and benefits remain in the community.

Investing in enhanced geothermal and deep drilling research in the Canadian Shield, along with small-scale pilot projects, could help remote Northern communities determine for themselves whether geothermal energy is a viable means of achieving energy security.

Table of contents

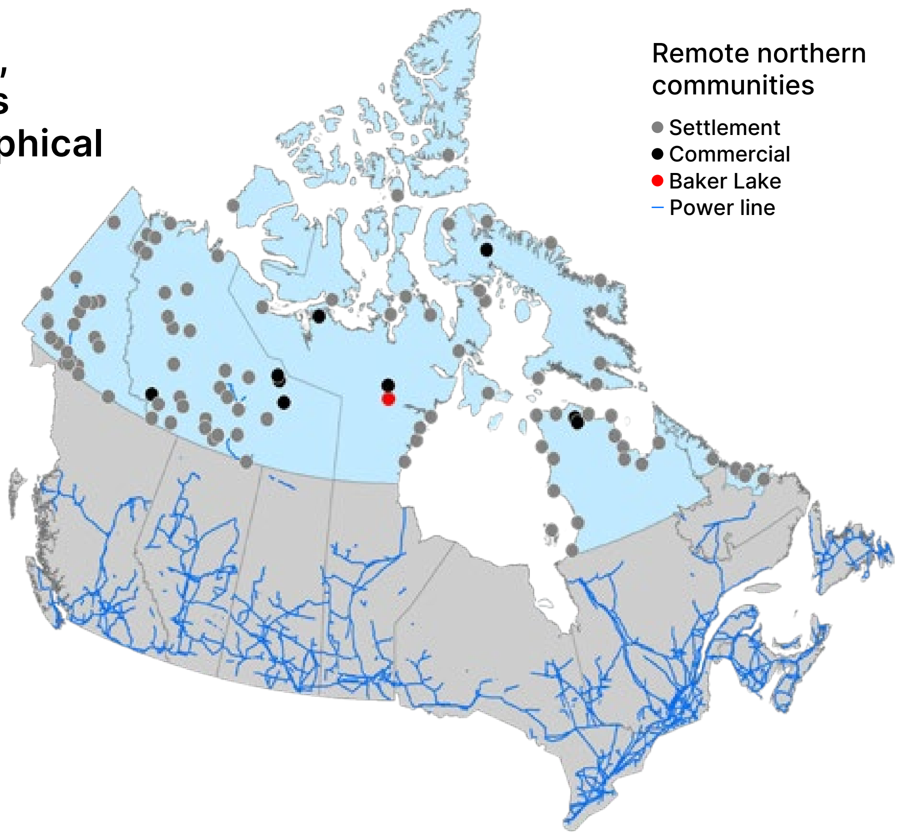
Introduction

Indigenous Peoples have long lived in close contact with the Earth's heat (Lund, 1995; Stokes, 2000). Hot springs such as those in Yellowstone, the African Rift, and the Andes were used for healing, gathering, and even peacemaking. Today, some Indigenous communities use geothermal energy for both heating and electricity generation, often through community-led initiatives that prioritize local benefits and self-determination (e.g., Tu Deh-Kah Geothermal in Canada or Aotearoa in New Zealand)However, geothermal energy isn't always accessible in an economically viable way, and exploring for subsurface heat anomalies can be challenging; there may be no surface manifestation, like steam or hot springs. Yet the heat is there, everywhere beneath our feet. The deeper you go, the hotter it gets.

On average, the subsurface warms by about 25-30 degrees Celsius per kilometre (°C/km), though this value varies depending on the local geology. This is known as the geothermal gradient. Even in cold regions over ancient and tectonically inactive bedrock, this buried energy could be harnessed if great enough depths were reached. That's exactly what we set out to explore in Baker Lake (also called Qamani'tuaq or ᖃᒪᓂᑦᑐᐊᖅ), an Inuit community in Nunavut, located on the ancient rock of the Canadian Shield (Figure 1), to find out if this buried heat could one day provide the community with local, clean, and secure energy.

FIGURE 1:

Far from any grid, Baker Lake marks Canada's geographical centre



Map of Canada, with Northern Canada shaded in blue and Southern Canada shaded in gray. Blue lines represent electrical transmission lines, gray dots denote off-grid communities, black dots represent mining and other commercial sites, and the red dot represents Baker Lake. Modified from Miranda et al. (2022).

Nunavut is a vast Inuit self-governed territory in Canada's North, home to approximately 39,000 people. Its 25 communities are not connected to the North American power grid, nor to any intercommunity transmission, pipeline, road, or rail infrastructure (Moorhouse et al., 2020). Each community must therefore manage its own energy supply independently, both for electricity and heat.

Electricity is provided by Qulliq Energy Corporation, the territory's public utility, which operates isolated diesel generator-powered microgrids with a total installed capacity of about 76 megawatts (MW) (Qulliq Energy Corporation, 2025). Unlike some regions in Canada, where renewable sources, particularly hydro, account for the majority of electricity generation, Nunavut remains entirely dependent on imported diesel (Nunavut Tunngavik Inc., 2020). This results in the highest electricity costs in the country (Figure 2), reaching up to $0.75 per kilowatt hour (kWh) for residential users and $1.13/kWh for government housing (Qulliq Energy Corporation, 2025), compared to about $0.12/kWh for a residential user in Toronto or Vancouver. These costs strain local budgets, diverting funds from local priorities such as education, cultural programs, and harvesting activities, while perpetuating energy dependence. Nunavut's rates are heavily subsidized, which obscures the true cost of this dependence on imported fuels (Pinto and Gates, 2022).

Heating in Nunavut relies on heating oil. Each building is equipped with its own oil tank and furnace, and fuel is delivered to communities once a year during the summer thaw, then distributed locally by the Petroleum Products Division of the Government of Nunavut. To reduce this heavy reliance on heating oil, Qulliq Energy Corporation has implemented *district heating systems* in several Nunavut communities. These systems use excess heat from the local power plants to provide heating for buildings and commercial facilities, reducing heating oil dependence by over 10%.

Existing fuel storage in Baker Lake. Geothermal energy offers a permanent alternative to imported diesel. Photo by Ysaline Bacon (CC BY 4.0).

