Emerging technologies in energy:
Environmental and regulatory considerations
for Western Canada

Geothermal

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ENVIRONMENT & ENGINEERING

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Recent years have seen the emergence of new technologies in energy, driven largely by the global shift away from conventional fossil-fuel energy sources toward low-carbon sources of energy and new means of harnessing them. These emerging technologies include those for geothermal, lithium, and hydrogen resources, which have been the subject of rapid policy and regulatory developments in Canada. Geothermal, lithium, and hydrogen technologies are expected to continue to advance in the coming years, as they are increasingly adopted and implemented in Canada and globally.

The physical setting and resource development experience in Western Canada present tremendous opportunities for meaningful growth in the development of these energy resources. However, as is to be expected with emerging sectors, there are uncertainties with respect to the environmental risks and regulatory frameworks that apply, which considerations and regimes are largely in a state of flux.

Osler's legal experts in conjunction with environmental specialists at Matrix Solutions Inc. have created a three-part series that discusses the current environmental and regulatory considerations in Alberta, British Columbia and Saskatchewan associated with the development of geothermal, lithium and blue hydrogen technologies.

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Introduction

Geothermal energy offers a number of advantages as a renewable energy source and is an important component of Canada's transition to a low-carbon energy future. In comparison to the intermittent output of traditional renewable energy sources, such as solar or wind power, it can provide constant, predictable baseload power year-round, with little fluctuation of power output. With proper reservoir management, geothermal resources are renewable in the sense that their thermal capacity can be assessed and designed to be maintained and replenished over the life of the power plants. In addition, geothermal power facilities typically have a small land footprint and a low carbon footprint, and consume less water than conventional power plants. Another perceived advantage in Western Canada is the potential to utilize the skillsets and experience of an existing oil and gas workforce and associated technologies, as well as the possibility of re-purposing some oil and gas infrastructure.

Within Canada, prospective high temperature geothermal resources have been identified in British Columbia, the Northwest Territories, Yukon and Alberta.[1] Several geothermal power projects at various stages of development currently exist in these jurisdictions with some attracting significant federal support in early financing rounds. These include projects located within the lower mainland of British Columbia, the foothills of the Rocky Mountains in Alberta and on the prairies in Saskatchewan. While several demonstration projects and feasibility assessments have been completed in recent years, two key projects currently in the design phase include a planned 5 MW geothermal power plant near Grande Prairie, Alberta and a plan for multiple small, scalable 20 MW geothermal power plants in southern Saskatchewan, near Estevan. Several other smaller scale projects, at earlier stages of development, are also underway in B.C. and Alberta.

1 S. E. Grasby et al, *Geothermal Energy Resource Potential of Canada* (Geological Survey of Canada, 2012), http://geoscan.nrcan.gc.ca/starweb/geoscan/servlet.starweb?path=geoscan/fulle.web&search1=R=291488%0APembina.

Process description

Geothermal energy production is the harnessing of thermal energy from the naturally occurring thermal gradient within the earth. Around the world, this practice is common in areas with extensive volcanic and magmatic activity. In Western Canada, geothermal potential exists in deep portions of the Western Canada Sedimentary Basin (sometimes in excess of 3,000 m below ground surface) where basinal fluids and rock can reach temperatures above 80°C, as well as within mountainous metamorphic and igneous terrane complexes with magmatic root systems hosting geothermal fluid systems. Fluids in these deep aquifers can be produced at temperatures ranging from approximately 70°C to greater than 125°C. The hot fluid is brought to surface and the heat is captured for use in power generation or heating.

Environmental considerations

The main task when developing a geothermal energy project is to safely drill and complete the necessary wells to the required depths. This type of deep drilling is comparable to drilling in the oil and gas sector and the potential environmental concerns (e.g., management of drilling fluids, presence of entrained gas) are well understood. Accordingly, it is expected that these concerns will be managed consistently within the existing frameworks that regulate the environmental aspects of oil and gas drilling within each province.

The main task when developing a geothermal energy project is to safely drill and complete the necessary wells to the required depths.

