

## Geothermal 101 course

### Conventional Geothermal Energy Development Meets Oil and Gas

**SEP**  
**07**  
**2021**



**TECHNICAL  
WEBINAR  
SERIES**



**GEOTHERMAL 101 COURSE**

**CONVENTIONAL GEOTHERMAL ENERGY  
DEVELOPMENT MEETS OIL AND GAS**

PRESENTED BY  
**CATHERINE HICKSON PH.D. P.GEO. ALBERTA NO. 1**

CSUR recently released a “Strategy Evolution” document, which discussed the Society’s expanded mandate to include alternate & emerging energy sources. Accordingly, a webinar course was designed, in collaboration with Geothermal Canada, for not only those already in this industry but also for those professionals & organizations looking to expand their own capabilities and operations into the realm of the growing Geothermal Industry. Dr. Catherine Hickson, a geologist & senior executive who has already been in this industry for over four decades, delivered this 2-hour course on the fundamentals of geothermal energy, the intricate details of planning & managing such projects and how oil & gas professionals may be able to leverage their existing skills for this emerging industry. A key part of the course was also to demonstrate the potential of using geothermal projects to garner carbon credits via sequestration. Those credits provide a powerful economic stimulus.

As indicated by Dr. Hickson, geothermal is an enormous resource within the Western Canadian Sedimentary Basin (WCSB). The challenge, however, appears to be a 3-pronged dilemma: lack of financial or capital support for this new industry, lack of regulatory framework or political will, and some technical challenges. The opportunity of developing this “greenest of green renewable energy” in a holistic eco-industrial manner could have tremendous upside. Specifically, properly

designed & developed projects could deliver baseload & consistent energy (24/7/365) without battery storage, with added value of being able to extract hydrocarbons and / or minerals (i.e., Lithium & other rare earth elements) from the well’s effluent if the mineral rights allow.

Catherine then went through some “geothermal fundamentals” and the history of geothermal development in Canada. Although Geothermal Canada and the industry have been in existence since the 1970’s, there are currently only a handful of active commercial projects in Western Canada targeting the power generation (electricity) market. For successful power generation projects, the instructor provided three key elements that are crucial: heat (depth), pore space (capacity & flow rate), and fractures (flow pathways). Shallow geothermal projects are also common, but are mostly utilized as thermal energy projects (heat exchange).

As for the ongoing commercial development landscape of the geothermal industry, the speaker doesn't believe that some of the technical challenges would be much of a drawback, especially given the strength of the energy industry in Western Canada. On the other hand, securing financial backing for projects and obtaining favorable regulatory & government incentives could be more problematic. However, with the previously mentioned potential total value chain of geothermal projects, it is anticipated that many more projects will become viable technically, economically, and socially in due course.

---

## **SUMMARY**

Green, baseload (dispatchable) conventional geothermal electrical generation and thermal energy is a hot topic around the globe as governments grapple with getting to net zero by mid-century. Those of you based or working in Alberta may have been hearing about geothermal over the past couple of years as a renewal energy source that is an excellent fit for Alberta's workforce and infrastructure; even the Minister of Energy and the Premier of Alberta have even been tweeting about geothermal. But what really is conventional geothermal and how does it fit into Alberta's rich oil and gas heritage and continued extraction plans? Is this the moment for the oil and gas industry to pivot? What is the difference between geexchange and conventional geothermal? Where do closed-loop heat pumps fit into the mix? What about co-generation?

There is a lot of misunderstanding of what conventional (i.e., wide bore deep wells 2 km and deeper) geothermal is and is not. This two-hour presentation including time for Q&As will cover a wide range of aspects of geothermal, starting with the basics – what it is and what it is not. The session will examine what a deep geothermal heat and power development needs for commercial success in a sedimentary basin, and specifically in the Alberta portion of the Western Canada Sedimentary Basin. We will then review the geothermal potential of Alberta discussing topics such as exploration and early drilling risk. A comparison between geothermal and oil and gas well bores and completions will be covered, including flow rates required for electrical generation. How the resource is managed over time and how injection strategies are key to longevity of the development.

A holistic view of geothermal development will also be presented, showing the synergies and connections between the extraction of thermal energy, and any contained hydrocarbons and/or metallic or industrial metals. Also, to be delved into, is how geothermal developments can aid in carbon sequestration, creating projects that obtain carbon credits, but can also be carbon negative. Investment in carbon zero to carbon negative geothermal projects will support industries that are already facing opposition and will soon be required to be net carbon zero in order to obtain international financing.

---

**PRESENTER:** Catherine Hickson PhD, P.Geo. Alberta No. 1

Catherine is a geologist and senior executive who has been involved in the geothermal industry for more than 40 years. Starting as a student running temperature logs in gradient wells, she then went on to finish her PhD at UBC investigating the Wells Gray Clearwater volcanic field and its potential for geothermal energy. She then became a research scientist with the Geological Survey of Canada (GSC) and was head of its Cordilleran Office in Vancouver for seven years. While at the GSC she continued working on projects that tied together geothermal energy and volcanology. In 2008 she left the GSC to join a pure play geothermal company as VP Exploration. Since then, she has

been working globally on projects in over 14 countries overseeing all facets of the industry - from green field exploration projects to reservoir modelling and injection strategies, to raising funds for development companies. She joined Geothermal Canada (then the Canadian Geothermal Association) in 1981 and has continued to participate in the association for the past 40 years, severing several stints as President. She currently serves as its Vice president. Catherine is CEO of Alberta No. 1 and Chief Geoscientist for Terrapin Geothermics, she is also President of Tuya Terra Geo Corp maintaining a global geothermal practice.



**CSUR**  
Canadian  
Society for  
Unconventional  
Resources

**WEBINAR COURSE**

## Conventional Geothermal Energy Development Meets Oil and Gas

Presented by Catherine Hickson PhD, P.Geo. Alberta No. 1

Tuesday  
September 7th, 2021  
10:00am MT

**REGISTER NOW !**

### AGENDA

The topics outlined below are intended to provide participants with a broad, basic view of what is required to undertake a conventional geothermal development project. Where appropriate, there will be a comparison between geothermal practices and those of the oil and gas industry. Given the time constraints, the topics provide only a basic outline of the various aspects necessary to consider for conventional geothermal development. Participants should consider the presentation as a spring board into further, more detailed investigations.

1. Geothermal Fundamentals – what are low enthalpy systems and where do they occur
2. Key points on why geothermal – GHG and ESG credits and other "green" advantages
3. Georexchange, conventional geothermal and closed loop geothermal
4. What to look for in a sedimentary basin and how oil and gas data is integrated into exploration
  - a. Temperature gradients
  - b. Rock/reservoir type
5. Flow requirements for conventional geothermal
  - a. Power plants and heat exchangers
  - b. Well bore sizing compared to oil and gas
    - i. design
    - ii. rig sizing
    - iii. well heads
    - iv. pumping (line shaft and ESP)
6. Fluid chemistry and temperature
  - a. Well bore scaling
  - b. Organic Rankin Cycle – secondary fluid
  - c. Heat exchangers – secondary fluid
7. Well stimulation and induced seismicity

- a. Targeting injection
  - b. Stimulation of under performing well bores
  - c. Injection monitoring
8. Commercial considerations
- a. Regulations
  - b. Power sales
  - c. Thermal (direct use sales)
  - d. Holistic and integrated developments
  - e. Carbon credits and politics
9. Hurdles and challenges to develop an industry
- a. What is needed for widespread adoption?
  - b. Why aren't the big players playing?