

Alberta Regulatory Update and Implications for Geothermal Projects

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Alberta No.1

Summary

On December 9, 2020, Alberta's *Geothermal Resource Development Act* received royal assent and was proclaimed in force December 8, 2021. The first piece of associated regulation – the *Geothermal Resource Tenure Regulation* - came into force January 1, 2022. On January 25, 2022 the *Mineral Rights Information Bulletin 2022-02* outlined how geothermal resource rights could be acquired, but it was still not possible to transact upon these rights by securing surface leases or subsurface drilling permits. It was not until August 15, 2022 that the Alberta Energy Regulator (AER) released *Directive 089: Geothermal Resource Development*. This directive:

- defines the types of geothermal developments and systems;
- identifies the licenses and authorizations for wells, facilities, and pipelines;
- extends the existing Licensee Management Program (i.e., holistic licensee assessment, estimates of liability, and security deposits) to include geothermal developments;
- identifies the requirements for converting an oil and gas well to geothermal; and
- identifies risk assessment requirements related to hazards for geothermal wells.

With a full suite of regulations in place, geothermal developers in Alberta are now able acquire geothermal rights within the province as well as access these resources through surface land control and licenses to drill geothermal wells. While clear regulations are an important step forward for geothermal development in Alberta, there are still numerous challenges facing developers. Presently, geothermal developers may be required to compete with hydrocarbon operators in Alberta for resource rights. Due to geothermal energy projects significant up-front capital requirements and longer return on investment, geothermal projects are at a disadvantage. Going forward, there is an opportunity for the government and the regulator to encourage geothermal development in Alberta through fiscal incentives and policy revisions. An escalating cost of natural gas increasingly favors geothermal resource development, in addition to carbon reduction incentives available for renewable energy projects.

Resource Definition and Ownership

Alberta has a long history of hydrocarbon development, with gas and oil discoveries dating to the first two decades of the 20th century. This legacy has given the province ample experience in regulating the subsurface for resource extraction. Presently, the Government of Alberta utilizes the Alberta Energy Regulator (AER) to manage the development of Alberta's energy resources, including both hydrocarbon and geothermal energy. However, there are some key differences between the extraction of hydrocarbons and the extraction of geothermal energy. When extracting hydrocarbons, the province licenses ownership of the hydrocarbon fluid over specific subsurface depths to an individual company. Prior to the delineation of geothermal energy as a distinct resource within legislation, any other geo-fluid that was produced along with the hydrocarbon was considered waste and was disposed of.

With a wide ranging interest developing in regards to greenhouse gas (GHG) reductions and overall global carbon management, a renewed interest in utilizing the thermal energy contained within these geo-fluids has been developing in Alberta over the last decade. Preliminary indications that the Alberta provincial government was considering the development of a geothermal regulatory framework was received by industry in 2017. Early on in the process the government held at least one public workshop where geothermal experts were invited to provide input. This workshop was followed by a second workshop on June 25, 2018 where a broad range of stakeholders were invited to participate. Regulations were not immediately forthcoming though developers continued to pursue first-of-kind geothermal developments, often under the auspices of temporary processes or through the utilization of existing hydrocarbon regulations. The ultimately unsuccessful application to drill a conventional geothermal well (the first in the province) under the existing hydrocarbon regulations by Alberta No.1 in 2019 (Hickson et al. 2020)(Figure 1), and increased developer interest spurred by rising natural gas and carbon pricing occurred in this timeframe. The Province of Alberta then ended the interim application processes and clarified a number of outstanding development questions raised by the first movers through the release of a draft regulatory framework for geothermal development. When the draft geothermal regulations were released there were two more stakeholder engagement sessions that were held via digital media (April 9, 2021 and August 25, 2021).