One option under consideration by some geothermal energy developers is repurposing existing oil or gas wells. Under this scenario, the environmental liability of the existing infrastructure needs to be understood and managed. Typical due diligence activities associated with liability transfer (i.e., Environmental Site Assessments) can be used to quantify environmental liability. The liability management frameworks vary in each province and may require modifications to consider the geothermal potential of the infrastructure to offset the environmental liability (as discussed further below). However, there may be few existing oil or gas wells completed deep enough to safely access areas with material geothermal potential or with sufficient casing diameter to accommodate the pump sizes required for commercial scale development.

During operations, the main environmental consideration is the potential for brine release. Most concepts consider a facility designed to contain the brine fluid within a closed loop system where it is pumped to surface, cooled and then reinjected into the same formation. Geothermal facilities will need to be designed to consider appropriate response measures in the event of accidents or malfunctions related to brine handling. Operational maintenance plans would also need to consider the potential for scaling and fouling of pumps, piping and equipment. Depending on the chemistry of the fluids, robust integrity programs may be required to minimize the potential for releases. These environmental considerations are comparable to those encountered at existing oil and gas facilities and it is expected they will be managed in accordance with the existing approaches in the oil and gas sector.

Regulatory considerations

Of the provinces surveyed, B.C. has a dedicated regulatory regime for geothermal energy development that has existed for many years, and Alberta has recently passed legislation to create such a regime. Saskatchewan does not have a dedicated regulatory regime, although geothermal projects have been accommodated to some extent within the existing oil, gas and mineral resource regulatory regimes. Aspects of the regulatory regimes in these provinces that may be of interest to geothermal project proponents are outlined below.

Alberta

Alberta recently passed legislation to create a dedicated regulatory regime for geothermal resources, which addresses issues of ownership and access, licensing and liability.

Definition of the resource

In Alberta, there is a statutory definition for geothermal resources based on depth. The *Geothermal Resource Development Act* (GRDA) defines the geothermal resource as "the natural heat from the earth that is below the base of groundwater protection."[2] The base of groundwater protection is defined in the *Water Wells and Ground Source Heat Exchange System Directive* published by Alberta Environment and Parks (AEP) as "the best estimate of the elevation of the base of the formation in which non-saline groundwater occurs at that location"[3] (i.e., the depth at which groundwater is estimated to transition from non-saline to saline at a given location).[4] Given that there are not significant heat resources above this depth in Alberta for industrial applications, the effect of this definition is that the GRDA's provisions relating to ownership, tenure, licensing and liability apply in respect of any heat resource that would realistically be considered for an industrial-sized geothermal project.

The definition of the geothermal resource as "natural heat" from the earth excludes other categories of resources. For example, it excludes waters that may contain heat or minerals dissolved in those waters. This means that tenure and licensing of geothermal resources under the GRDA does not give ownership, tenure and licensing in respect of water or dissolved minerals, such as lithium.

2 *Geothermal Resource Development Act*, SA 2020, c. G5.5, s. 1(1)(d).
3 *Geothermal Resource Development Act*, SA 2020, c. G5.5, s. 1(1)(a); *Water Wells and Ground Source Heat Exchange System Directive*, s. 1.2(2)(c).
4 These depths can be found on the Alberta Energy Regulator's website: http://www1.aer.ca/ProductCatalogue/378.html.

Ownership and access to the resource

In Alberta, title in geothermal resources has been vested in the owner(s) of the mineral title. According to section 10.2 of the *Mines and Minerals Act* (MMA),

> **Geothermal resources**
>
> **10.2** The owner of the mineral title in any land in Alberta has the right to explore for, develop, recover and manage the geothermal resources associated with those minerals and with any subsurface reservoirs under the land.[5]

This means that the provincial Crown owns the geothermal resource in most cases, given that it owns approximately 80% of mineral titles in Alberta. Freehold mineral rights cover the other 20%, which is generally located in the more populated areas of the province.[6]

This approach to the ownership of geothermal resources in Alberta has been criticized on the basis that, on freehold lands with split mineral title, a company would likely be required to obtain a grant of geothermal resource rights from each mineral title owner to be able to proceed with clear title, which could be difficult. For example, there could be separate owners of petroleum, natural gas and coal. In such a case, a company would likely require a grant of geothermal resource rights from each owner and, while each such owner would have geothermal resource rights, they would not be able to exercise their rights without a grant from the others.