The Petroleum Products Division is responsible for the bulk procurement of all fuels for the territory in a single annual purchase, allowing fuel prices to be fixed for the entire year. In 2022–2023, approximately 216.5 million litres of petroleum products were delivered to communities, an 11.7% increase over the previous year (Government of Nunavut, 2025a). Heating oil prices have also risen significantly from $1.0269 per litre in 2022 to $1.426 per litre in 2025, a 38% increase in just 3 years (Government of Nunavut, 2025b). The Nunavut Housing Corporation covers heating oil costs for its public housing tenants as part of their rent. In 2016–2017, it spent $12.26 million on heating fuel and replacing aging oil tanks (Touchette et al., 2017).

Despite subsidies and efficiency programs, the absence of alternative energy infrastructure keeps heating and electricity prohibitively expensive. Unlike other provinces that benefit from access to hydroelectricity, natural gas, heat pumps, and electric baseboard heating, Nunavut lacks viable alternatives. As a result, residents must rely on one of the most expensive heating systems in the country, with the levelized cost of heat estimated at $0.34/kWh (Miranda et al., 2024), two to six times higher than the cost of heat in the rest of the country. Moreover, this heavy reliance on imported fuels also exposes the territory to substantial logistical, financial, and environmental risks, including the potential for supply disruptions and oil spills in fragile Arctic ecosystems (Afenyo et al., 2022).

In Baker Lake, the community's diesel power plant is expected to reach the end of its operational life by 2032 (Byrne, 2018), adding urgency to the search for alternatives. The federal government has committed to eliminating diesel use in all off-grid communities by 2030 (Prime Minister of Canada, 2019), reinforcing the importance of identifying sustainable, locally adapted energy solutions. However, the transition to sustainable energy in Nunavut cannot be purely technical: it must be rooted in Inuit self-determination and community ownership and Inuit Societal Values (see Box 1).

Baker Lake's annual energy demand is significant, with approximately 77 GWh required for space heating and 14 GWh for electricity generation (Miranda et al., 2024). Meeting this demand is challenging in such a remote northern region, yet critical given the harsh winters.

Geothermal energy may be a viable alternative because it can deliver steady, low-emission heat year-round and doesn't rely on costly fuel imports. Previous research by our team at INRS has examined the potential of a closed-loop system using geothermal heat pumps with borehole heat exchangers for Baker Lake (Miranda et al., 2024). Another study had explored similar approaches in Resolute Bay by assessing solar-assisted, closed-loop geothermal storage (Yuan et al., 2024), which highlights how subsurface heat can help balance seasonal energy variability. As part of this present study, our team focused on the potential of a deep, enhanced, open-loop system to extract the heat stored in the hot, dry subsurface (Bacon et al., 2024).

Photo by Ysaline Bacon (CC BY 4.0).

BOX 1

Community ownership model and Inuit Societal Values

Community ownership of renewable energy infrastructure is an integral requirement for any grid-scale energy project in a Nunavut community.Projects are most successful when the infrastructure is owned by the community, revenues remain within the community, and development occurs under strong community leadership, with clear governance structures and local decision-making authority. Community ownership helps ensure that economic benefits such as cost savings, revenues, and employment opportunities are retained locally and reinvested in ways that support community priorities. In the context of Baker Lake, renewable energy assets should be understood not only as technical systems but as long-lived public infrastructure that can strengthen local government capacity, support local economic development, and enhance long-term community resilience. Framing energy projects around community ownership and leadership aligns with Inuit self-determination and economic reconciliation while reducing the risk of externally driven solutions that do not fully reflect local needs, values, or long-term interests.

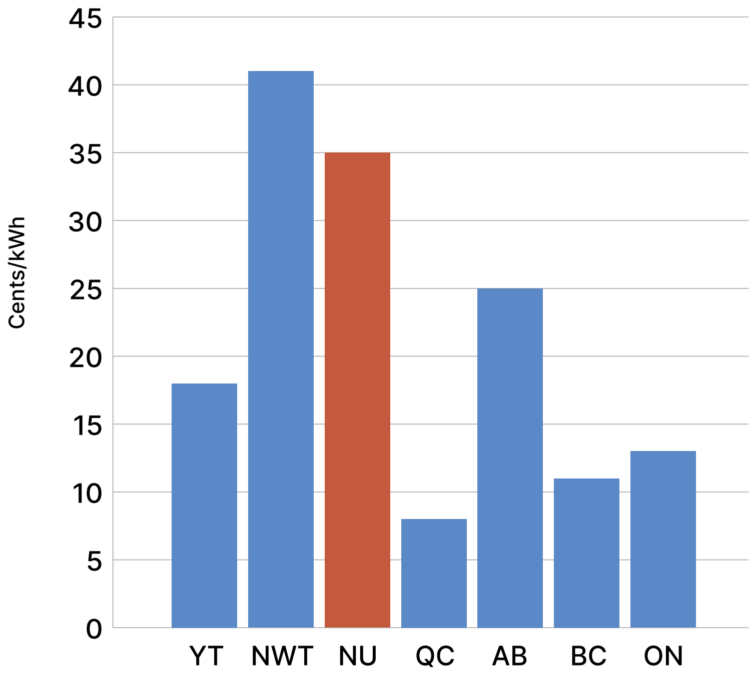
Alignment with the Government of Nunavut's Inuit Societal Values framework is also an important lens through which to view this work. Some examples of relevant Inuit Societal Values pertaining to this report include:

- ***Inuuqatigiitsiarniq**: Respecting relationships and caring for people*, which emphasizes the importance of developing energy solutions that prioritize community well-being and trust and that incorporate lived experience alongside technical analysis.
- ***Piliriqatigiinniq/Ikajuqtigiinniq:** Working together for a common purpose*, which speaks to the need for collaborative, Inuit-led approaches to energy planning, where communities, governments, and technical experts work as partners.
- ***Qanuqtuurniq:** Being innovative and resourceful*, which is reflected in the report's exploration of geothermal energy as a potential option in a challenging northern environment, while also highlighting the importance of adaptability and realistic assessment of constraints.
- ***Avatittinnik Kamatsiarniq:** Respect and care for the environment*, which is particularly relevant given the long-term and intergenerational implications of subsurface resource development; reinforcing the need for stewardship, caution, and long-term thinking.

Viewed through this framework, this research provides a useful technical foundation while also highlighting the importance of embedding future analysis and decision making within Inuit values, governance, and community-defined outcomes.