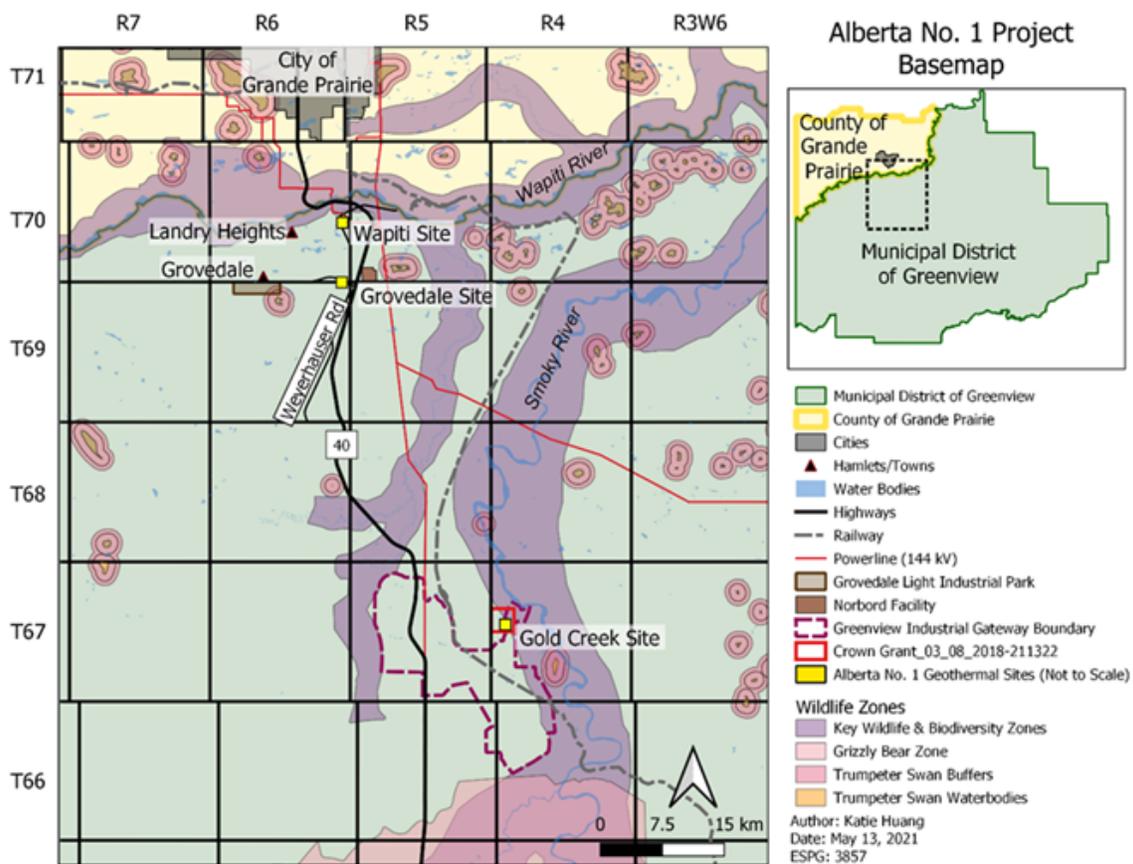
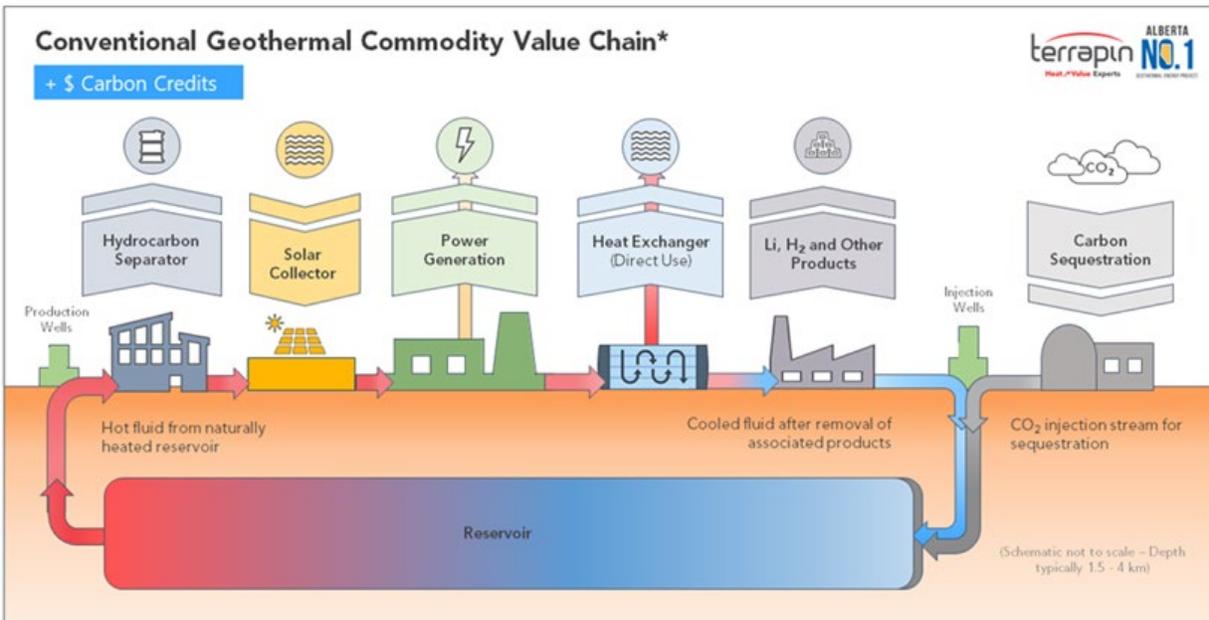


Figure 1: ABNo1 project is located south of Grande Prairie in the Municipal District of Greenview No. 16. The project has moved forward on acquiring geothermal resource leases surrounding two of its sites - Wapiti Site and Gold Creek Site. ABNo1 has one crown granted section at Section 19-067-04W6 (highlighted in red).