Moreover, at common law, the surface title owner may own the geothermal resource rights (rather than the mineral title owner) and, if that is the case, section 10.2 of the MMA may not be clear enough to transfer title to the mineral owner(s), as intended. If the surface title owner owns the geothermal resource rights, there would be greater potential for subsurface conflicts resulting from the rights to extract different resources (e.g., oil, gas and geothermal) being held by different parties. For example, conflicts could arise if activities to extract one resource impact another resource (e.g., oil and gas activities resulting in incidental extraction of geothermal resources and/or negatively impacting the recovery of geothermal resources).

Without clearer legislative direction, clarification of ownership and control of geothermal resources in Alberta may require resolution through litigation. Further, if ownership is transferred from the surface title holder to the mineral rights owner, issues of expropriation may arise, similar to those that arose from the declaration that the Alberta Crown owns pore space in 2010.[7] Unlike the pore space case,[8] there is currently no statutory bar to expropriation claims by surface owners in respect of geothermal resources in Alberta.

Without clearer legislative direction, clarification of ownership and control of geothermal resources in Alberta may require resolution through litigation.

5 *Mines and Minerals Act*, RSA 2000, c. M-17, s. 10.2.

6 For a map of Crown and non-Crown mineral holdings, see https://open.alberta.ca/dataset/53e7a692-c60f-49fb-b1d5-58f7c3f33d59/resource/8824ff78-653b-421e-ab5a-ce31a765e0a5/download/mapfreehold.pdf.

7 *Mines and Minerals Act*, RSA 2000, c. M-17, s. 15.1; Paul Negenman, "Why is the Crown Stealing from Fee Owners?" (2011) The Negotiator: The Magazine of the Canadian Association of Petroleum Landmen 3.

8 *Mines and Minerals Act*, RSA 2000, c. M-17, s. 15.1(4).

For geothermal resource rights owned by the Crown, section 54 of the MMA prohibits any person or company from recovering them unless the person or company is authorized to do so under the MMA or by an agreement.[9] A person or company may be authorized to do so under an agreement entered into with the minister, on behalf of the Crown, respecting the exploration for or the development and recovery of such geothermal resources.[10] In the future, a person or company may also be authorized to do so via a tenure regime for geothermal resources established by regulation, as was done with pore space for carbon sequestration.[11] The Lieutenant Governor in Council has the power to legislate a geothermal resources tenure regime by regulation,[12] but has yet to do so.

A person or company with the right to explore for, develop and/or recover geothermal resources will also require surface rights so they can exercise those rights, whether in respect of Crown or private resources. The Lieutenant Governor in Council has the power to make regulations respecting surface access and consents required for the development of geothermal resources,[13] but has yet to do so.

Closely linked to Crown ownership and tenure is the question of royalties. An agreement entered into between a company and the Crown respecting the exploration for or the development and recovery of Crown-owned geothermal resources may also address the amounts payable to the provincial Crown (the owner) on such exploration or development and recovery.[14] Alternatively, the Lieutenant Governor in Council has the power to make regulations respecting the amounts payable to the provincial Crown in relation to such exploration, development or recovery (i.e., royalties),[15] but has yet to do so. Until any such regulations are in place, royalties are expected to be set on a case-by-case basis through site-specific geothermal tenure agreements.