FIGURE 2:

While most Canadians pay moderate rates for power, Nunavut bears a much heavier burden



Comparison of electricity prices in Canadian dollars across provinces and territories. Modified from Mahbaz et al. (2020).

Baker Lake's annual energy demand is significant, with approximately 77 GWh required for space heating and 14 GWh for electricity generation (Miranda et al., 2024). Meeting this demand is technically challenging in such a remote northern region, yet critical given the harsh winters.

Geothermal energy may be a viable alternative because it can deliver steady, locally sourced, low-emissions heat year-round and doesn't rely on costly fuel imports. Previous research by our team at INRS has examined the potential of a closed-loop system using geothermal heat pumps with borehole heat exchangers for Baker Lake (Miranda et al., 2024). Another study had explored similar approaches in Resolute Bay by assessing solar-assisted, closed-loop geothermal storage (Yuan et al., 2024), which highlights how subsurface heat can help balance seasonal energy variability. As part of this present study, our team focused on the potential of a deep, enhanced, open-loop system to extract the heat stored in the hot, dry subsurface (Bacon et al., 2024).

Geothermal energy and enhanced geothermal systems

Geothermal energy, from the Greek *γῆ* (gē) meaning Earth, and *θερμός* (thermos) meaning heat, refers to the heat originating from the Earth's interior. This energy can be used as a reliable and non-polluting source of heat and electricity, and, if you drill deep enough, it can be harnessed almost anywhere on Earth.

This energy does not manifest uniformly around the globe. In a few volcanically or tectonically active regions, such as the well-known example of Iceland, the heat reaches right to the surface. Geysers, fumaroles, and hot springs are all visible signs of underground heat. However, geothermal energy is not limited to these unique environments. On a global scale, the Earth generates around 47 terawatts of thermal energy (Davies and Davies, 2010), which is more than double the average power consumed by humans globally (Ritchie & Roser, 2020), and only two of those terawatts come from active volcanic systems. Indeed, most of the untapped geothermal potential is found in regions without any surface manifestations. The heat is there but hidden deep underground.

Everywhere on Earth, temperature increases with depth. This thermal energy comes from two primary sources: residual heat from the planet's formation and the natural radioactive decay of elements such as potassium, thorium, and uranium. To enable geothermal energy use across diverse environments and for different purposes (Figure 3), developers have pursued a wide range of technologies. These can be categorized by the amount of heat, and therefore the amount of energy, they unlock: low-, medium-, and high-enthalpy systems (Lee, 2001):

- **Low-enthalpy systems** use geothermal resources with temperatures below 90°C, often around 20°C, and generally at depths of less than 300 metres (Dickson & Fanelli, 2018). They are mainly used for heating and cooling buildings, as well as for domestic hot water. These systems usually rely on ground-coupled heat pumps connected to vertical or horizontal ground loops, where a heat-transfer fluid circulates, absorbing or releasing heat depending on the season. During winter, the system draws heat from the ground to warm the building, while in summer, it redirects excess indoor heat back into the cooler subsurface. These systems are relatively easy and inexpensive to install, and they have a very low environmental impact, with negligible seismic risk. This makes them the most widely deployed geothermal systems in Canada.
- **Medium-enthalpy systems** use resources with temperatures between 90 and 120°C, usually found at depths below 2 km. They are used for more demanding applications, such as industrial heating, urban heating networks, and sometimes cogeneration systems that produce both heat and electricity (Dickson & Fanelli, 2018). These systems often use a geothermal doublet of two connected wells: one extracts the hot water, and another well reinjects the cooled water back underground.

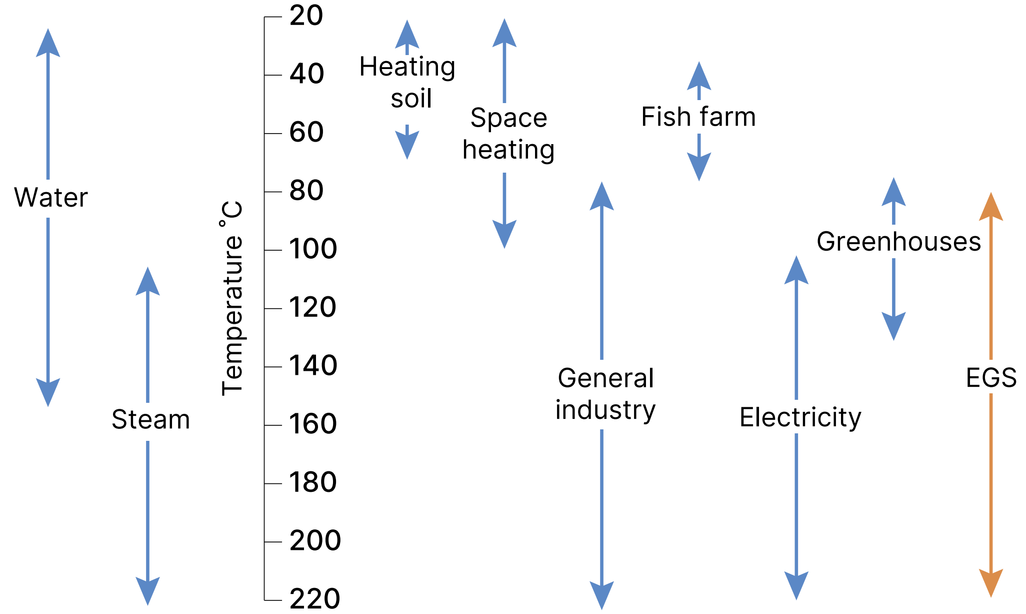
- **High-enthalpy systems** use geothermal resources at temperatures above 120°C, found several kilometres deep or in volcanically active regions. These systems are mainly used to generate electricity (Dickson & Fanelli, 2018). Surface facilities include power plants, typically of the flash steam, dry steam, or binary cycle type.

Geothermal energy is not just about heat: it also depends on fluids capable of transporting that heat to the surface. Traditionally, this limits geothermal developments to areas with usable hydrothermal reservoirs, but enhanced geothermal systems make it possible to access underground heat in areas that lack such reservoirs (Lu, 2018). Enhanced geothermal systems can be created in places where the rock is hot enough, but not permeable enough to let fluids flow through it. Enhanced geothermal technology creates or improves this permeability, often through hydraulic stimulation, also known as hydraulic fracturing. A fracture network is engineered; working fluid is then injected, circulates through the hot rock, heats up, and is brought back to the surface. This method makes it possible to use geothermal energy in more locations.