Alberta's definition of geothermal resources are defined in both the *Mines and Minerals Act* and in the *Geothermal Resource Development Act (GRDA)* as “the natural heat from the earth that is below the base of groundwater protection” ((*GRDA*, 1(1)(d)). This definition, and subsequent directives based on the definition, place ownership of geothermal energy on the heat that is extracted from the earth, not the geo-fluid that it is carried in – the ownership is of the resource rather than on the transfer medium.

In January of 2022, the Province of Alberta began allowing application for geothermal resource leases in the subsurface through the *Geothermal Resource Tenure Regulation (2022)*. These subsurface leases are granted over a maximum area of 9 contiguous sections. These rights are awarded through an application process, as opposed to a public offering (which is the standard with hydrocarbon rights). However, these subsurface rights are non-exclusive, and two operators can potentially have an interest in the thermal energy over the same zones and formations. These regulations also permit the extraction of multiple commodities simultaneously (Figure 1). This is advantageous for geothermal operators, as it allows for the use of a holistic approach to geothermal energy extraction, that can shorten the return on investment for the capital intensive projects (Hickson et al. 2021).

However, the prospect of non-exclusive rights to the heat resource are not tenable to most operators, and certainly where both a deep and shallow resource potentially exist, having multiple operators accessing the same resource is untenable. An important aspect of geothermal energy extraction is pressure support of the reservoir. Pressure support is tied to the injection of the produced fluids back into the reservoir from where they came. Typically, it takes several years to fully understand the reservoir dynamics and how the resource extraction impacts the sustainability of the reservoir. During this time, the operators are working on reservoir models, testing for pressure and temperature changes and carrying out tracer tests to understand the system. Additional production from or disposal into a geothermal aquifer, even outside the boundaries of a specific granted geothermal lease, may impact the reservoir chemistry, pressure, and thermal energy content, causing a negative effect on the geothermal producer



*Potential value additions depend on local geological conditions.

Figure 2: Geothermal energy extraction in the context of Alberta's deregulated power market and low-cost natural gas needs a commercial boost. This figure shows the holistic value chain for geothermal energy as a way to encourage investment in geothermal.

In August of 2022 the Alberta Energy Regulator published *Directive 89: Geothermal Resources Development (2022)*. This directive states that in order to extract heat from a geo-fluid, the operator must hold the geothermal rights over the sub-surface extraction zone. With the issuing of Directive 89, operators are now able to apply for geothermal well licenses within the province of Alberta. Due to the new and evolving nature of geothermal energy development in Alberta, all applications to drill have to go through a full audit by the AER. To date, no licenses have been issued for conventional geothermal development. Hopefully, by the date of this conference, there will be licensed geothermal-specific wells in the province of Alberta, but the significant time lapse between the introduction of the *GRDA* and the release of *Directive 089* have caused years of project development delays.

Resource Tenure

In January of 2022, Alberta Energy outlined the various stages of geothermal resource tenure under the *Geothermal Resource Tenure Regulation* in *Mineral Rights Information Bulletin 2022-02* (Wadson 2022). The tenure process consists of three stages, the initial lease, the intermediate lease and the indefinite lease as summarized in Figure 3.