Licensing regime

The GRDA establishes a licensing regime for geothermal resource exploration and development that is modelled after the *Oil and Gas Conservation Act* (OGCA) and regulated by the Alberta Energy Regulator (AER).[16] A licence must be applied for and obtained from the AER to drill a deep geothermal well or to

9 *Mines and Minerals Act*, RSA 2000, c. M-17, s. 54(1).
10 *Mines and Minerals Act*, RSA 2000, c. M-17, s. 9(a)(v.1).
11 *Carbon Sequestration Tenure Regulation*, Alta Reg 68/2011.
12 *Mines and Minerals Act*, RSA 2000, c. M-17, s. 5(1)(a)(iii.1).
13 *Geothermal Resource Development Act*, SA 2020, c. G5.5, s. 27(e).
14 *Mines and Minerals Act*, RSA 2000, c. M-17, s. 9(a)(v.1).
15 *Mines and Minerals Act*, RSA 2000, c. M-17, ss. 5(1)(w.8); 36(1)(l).
16 *Geothermal Resource Development Act*, SA 2020, c. G5.5, s. 1(1)(g); *Responsible Energy Development Act*, SA 2012, c. R-17.3, ss. 1(1)(j)(ii.1), 2.

operate any geothermal well or facility[17] (including repurposed oil and gas wells or facilities[18]), which may be granted on any terms and conditions that the AER considers appropriate. Licences may be amended on the AER's own motion or on application by the licensee and may only be transferred with the written consent of the AER, subject to any conditions that the AER considers appropriate.[19] The AER has the authority to cancel or suspend a licence (in the event of non-compliance or if equipment or operations are improper, hazardous, inadequate or defective), and it may also shut down a well or facility and direct remedial actions be taken.[20]

As with oil and gas developments, the AER has various powers to enforce the licensing regime, including powers to inspect and investigate,[21] to direct or take steps for the suspension or abandonment of a well or facility,[22] to direct or take remedial action in the event of a substance release[23] and to suspend directors and officers from engaging in ongoing or future geothermal operations.[24]

Like the OGCA, the GRDA also gives the AER the power to make rules respecting many matters,[25] including licensing, operations, waste management, monitoring and compliance, suspension and abandonment, security requirements, conservation and management of geothermal resources and location of geothermal operations. The AER may also designate a geothermal well or facility as a well or facility for the purposes of the OGCA.[26] The GRDA further gives the Lieutenant Governor in Council the power to make regulations respecting several matters,[27] including access to geothermal resources, applicability of other energy resource enactments to geothermal resources[28] and prescribing things as not being wells or facilities for the purposes of the GRDA. Given that the GRDA was only recently enacted, no such rules or regulations have been made yet.

Geothermal resource activities in Alberta are also subject to environmental laws of general application, such as the *Water Act* and the *Environmental Protection and Enhancement Act* (EPEA).

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17 *Geothermal Resource Development Act*, SA 2020, c. G5.5, s. 7.
18 *Geothermal Resource Development Act*, SA 2020, c. G5.5, s. 8.
19 *Geothermal Resource Development Act*, SA 2020, c. G5.5, s. 9.
20 *Geothermal Resource Development Act*, SA 2020, c. G5.5, s. 10.
21 *Geothermal Resource Development Act*, SA 2020, c. G5.5, s. 12.
22 *Geothermal Resource Development Act*, SA 2020, c. G5.5, ss. 14-15.
23 *Geothermal Resource Development Act*, SA 2020, c. G5.5, s. 21.
24 *Oil and Gas Conservation Act*, RSA 2000, c. O-6, s. 106.
25 *Geothermal Resource Development Act*, SA 2020, c. G5.5, s. 26.
26 *Oil and Gas Conservation Act*, RSA 2000, c. O-6, s. 3(3).
27 *Geothermal Resource Development Act*, SA 2020, c. G5.5, s. 27.
28 An amendment to the OGCA similarly provides that, to the extent provided by the regulations to the OGCA, it applies to a well or facility as defined in the GRDA: *Oil and Gas Conservation Act*, RSA 2000, c. O-6, s. 3(2).