Enhanced geothermal systems, once considered an emerging technology, are now entering a phase of commercial interest. In recent years, several demonstration and pilot projects have come online, demonstrating both technical feasibility and growing investor interest (International Energy Agency, 2022; Energies Media, 2025). With continued innovation in deep drilling and subsurface engineering to bring down costs, enhanced geothermal systems could significantly expand the number of locations capable of producing geothermal heat and electricity, especially in off-grid and remote regions (Lipton, 2024; Miranda et al., 2021).

FIGURE 3:

How varying subsurface temperatures determine geothermal system possibilities



Different applicability of geothermal resources based on temperature and geothermal fluid state, adapted from Byrne (2018).

Regional context and previous research

Geothermal energy is increasingly seen as a viable option to support the energy transition in remote Northern regions, where communities still rely heavily on diesel and heating oil. However, geothermal resources vary greatly across Canada's geological regions (Figure 4). In western British Columbia, there are areas with active volcanic or tectonic activity, resulting in potential for conventional geothermal systems, or systems engineered to harvest heat from hot dry rock. By contrast, in northeastern British Columbia, Alberta, Saskatchewan, and southern Manitoba, the Western Canadian Sedimentary Basin has several warm aquifers, with naturally occurring warm saline water in porous rocks that can be produced for direct-use applications. In the southern portions of the Northwest Territories, there are hot sedimentary aquifers with warmer water located closer to the surface than in other parts of the Western Canadian Sedimentary Basin.

By contrast, the Canadian Shield is an ancient and vast geological region that covers more than half of Canada's landmass, including eastern parts of the Northwest Territories, Nunavik, and most of Nunavut. It is composed of old, dense crystalline bedrock that formed through billions of years of tectonic, metamorphic, and magmatic processes. Because this rock is low in porosity and permeability, the Canadian Shield has no potential for conventional hydrothermal geothermal systems, which depend on naturally circulating fluids (Grasby et al., 2012).

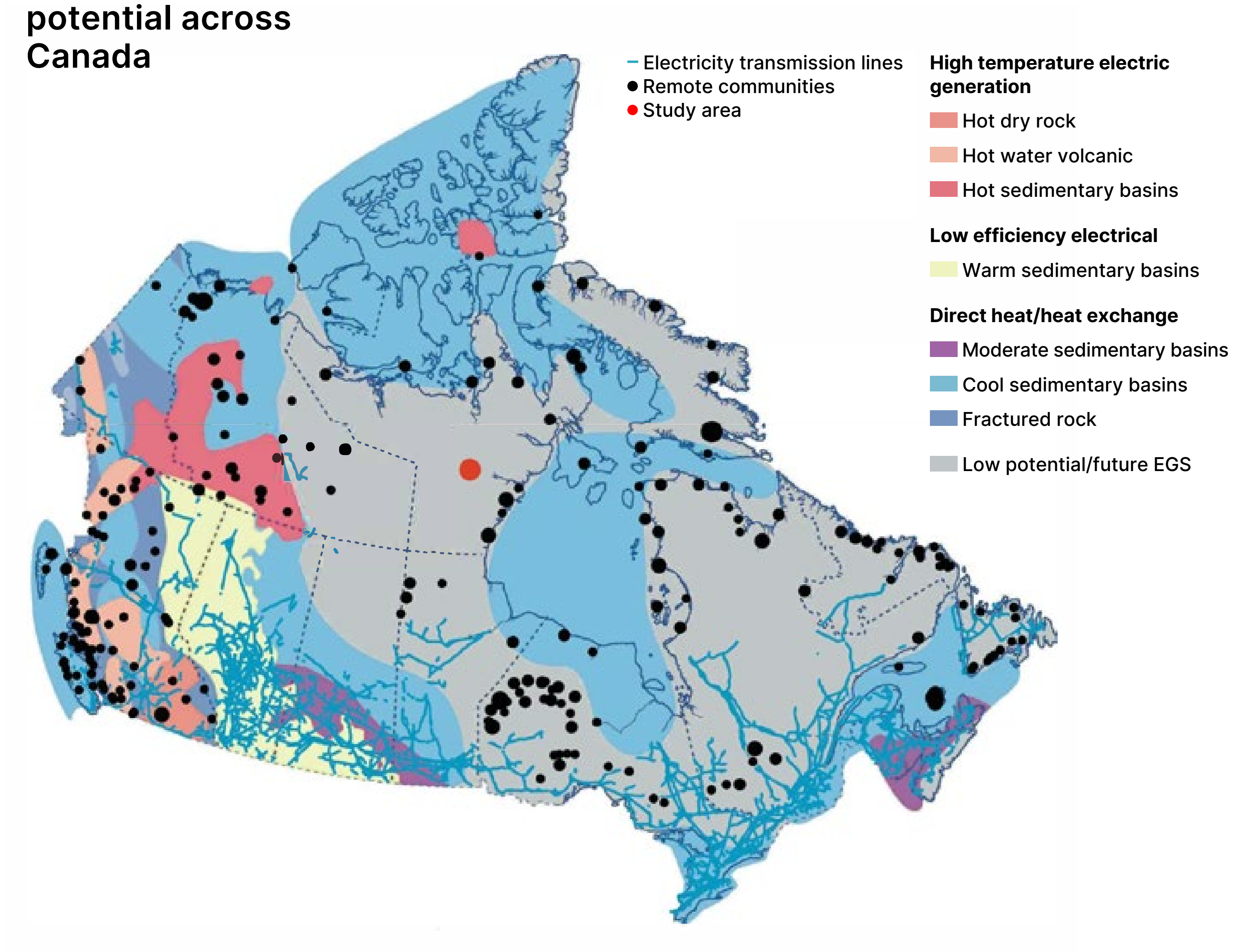
In 2018, Matthew Minnick and several colleagues from RESPEC, a consulting firm specializing in geothermal and subsurface studies, worked specifically on Nunavut geothermal feasibility, where thermal data had been extremely scarce (Minnick et al., 2018). By compiling and mapping heat flow measurements, Minnick and team found some variability in the heat flow distribution in Nunavut and highlighted Baker Lake as an important site for further investigation. Following these insights, RESPEC and Qulliq Energy Corporation, the utility responsible for energy in Nunavut communities, drilled a 500-metre exploratory borehole in Baker Lake in 2022. This was the first direct access to thermal and geological data from the Canadian Shield in Nunavut, sparking several new geothermal research initiatives.