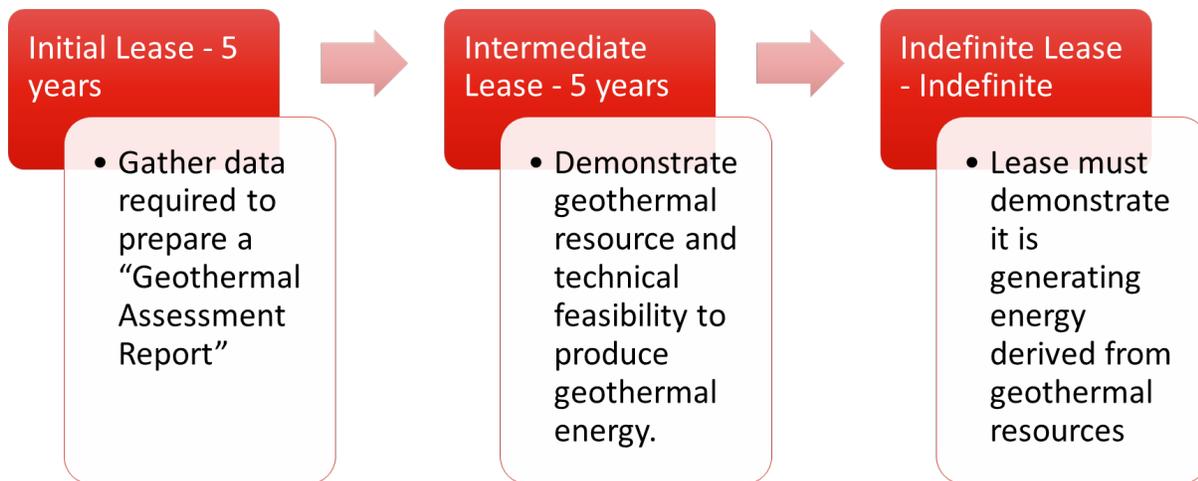


Figure 3: The resource tenure path in Alberta for geothermal operators.

During the initial lease period, which is a maximum of 5 years, the operator is required to demonstrate the geothermal resource and technical viability of producing geothermal energy (Wadson 2022). This involves proving the geothermal resource through a variety of activities, including but not limited to:

- drilling a well(s),
- re-completing or deepening of existing well(s),
- testing wells,
- logging wells,
- surface infrastructure (e.g., pipelines, tanks, equipment supporting the extraction of heat or generation of power), or
- fluid sampling and bottom hole temperatures.

This data will be included in the “Geothermal Assessment Report” which is used by Alberta Energy to determine the leases eligibility to move into the intermediate term.

The intermediate lease period, with a maximum of 5 years, is to be used to demonstrate the technological feasibility of producing geothermal energy. Activities completed during this period may include:

- drilling additional well(s),
- continued construction of surface infrastructure (e.g., pipelines, tanks, equipment supporting the extraction of heat or generation of power),
- fluid and temperature analysis
- fluid disposal and/or injection
- technology testing and initial operations
- monitoring geothermal energy production and sustainability
- connecting and utilization of geothermal energy by the end user

In order for a geothermal lease to advance from the intermediate lease to the indefinite lease, Alberta Energy must deem the lease to be productive (Wadson 2022).

Once a lease has been granted for a continued indefinite term, Alberta Energy may request additional information at any time. It is expected that the lease will continue as long as the geothermal operation remains productive. This three-stage system of geothermal resource tenure allows for geothermal operators to explore, prove and produce the resource in a timely manner.

Incentivizing the Geothermal Industry

One of the challenges to geothermal energy development has been the longer return on investment compared to hydrocarbon producers. The regulator can assist geothermal operators with this by creating a clear and efficient pathway for geothermal developments as shown in Figure 4. By streamlining the process from permitting to energy generation, the government can help minimize the time from initial investment to profits. The regulations and directives created by the Province of Alberta, Alberta Energy and the Alberta Energy Regulator have now outlined the process.



Figure 4: A summary of key actions that could incentivize the geothermal industry in Alberta (Hickson et al. 2022).

In addition to the streamlining of the permitting and development process, geothermal operators need clear geothermal subsurface rights in order to de-risk investments. With the current geothermal rights being non-exclusive there is a risk of overlapping geothermal production. Besides causing legal disputes, this could lead to the premature depletion of the geothermal resource. Unlike hydrocarbon extraction, geothermal energy must be produced in a way that maintains the reservoir volume and pressure. If a geothermal system operates in a way that does not maintain mass balance, it can lead to the premature degradation of the reservoir temperature. As the regulations govern the heat that is extracted, the geo-fluid that this heat is extracted from must be returned to the subsurface. Ideally the geo-fluid would be re-injected into the same geologic unit that it was produced from in order to maintain mass balance in the reservoir. Should

two operators be extracting geo-fluids from the same lease, it would likely lead to suboptimal heat production and a shorter lifespan for the project.

Conclusions

The Province of Alberta is seeing increased interest in the development of geothermal energy. While there are many opportunities in the province, there are also numerous challenges as noted above; non-exclusive rights for the heat resource is the main stumbling block. The province has a substantial database of subsurface data, thanks to over 400,000 hydrocarbon wells that have been drilled in the last 100 years. This experience has been leveraged from the regulatory standpoint and the geothermal directives frequently reference Alberta's hydrocarbon directives.

The current geothermal regulations favor operators who already own the hydrocarbon rights in the subsurface. This is promising for the transition of Alberta's current hydrocarbon operators to renewable energy. However, while there is now a clear path for geothermal developments in Alberta, it is still challenging for single commodity (heat) geothermal operators to compete with these more financially lucrative commodities.

Moving forward, the geothermal energy regulations in Alberta need to be flexible and revisable, while maintaining the responsible development of geothermal resources. The current regulations and directives are a good start, but there is still more that could be done to incentivize geothermal investment and development in Alberta.

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