Under the *Water Act*, a licence is required for any "diversion of water,"[29] which is defined as "the impoundment, storage, consumption, taking or removal of water for any purpose."[30] However, certain diversions of water are exempt from the requirement for a licence including, notably, the diversion of saline groundwater.[31] Given that the GRDA only applies in respect of the heat resource at depths where the groundwater is saline, it is difficult to imagine a geothermal project regulated under the GRDA that would require a *Water Act* licence, in light of this exemption for the diversion of saline groundwater.

Under the EPEA, an approval or registration is required for any "activity" designated by the regulations. The Schedule of Activities provides a list of such activities for the purposes of the Act, including

- the construction, operation or reclamation of a plant, structure or thing for the recovery, transfer, injection or storage of natural heat from the earth for the purpose of heating
- the drilling or reclamation of a water well or borehole
- the drilling, construction, operation or reclamation of a well other than a water well (including a well that is for exploration or development of deep geothermal resources)
- any other activity that requires an approval under the *Water Act* or a diversion of water that requires a licence under the *Water Act*
- the construction, operation or reclamation of a plant for the generating of thermal electric power or steam[32]

Of these activities, the only one currently designated by the regulations as requiring an approval or registration under the EPEA is the construction, operation or reclamation of a plant that produces steam or thermal electrical power (provided its rated production output is greater than 1 MW).[33] Accordingly, a utility-scale geothermal power plant would likely require an EPEA approval under the current regime. A provincial environmental assessment would only be required for a geothermal power plant with a capacity of 100 MW or greater or at the discretion of the director or minister.[34]

29 *Water Act*, RSA 2000, c. W-3, s. 49(1).
30 *Water Act*, RSA 2000, c. W-3, s. 1(1)(m).
31 *Water (Ministerial) Regulation*, Alta Reg 205/1998, s. 5(1), Sched. 3.
32 *Environmental Protection and Enhancement Act*, RSA 2000, c. E-12, s. 1(a), Sched.
33 *Activities Designation Regulation*, Alta Reg 276/2003, ss. 2(2)(vv), 5(1), Sched. 1.
34 *Environmental Protection and Enhancement Act*, RSA 2000, c. E-12, ss. 39(c), 44(1)(a); *Environmental Assessment (Mandatory and Exempted Activities) Regulation*, Alta Reg 111/1993, s. 1, Sched. 1; *Environmental Protection and Enhancement Act*, RSA 2000, c. E-12, ss. 45(1), 47.

In addition, the construction and operation of a geothermal power generation facility may require power plant and connection approvals from the Alberta Utilities Commission (AUC) under the *Hydro and Electric Energy Act*[35] (applied for and considered pursuant to AUC Rule 007),[36] subject to some exceptions.[37]

While the AER currently administers the licensing regimes under the *Water Act* and the EPEA for energy resource activities within its jurisdiction, the AUC has sole jurisdiction over the assessment and approval of power plants and associated interconnections. Given that the GRDA has granted the AER authority over geothermal development, it is unclear how – or if – the AER and AUC will coordinate their processes where a geothermal project triggers licensing requirements under the two regulators' respective regimes. It is worth noting that in the case of cogeneration facilities associated with oil sands projects, which also involve licensing requirements under both the AER and the AUC regimes, the two regulators' processes have been coordinated to some extent through the AUC requesting and relying on information regarding AER approvals, which may be an appropriate approach for geothermal power projects.

Liability regime

The GRDA also establishes a liability regime for geothermal resource exploration and development that is regulated by the AER. In the case of a suspended or abandoned oil and gas well or facility, the AER may designate it as a well or facility for the purposes of the GRDA and a licence may be granted to rework it for geothermal operations.[38] When a licence to rework is granted, the former licensee is relieved from all obligations under the GRDA with respect to the well or facility except outstanding debts to the AER or to the orphan well program in respect of suspension or abandonment costs.[39] This effectively transfers the liability for the reworked well or facility to the new licensee (i.e., the licensee for the geothermal well or facility).

In the case of a remediated oil and gas well or facility (i.e., one that previously experienced a substance release with significant adverse effects), the new licensee may be liable under an environmental protection order for further remediation if there is a further substance release or substances are otherwise present in the area.[40] While this risk can be mitigated to some extent through contract, this liability exposure applies regardless of the agreements in place between prior and current licensees.