The borehole data were analyzed at the Laboratoire Ouvert de Géothermie at INRS (Miranda et al., 2023), together with RESPEC and CanmetENERGY. These analyses allowed for the characterization of the thermophysical properties of the rock samples, which are essential to assess the potential for geothermal energy extraction.

Based on these results, RESPEC studied Borehole Thermal Energy Storage systems, which allow heat to be stored underground during summer and recovered in winter. At INRS, Miranda et al. (2024) used this new data to evaluate the feasibility of borehole heat exchangers coupled with heat pumps at depths of 100, 300, and 1,500 metres. The results showed that shallow systems were not viable due to the thick permafrost layer, and that deep systems could offer strong thermal output adapted to a district heating system, but remained costly compared to current heat supply methods. However, a 300-metre system combined with a conventional water-to-water heat pump emerged as a promising option, delivering approximately 28 MWh of heat energy per year at a levelized cost of $0.11-0.29/kWh. This setup could meet over 20% of the heating demand of a residential building, or up to 70% of the Baker Lake municipal pool demand.

FIGURE 4:

Regional assessment of geothermal potential across Canada



The geothermal potential of Canada was estimated by Grasby et al. (2012) with the location of remote communities taken from Arriaga et al. (2014) and modified by Miranda (2021). The red dot represents the municipality of Baker Lake.

This report aims to support the development of clean, secure, and affordable energy solutions suited to the northern Canadian Shield.

Miranda et al. (2021) carried out a probabilistic feasibility study of enhanced geothermal system in Kuujjuaq, a Nunavik community located on the Canadian Shield, which highlighted the potential cost-competitiveness of deep enhanced geothermal systems despite important uncertainties related to subsurface temperatures and hydraulic properties. These uncertainties were largely due to the absence of deep exploration wells in the Canadian Shield.

In this context, the 500-metre borehole drilled in Baker Lake in 2022 represents a valuable opportunity for Northern communities to determine the viability of deep geothermal as a source of energy independence. By analyzing local thermal gradients and rock properties, our INRS research team aimed to estimate the deep to ultra-deep geothermal resource (more than 3 km to more than 7 km; Bacon et al., 2024). This report aims to provide a clear assessment of the community's geothermal resource potential to support the development of clean, secure, and affordable energy solutions suited to the northern Canadian Shield.

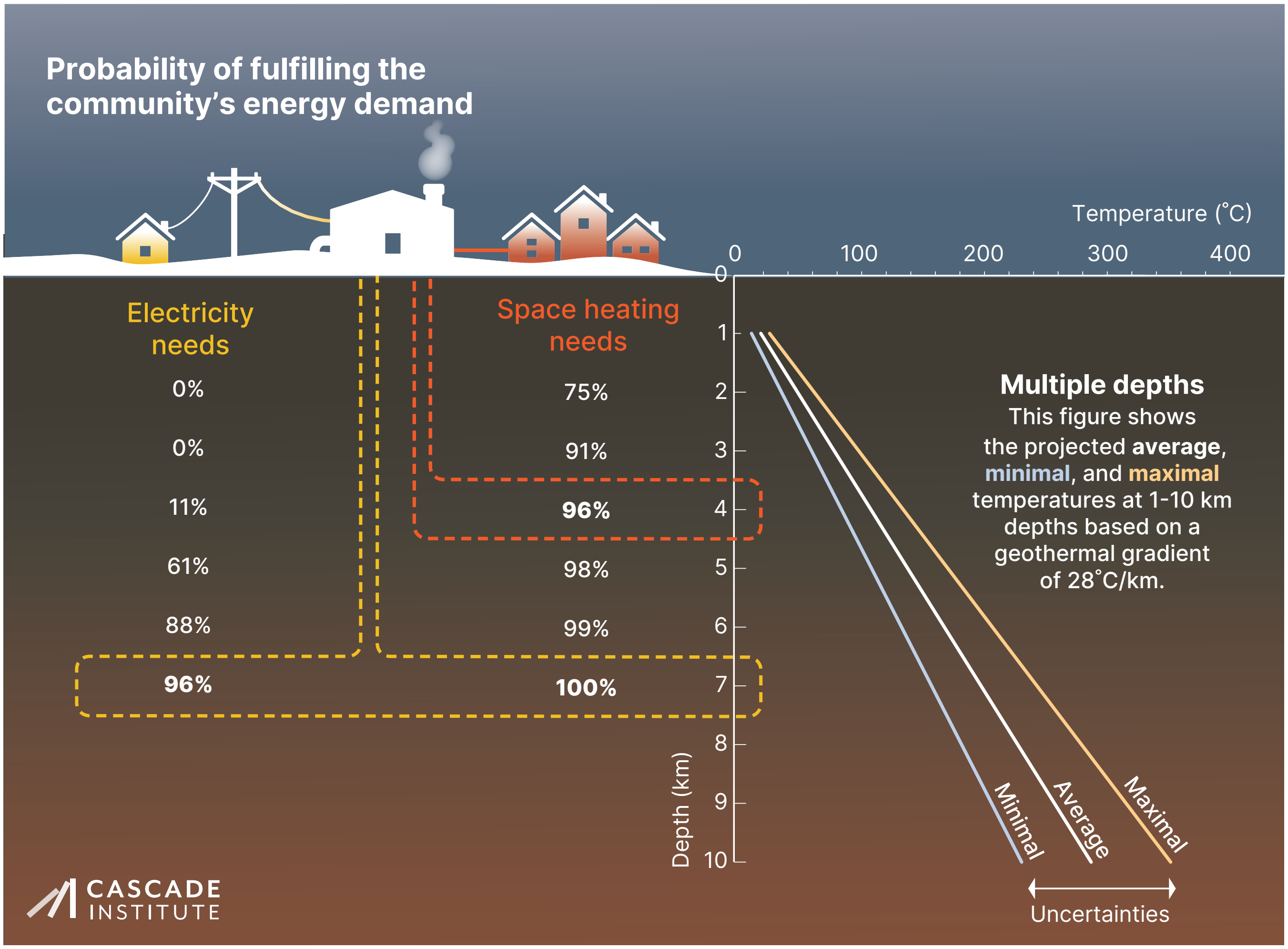
Typical summer landscape of the Canadian Shield in Baker Lake: tundra, flat terrain, and lakes. Photo by Ysaline Bacon (CC BY 4.0).

