Imaging, Characterizing and Modeling Canada's Geothermal Resources

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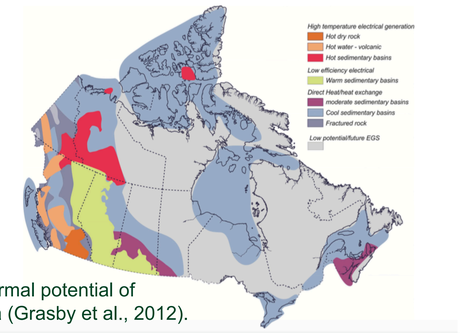
BACKGROUND

- Geothermal energy is a sustainable natural resource that promises low greenhouse gas emissions, a small spatial footprint, and high capacity base-load power.
- High upfront cost and poor constraints on reservoir characteristics have hindered development of geothermal energy in Canada, despite high potential in the west.
- A viable geothermal resource requires:
  -heat source (magma body, thin continental crust, etc.).
  -permeable reservoir at depth.
  -fluids (water or steam) to transport heat to the surface.



Geothermal potential of Canada (Grasby et al., 2012).

SHORT-TERM OBJECTIVES

Rocky Mountain Trench and Tintina Fault

- Collate pre-existing information including: bedrock mapping, structural geology, and geophysical surveys.
- Pick strategic study locations within the Rocky Mountain Trench and/or Tintina Fault exhibiting significant geothermal potential.
- Possible sites include: Invermere and Valemount in BC, Ross River and Watson Lake in the Yukon.

Western Canada Sedimentary Basin

- Revise geological and temperature models for selected geothermal reservoirs.
- Strategies for heat extraction will be modelled using reservoir modelling software
- Select preferred locations for demonstration projects within the Western Canada sedimentary basin

Societal aspects of geothermal energy production

- Investigate public perceptions of geothermal energy production, as compared to other energy sources.
- Develop strategies to mitigate impact of geothermal energy production on local communities.

PROJECT OVERVIEW

This project aims to improve our understanding of Canada's geothermal resources using techniques in sedimentary and structural geology, electromagnetic geophysics, and reservoir modelling. Research will target two locations in Western Canada:

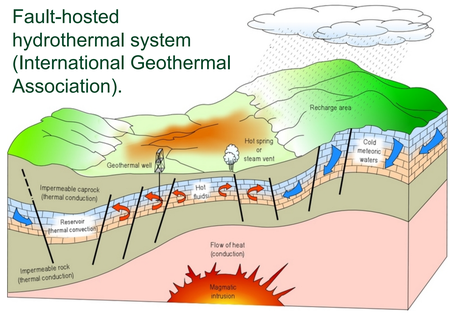
Rocky Mountain Trench and Tintina Fault

Major fault-controlled valley stretching from US to the Yukon.

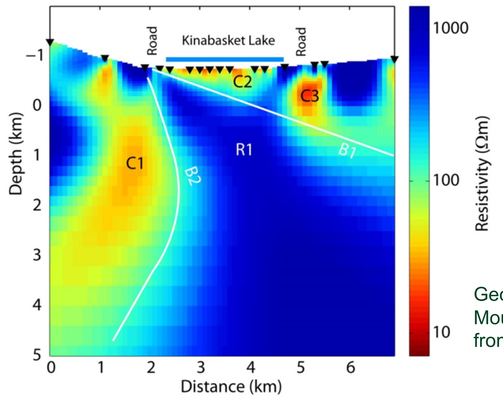
- Numerous thermal springs occur along its length, indicating hydrothermal systems at depth.
- Fluid circulation is likely controlled by fault architecture.
- Structural geological mapping and electromagnetic geophysics will improve constraints on this geothermal resource.

Western Canada Sedimentary Basin

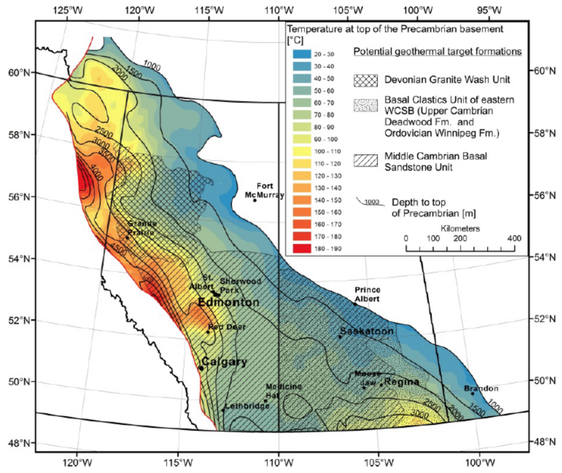
- Warm, 3-5 km thick sequence of porous sediments.
- Host to large volume of warm/hot water.
- Abundance of existing infrastructure and data due to oil and gas development past and present.
- Reservoir modelling is key to understanding this geothermal resource.



Fault-hosted hydrothermal system (International Geothermal Association).



Geophysical image of the Rocky Mountain Trench at Valemount from a magnetotelluric survey



Temperature at bottom of the Western Canada Sedimentary Basin (Weides and Majorowicz, 2014).

THEME OVERVIEW

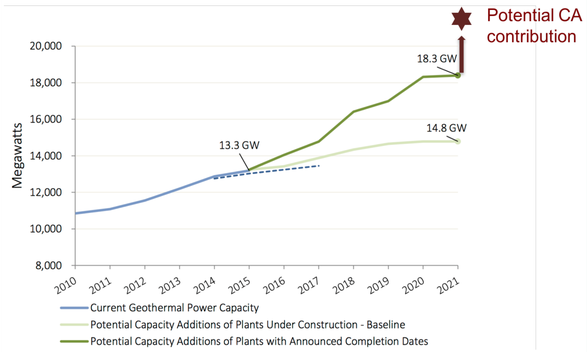
Geothermal

Canada's geoscape possesses more potential geothermal energy than hydrocarbon energy, but numerous challenges must be overcome if this renewable resource is to be effectively harnessed. Reservoirs of geothermal energy must be located, characterized, and modeled. The nature of the interaction between rock at reservoir sites and geothermal fluids must be understood, and the potential costs of exploiting them in real-world scenarios must be understood. At the same, new engine technologies must be developed to enable generation of power from geothermal heat sources with non-ideal temperatures.

EXPECTED OUTCOMES

- Provide scientific results that will reduce risk of capital investment in geothermal energy in Western Canada.
- Improve knowledge of the spatial distribution of geothermal resources in Western Canada.
- Enable the development of Canada's first geothermal power plants.
- Contribute to Canada's renewable energy portfolio.
- Extend life of oil and gas infrastructure, and utilize existing technical expertise.
- Develop strategies to minimize the impact of geothermal energy development on local communities.

Geothermal test well at Mount Meager, British Columbia (Western GeoPower).



Forecasted global geothermal energy growth and Canada's potential contribution (Geothermal Energy Association).

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