In the case of a suspended or abandoned oil and gas well or facility, the AER may designate it as a well or facility for the purposes of the GRDA and a licence may be granted to rework it for geothermal operations.

35 *Hydro and Electric Energy Act*, RSA 2000, c. H-16, ss. 11, 18.
36 AUC Rule 007: *Applications for Power Plants, Substations, Transmission Lines, Industrial System Designations and Hydro Developments* (amended August 1, 2019) (Rule 007), https://www.auc.ab.ca/Shared%20Documents/rules/Rule007.pdf.
37 *Hydro and Electric Energy Regulation*, Alta Reg 409/1983, ss. 18.1(2), 18.3(2); AUC Rule 007, s. 1.4.3; AUC Rule 024: Rules Respecting Micro-Generation (amended July 16, 2019), https://www.auc.ab.ca/Shared%20Documents/Rules/Rule024.pdf.
38 *Geothermal Resource Development Act*, SA 2020, c. G5.5, ss. 1(1)(h), 1(3)(b), 8(1).
39 *Geothermal Resource Development Act*, SA 2020, c. G5.5, ss. 8, 16.
40 *Environmental Protection and Enhancement Act*, RSA 2000, c. E-12, s. 113; *Remediation Regulation*, Alta Reg 154/2009, s. 8.

At the end of a project's life, the abandonment of a geothermal well or facility does not relieve the licensee or working interest participant from responsibility for the control or further abandonment of the well or facility or from the responsibility of the costs of doing that work.[41] Like reclamation costs (discussed below), costs of suspension, abandonment and remediation must be paid by each working interest participant in accordance with their proportionate share in the geothermal well or facility, unless the AER determines otherwise.[42] Similarly, the cancellation or suspension of a licence does not relieve the licensee from the liability to complete or abandon the well or facility, reclaim the site and suspend operations as the AER directs.[43]

There is also a duty under the EPEA for an operator to conserve and reclaim "specified land" and to obtain a reclamation certificate in respect thereof.[44] The term "specified land" is defined to include land that contains a geothermal well[45] and land on which there was construction, operation or reclamation of a renewable energy operation (which includes a site or plant generating renewable electricity from "heat from the earth").[46] A reclamation certificate is not required where the renewable electricity generated or produced by a renewable energy operation (e.g., a geothermal power plant) is less than or equal to 5 MW and the total footprint boundary is no greater than 1 ha in size.[47]

Where there is a duty to conserve and reclaim specified land, it must be returned to an equivalent land capability (i.e., "the ability of the land to support land uses after conservation and reclamation [must be] similar to the ability that existed prior to an activity being conducted on the land").[48] Reclamation costs must be paid by each working interest participant in accordance with their proportionate share in the geothermal well or facility, unless the AER determines otherwise.[49] Where a reclamation certificate is required for land used for a geothermal power plant (i.e., where the electricity generated is greater than 5 MW or the total footprint boundary is greater than 1 ha), an operator may be liable for an environmental protection order (EPO) regarding conservation or reclamation for up to five years after the date the certificate is issued (or longer, if an approval for the plant is held on that date).[50] Where a reclamation certificate is required for land that contains a geothermal well, an operator may be liable for an EPO for up to 25 years after the certificate is issued.[51]