Study and results

To assess the deep geothermal potential in the Baker Lake region, our research team analyzed the subsurface geology and temperature using data from the 2022 Baker Lake borehole (Bacon et al., 2024). This included a downhole temperature profile and laboratory analyses of 26 rock samples to determine their thermal conductivity and radiogenic heat production. Using these data, we applied a simple one-dimensional heat flow model (Birch, 1948) that accounts for steady heat flow and past variations in surface temperature. This approach yielded a geothermal gradient of approximately 28°C/km, with an estimated uncertainty of ±2°C/km based on the variability of rock properties and the temperature profile. This value is notably high for the region, where gradients typically do not exceed 20°C/km. This gradient suggests that temperatures between 100°C and 150°C could be reached at depths of 4 to 7 km. Such temperatures are high enough to support applications like district space heating or even electricity generation using a binary geothermal power plant.

FIGURE 5:

Assessing the potential of geothermal heating or electricity generation at multiple depths



Our analysis combines the temperature-depth profile with a probabilistic evaluation of the subsurface parameters to estimate the amount of geothermal heat that can be recovered at different depths. We varied the key inputs presented in Table 1 within realistic uncertainty ranges. We used the commercial software @Risk to run a Monte Carlo simulation. This allowed us to quantify the likelihood of meeting Baker Lake's annual energy demand under a wide range of subsurface conditions. The system concept considered is a conventional deep geothermal doublet with a vertical production well and a vertical injection well, representative of typical open-loop power plants in crystalline rock. This probabilistic approach is particularly relevant in Northern regions, where subsurface data are limited and technical and economic risks of deep geothermal development are high.

TABLE 1 :

Input parameters for the resource estimate

Variable	Value	Unit	Distribution
Surface temperature	-6		
Thermal conductivity	2.1, 2.4, 2.7	W/m·K	Triangular
Surface heat flow	68, 73, 78	mW/m^2	Triangular
Depth		m	Single value
Radiogenic heat production	6.4×10^{-7}, 1.5×10^{-6}, 3.7×10^{-6}	W/m^3	Triangular
Reservoir volume	1×10^9 to 4×10^9	m^3	Uniform
Heat capacity	1.38×10^6, 1.75×10^6, 2.03×10^6	$J/m^3\cdot K$	Triangular
Reservoir temperature	See Bacon et al., 2024	°C	Triangular
Reservoir abandonment temperature	30, 50	°C	Uniform
Recovery factor	0.02, 0.20	-	Uniform
Geothermal power plant conversion factor	0.90, 0.97	-	Uniform
Thermal efficiency	Function of T_{res}		
Project lifetime	20, 30, 50	years	Triangular

Communicating the probability of the heat resource (which should not be confused with estimates related to P10, P50, P90 resource classification from SPE, PRMS, or SRMS conventions) is essential for risk assessment because it provides a clear picture of uncertainty in subsurface conditions. By expressing resource estimates in probabilistic terms (triangular or uniform distribution) rather than as single-point values, developers and decision makers can better understand the range of possible outcomes and the likelihood of meeting energy targets. This approach helps communities evaluate whether a project aligns with their energy security goals, enables governments to prioritize investments in technologies with the highest chances of success, and gives investors a transparent framework for weighing financial risk against potential returns. In short, probabilistic resource communication transforms geothermal assessments into actionable tools for informed decision-making across technical, social, and economic dimensions.

For heating-only scenarios, geothermal energy becomes sufficient starting at 4 km. At this depth, 90% of all simulated scenarios deliver more than 77 GWh, meaning that only 10% of the possible parameter combinations fail to meet the heating needs. This probability rises to 96% at 5 km, and all simulations meet the demand at 6 km. These values describe the likelihood of meeting the heating demand at a given depth. Such a heating system would require the construction of a district heating network, the cost and logistics of which were not addressed in this study.

For electricity-only scenarios, temperatures around 120 °C are generally required to operate a binary power cycle efficiently. This threshold may be reached at 5 km, but is more reliably achieved beyond 7 km. Therefore, at depths shallower than 7 km, it is unlikely that geothermal energy could meet the community's entire annual electricity demand (about 14 gigawatt hours). However, the probability of meeting this entire demand exceeds 90% between 7-8 km. This suggests that electricity generation from geothermal energy is possible but would require ultra-deep and costly drilling, posing both technical and economic challenges, especially in a remote community lacking equipment and expertise.

We also evaluated a combined heat-and-power scenario, which uses part of the extracted heat for electricity via a binary cycle and allocates the remaining thermal energy for district heating. Using the same Monte Carlo framework, we combined the temperature-depth results with a volumetric heat-in-place calculation and typical conversion efficiencies for binary systems. Standard flow rates and recovery factors were applied to estimate first-order electricity production and residual heating potential through a new district heating network. Under these assumptions, a system at 6 km could provide up to 80% of the annual electricity demand while still covering 50-60% of the heating needs via district heating, demonstrating that cogeneration can optimize the use of available geothermal energy.

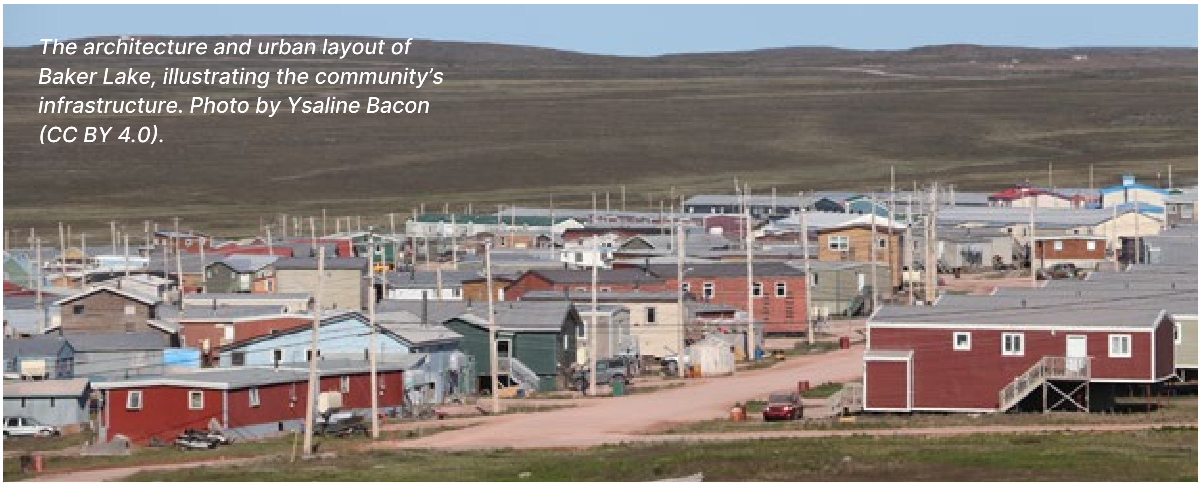
These estimates remain uncertain, of course, as they depend on factors such as sustainable heat extraction rates and subsurface permeability. An intermediate study, currently underway at INRS, combines scanline fracture analysis and numerical reservoir modelling to reduce these uncertainties. If the results prove promising, community energy proponents could pursue further investigations such as deep exploratory drilling and hydraulic testing to confirm the resource and guide future development decisions.