41 *Geothermal Resource Development Act*, SA 2020, c. G5.5, s. 16.
42 *Geothermal Resource Development Act*, SA 2020, c. G5.5, s. 17.
43 *Geothermal Resource Development Act*, SA 2020, c. G5.5, s. 10(3).
44 *Environmental Protection and Enhancement Act*, RSA 2000, c. E-12, s. 137(1).
45 *Environmental Protection and Enhancement Act*, RSA 2000, c. E-12, s. 1(aaa); *Conservation and Reclamation Regulation*, Alta Reg 115/1993, s. 1(t)(i).
46 *Environmental Protection and Enhancement Act*, RSA 2000, c. E-12, s. 134(f); *Conservation and Reclamation Regulation*, Alta Reg 115/1993, ss. 1(q.2-q.3), 1(t)(x).
47 *Conservation and Reclamation Regulation*, Alta Reg 115/1993, s. 15.1(1)(a)(vi)(B); *Micro-generation Regulation*, Alta Reg 27/2008, s. 1(1)(e)(i).
48 *Conservation and Reclamation Regulation*, Alta Reg 115/1993, ss. 1(e), 2.
49 *Geothermal Resource Development Act*, SA 2020, c. G5.5, s. 17.
50 *Conservation and Reclamation Regulation*, Alta Reg 115/1993, ss. 1(t)(x), 15(1).
51 *Conservation and Reclamation Regulation*, Alta Reg 115/1993, ss. 1(t)(i), 15(2).

British Columbia

British Columbia's dedicated regulatory regime for geothermal energy development addresses issues of ownership and access, licensing and liability. Although it has existed for 25 years,[52] this regime has long been criticized (particularly in terms of the leasing process) and no significant changes have been made to address these criticisms.

Definition of the resource

In B.C., the statutory definition of geothermal resources is based on temperature. The *Geothermal Resources Act* (GRA) defines geothermal resource as

> the natural heat of the earth and all substances that derive an added value from it, including steam, water and water vapour heated by the natural heat of the earth and all substances dissolved in the steam, water or water vapour obtained from a well, but does not include
>
> (a) water that has a temperature less than 80°C at the point where it reaches the surface, or
>
> (b) hydrocarbons[53]

The effect of this definition is that the GRA's provisions relating to ownership, tenure, licensing and liability apply regardless of depth and they apply to steam, water and water vapour heated by the natural heat from the earth and all substances dissolved therein that are obtained from a well. They do not apply to hydrocarbons or to water that has a temperature less than 80°C at the point where it reaches the surface. Geothermal resources with a temperature less than 80°C are therefore not governed by the GRA and there is no comprehensive legislative framework in place for their uses. Currently, it appears that these resources and associated activities would fall under the *Water Sustainability Act*,[54] which was not designed to address geothermal resource regulation.

Ownership and access to the resource

In B.C., ownership in all geothermal resources is vested in and reserved to the provincial government and only the provincial government may dispose of them under the GRA.[55] This avoids having to obtain a grant of geothermal resource rights from multiple owners to proceed with geothermal operations, as is the case with private mineral title owners in Alberta. It also uses declaratory language that is likely clear enough to overcome any common law claim to ownership of geothermal resources on the part of the surface title owner(s).

In B.C., ownership in all geothermal resources is vested in and reserved to the provincial government and only the provincial government may dispose of them under the GRA.

52 *Geothermal Resources Act*, RSBC 1996, c. 171.
53 *Geothermal Resources Act*, RSBC 1996, c. 171, s. 1(1).
54 *Water Sustainability Act*, SBC 2014, c. 15.
55 *Geothermal Resources Act*, RSBC 1996, c. 171, s. 2.

Section 4 of the GRA prohibits any person or company from producing a geothermal resource (other than for testing purposes) unless they have been issued a lease by the minister for the right to produce a geothermal resource from a location, subject to the GRA.[56]

For access to unoccupied Crown land for a geothermal resource activity, a company may obtain an authorization from the BC Oil and Gas Commission (BC OGC).[57] For access to private land for geothermal resource exploration, a company must enter into an agreement with the landowner authorizing the access.[58] For access to private land for geothermal resource production, a company must enter into an agreement with the landowner authorizing the access or, if they are unable to do so, it may apply to the Surface Rights Board for a right of entry order.[59]

The GRA also addresses royalties. A lessee who produces a geothermal resource (other than for testing purposes) must pay the government the royalty or amount to be paid that is established by agreement with the minister (and approved by the Lieutenant Governor in Council) or, if there is not such an agreement, the lessee must pay the prescribed royalty.[60]

Licensing regime

The GRA also establishes a licensing regime for geothermal resource exploration and development. To produce a geothermal resource, in addition to having a lease with the right to produce from the location, a company must have a production plan approved by the BC OGC and the producing well must be permitted by the BC OGC.[61] For exploration, the company must obtain a permit from the minister and an exploratory well must be authorized by the BC OGC or, if another method of exploration is proposed to be used, the BC OGC must be notified in writing using the prescribed form.[62] Each year, the company must carry out geothermal exploration of a prescribed value or make payments in lieu thereof, and the company must record all work with the minister.