Discussion and recommendations

We find that deep geothermal energy is a realistic and technically achievable option for Baker Lake, especially to meet the community's heating needs. Based on the 500 m deep gradient well, ground in the region appears to warm by an average of 28°C/km of depth, which is promising. This geothermal gradient is suitable for deep geothermal systems (around 4 km), which can provide sufficient temperatures (110–140°C) for space heating through district heating networks. Future improvements and cost reductions in ultradeep drilling could also enable access to higher temperatures at 7 km or more, opening the door to high-enthalpy systems capable of generating electricity.

Deep geothermal energy is a realistic and technically achievable option for Baker Lake, especially to meet the community's heating needs.

For isolated Northern communities like Baker Lake, which currently rely entirely on oil for heating and diesel for electricity, deep geothermal energy represents a local, sustainable, and strategic alternative. The community's dependence on imported fuel leads to high energy costs, greenhouse gas emissions, and vulnerability to supply disruptions. A geothermal system could provide a stable, local, and year-round source of heat and potentially electricity. This option is especially relevant for heating, which accounts for the largest share of energy use in cold climates. And polar regions are not optimal for solar and wind installations due to extreme seasonal variability. To make effective use of geothermal heat, a district heating system would need to be installed to replace the individual oil-fired furnaces currently in each building. An enhanced geothermal system connected to such a network could significantly reduce emissions and operating costs, providing a reliable and sustainable source of energy for the community.



The architecture and urban layout of Baker Lake, illustrating the community's infrastructure. Photo by Ysaline Bacon (CC BY 4.0).

Developing this geothermal resource would enhance Baker Lake's energy independence, improve its resilience, and support national climate objectives aligned with Canada's emission reduction targets and Indigenous-led energy development strategies. The project would create local employment and training opportunities in drilling, geosciences, engineering, and system maintenance, with priority given to long-term operations roles and Inuit workforce development to build lasting technical capacity. From an Inuit governance perspective, such a system should be structured as a community-owned asset to ensure long-term benefits accrue primarily to Baker Lake residents. The experience gained in Baker Lake could eventually serve as a replicable model for other Arctic and sub-Arctic communities located where the Canadian Shield is exposed at the surface.

Developing this geothermal resource would enhance Baker Lake's energy independence, improve its resilience, and support national climate objectives.

Although this study provides a promising first look at geothermal potential in Baker Lake, more work is needed to reduce both geological and economic uncertainties. The next steps toward assessing the geothermal potential of Baker Lake should begin with a strong foundation of community engagement. Any further research or project development must be co-developed in close dialogue with the Baker Lake community, Inuit organizations such as the Kivalliq Inuit Association, and regional authorities, including the Government of Nunavut and Qulliq Energy Corporation. To be a viable option for remote Indigenous communities, geothermal energy must be approached not merely as a technical fix to energy insecurity but as a sustainable development initiative grounded in Indigenous knowledge, local priorities, and territorial governance.

This study demonstrates that probabilistic resource assessment is not only a technical exercise but a strategic decision-making tool. By quantifying uncertainty and expressing resource potential in terms of likelihood rather than fixed values, communities, governments, and investors gain a clearer understanding of risk and opportunity. This approach enables informed choices about whether to proceed with exploratory drilling, invest in district heating infrastructure, or allocate funding for ultra-deep projects. In regions like Nunavut, where data scarcity amplifies uncertainty, probabilistic methods provide transparency and confidence, helping stakeholders prioritize projects that offer the highest probability of success.

Local Indigenous rights holders, stakeholders, researchers, and project developers could begin assessing the feasibility of a phased district heating approach, starting with anchor tenants such as schools, health centres, or municipal buildings. Given the high capital costs of Arctic infrastructure, this strategy would allow for gradual expansion while demonstrating immediate benefits, such as supporting food security initiatives (e.g., geothermal-heated greenhouses) or high-performance building retrofits. Evaluating surface requirements and energy profiles would help determine how to best integrate surface infrastructure to meet immediate heating demands while paving the way for the future development and successful integration of a deep geothermal project. Understanding local energy use patterns and the viability of district heating at the residential level are key to ensuring the overall project's technical, economic, and social success.

On the resource side, researchers should focus on reducing the uncertainties and mitigating the risks associated with developing a deep geothermal system in the region. Surface-based methods like scanline mapping and outcrop analysis can support preliminary assessments. And hydrogeological and geomechanical studies based on data from deeper boreholes can better characterize the hydraulic properties and fracture behaviour of the subsurface to optimize reservoir creation design. Ultimately, project proponents will need to integrate thermo-hydro-mechanical numerical modelling of heat extraction processes to determine the long-term viability of an enhanced geothermal project at Baker Lake. However, to truly derisk the project, a well must be drilled to the target depth for heat or power, completed, and tested. Data from this well would then validate the project's technical and commercial viability and inform the design of the heating, power, or hybrid system.

In parallel, researchers should conduct a detailed techno-economic feasibility study to weigh geothermal energy against the fossil-fuel system. The study would examine drilling and installation costs, district heating system development costs, long-term operating scenarios, and the full life cycle of greenhouse gas emissions. Future work could extend this analysis with numerical simulations of fluid flow and heat extraction, once stronger data on permeability, porosity, and reservoir connectivity are available.

Power pole stands as the sole verticality of the Arctic landscape, reflecting the essential role of electricity in the community's daily life. Photo by Ysaline Bacon (CC BY 4.0).

References

Afenyo, M., Ng, A. K., & Jiang, C. (2022). A multiperiod model for assessing the socioeconomic impacts of oil spills during Arctic shipping. *Risk Analysis,* 42(3), 614-633. https://doi.org/10.1111/risa.13773

Arriaga, M., Cañizares, C. A., & Kazerani, M. (2014). Northern lights: Access to electricity in Canada's northern and remote communities. *IEEE Power and Energy Magazine,* 12(4), 50–59. https://doi.org/10.1109/MPE.2014.2317963

Bacon, Y., Miranda, M., Raymond, J., Newson, J., Wigston, A., & Minnick, M. (2024). The deep geothermal energy potential of Baker Lake (Nunavut, Canada): Initial resource assessment from Monte Carlo analysis. *Transactions—Geothermal Resources Council,* 48, 2443–2465.

Birch, A. F. (1948). The effects of Pleistocene climatic variations upon geothermal gradients. American Journal of Science, 246(12), 729-760. https://doi.org/10.2475/ajs.246.12.729

Byrne, D. L. (2018). *Exploring renewable energy opportunities for Nunavut* (Master's thesis, University of Calgary). https://doi.org/10.11575/PRISM/33094

Dickson, M. H., & Fanelli, M. (2018). What is geothermal energy? In *Renewable Energy* (pp. 302–328). Routledge.

Davies, J. H., & Davies, D. R. (2010). Earth's surface heat flux. *Solid Earth,* 1(1), 5–24. https://doi.org/10.5194/se-1-5-2010

Energies Media. (2025). Why enhanced geothermal energy could be your next smart investment – 2025 guide. Retrieved in July 2025 from https://energiesmedia.com/why-enhanced-geothermal-energy-could-be-your-next-smart-investment-2025-guide/

Government of Nunavut. (2025a). Petroleum Products Division 2022–2023 annual report. Legislative Assembly of Nunavut. Retrieved in July 2025 from https://assembly.nu.ca/sites/default/files/2025-05/TD-397-6%282%29-EN-PPD%202022-2023%20Annual%20Report.pdf

Government of Nunavut. (2025b). PPD price change display table – March 2025. *Nunavut News*. Retrieved in July 2025 from http://www.news.gov.nu.ca/2025/march/2025-03%20PPD%20price%20change%20display%20table%20-%20ENG.pdf

International Energy Agency. (2022). *Geothermal in clean energy transitions*. Retrieved in July 2025 from https://www.iea.org/reports/geothermal-in-clean-energy-transitions

Lee, K. C. (2001). Classification of geothermal resources by exergy. *Geothermics,* 30(4), 431–442. https://doi.org/10.1016/S0375-6505(00)00056-0

Lipton, J. T. (2024). *From Fenton Hill to Fervo: Is EGS approaching commercial viability?* (Master's thesis). Réykjavík University.

Lu, S. M. (2018). A global review of enhanced geothermal systems (EGS). *Renewable and Sustainable Energy Reviews,* 81, 2902–2921. https://doi.org/10.1016/j.rser.2017.06.097

Lund, J. W. (1995). Historical impacts of geothermal resources on the people of North America. *Geo-Heat Center Quarterly Bulletin*, *16*(4).

Minnick, M., Schewfelt, D., Hickson, C., Majorowicz, J., & Rowe, T. (2018). Nunavut geothermal feasibility study. Topical Report RSI-2828. RESPEC Consulting Inc.

Miranda, M. M., Bacon, Y., & Raymond, J. (2023). *Deep geothermal energy potential of Baker Lake (Nunavut, Canada): Thermal properties characterization and surface heat flow estimation*. Research Report R2217, INRS, Centre Eau Terre Environnement, Québec, 64 p.

Miranda, M. M., Comeau, F.-A., Raymond, J., Gosselin, L., Grasby, S. E., Wigston, A., Dehghani-Sanij, A., Sternbergh, S., & Perreault, S. (2022). Geothermal resources for energy transition: A review of research undertaken for remote northern Canadian communities. *European Geologist,* 54. https://doi.org/10.5281/zenodo.7882811

Miranda, M., Raymond, J., Willis-Richards, J., & Desayes, C. (2021). Are engineered geothermal energy systems a viable solution for Arctic off-grid communities? A techno-economic study. *Water,* 13(24), 3526. https://doi.org/10.3390/w13243526

Miranda, M. M., Gascuel, V., Bacon, Y., & Raymond, J. (2024). Evaluation of borehole heat exchange systems at various depths as a source of clean heat for diesel-reliant communities in Northern Canada [Research report R2233]. Québec, Canada.

Moorhouse, J., Lovekin, D., Morales, V., & Salek, B. (2020). *Diesel reduction progress in remote communities: Modelling approach and methodology*. Pembina Institute. Retrieved in July 2025 from https://www.pembina.org/reports/diesel-reduction-technical-report-final.pdf

Pinto, H., & Gates, I. D. (2022). Why is it so difficult to replace diesel in Nunavut, Canada? *Renewable and Sustainable Energy Reviews,* 157, 112030. https://doi.org/10.1016/j.rser.2021.112030

Qulliq Energy Corporation. (2025). 2025/26 general rate application. Retrieved in July 2025 from https://www.qec.nu.ca/sites/default/files/2025-26%20QEC%20GRA%20-%20Master-Final.pdf

Ritchie, H., & Roser, M. (2020). Global direct primary energy consumption. Our World in Data. Retrieved in July 2025 from https://ourworldindata.org/energy

Stokes, E. (2000). The legacy of Ngatoroirangi: Maori customary use of geothermal resources. Hamilton, New Zealand: Department of Geography, University of Waikato. https://hdl.handle.net/10289/6323

Touchette, Y., Gass, P., & Echeverría, D. (2017). Tracking diesel fuel subsidies in Nunavut. WWF Canada. Retrieved in July 2025 from https://wwf.ca/wp-content/uploads/2020/03/Tracking-DieselFuel-Subsidies_April-2017.pdf

Yuan, W., Grasby, S. E., Chen, Z., & Zhao, G. Preliminary Study on Utilizing Closed-Loop Geothermal Systems for Seasonal Storage of Surplus Solar and Wind Energy. https://pangea.stanford.edu/ERE/db/GeoConf/papers/SGW/2025/Yuan.pdf