A permit or lease may be transferred, without any third-party (e.g., the minister or BC OGC) consent, but only in compliance with the regulations. A permit or lease may be cancelled by the minister, in writing, if the company fails to comply with a provision of the GRA or the regulations.[63]

56 *Geothermal Resources Act*, RSBC 1996, c. 171, ss. 1(1), 8.
57 *Geothermal Resources Act*, RSBC 1996, c. 171, ss. 1(2); *Petroleum and Natural Gas Act*, RSBC 1996, c. 361, s. 138.
58 *Geothermal Resources Act*, RSBC 1996, c. 171, ss. 1(2); *Petroleum and Natural Gas Act*, RSBC 1996, c. 361, s. 144.
59 *Geothermal Resources Act*, RSBC 1996, c. 171, ss. 1(2); *Petroleum and Natural Gas Act*, RSBC 1996, c. 361, ss. 158-159.
60 *Geothermal Resources Act*, RSBC 1996, c. 171, s. 17.
61 *Geothermal Resources Act*, RSBC 1996, c. 171, ss. 1(1), 4.
62 *Geothermal Resources Act*, RSBC 1996, c. 171, ss. 4-5.
63 *Geothermal Resources Act*, RSBC 1996, c. 171, s. 10.

The BC OGC has various powers to enforce the licensing regime, including powers to inspect and investigate,[64] to suspend or revoke a well authorization[65] and to direct remedial action.[66] The Board of the BC OGC has the power to make regulations of general application and orders related to specific locations or wells, governing the drilling of wells and the production and conservation of geothermal resources.[67] The GRA also gives the Lieutenant Governor in Council the power to make regulations respecting numerous matters, including suspension and revocation of permits and leases, royalties, application of other legislation to geothermal resources, transfer of permits and leases and rent payable for leases.[68] Regulations have been made respecting many of these matters.[69]

In B.C., geothermal resource activities are also subject to environmental regulation. The *Environmental Protection and Management Regulation* (EPMR) applies to a company with a permit or lease under the GRA, albeit with the modifications set out in the *Geothermal Resources General Regulation*.[70] Under the EPMR, prior to permitting a well, the BC OGC must consider whether the issuance of a well authorization is consistent with the government's environmental objectives set out in the EPMR with respect to water quality, riparian values, wildlife and wildlife habitat, old-growth management areas, resource features and cultural heritage resources.[71] The EPMR also sets out requirements to ensure the resource activity does not cause a material adverse effect on water quality, quantity or flow or result in any deleterious materials being deposited into streams, wetlands or lakes, to conserve soil and to restore the operating area.[72]

Under the *Environmental Assessment Act*, geothermal resource activities are not reviewable and do not require an environmental assessment certificate.[73] However, a thermal electric power plant (including one that generates electricity from the use of geothermal energy) is a reviewable project requiring an environmental assessment certificate if its rated nameplate capacity is 50 MW or greater.[74]

Under the *Environmental Assessment Act*, geothermal resource activities are not reviewable and do not require an environmental assessment certificate.

64 *Geothermal Resources Act*, RSBC 1996, c. 171, s. 14.
65 *Geothermal Operations Regulation*, BC Reg 79/2017, s. 45.
66 *Geothermal Resources Act*, RSBC 1996, c. 171, s. 16.
67 *Geothermal Resources Act*, RSBC 1996, c. 171, s. 23.
68 *Geothermal Resources Act*, RSBC 1996, c. 171, s. 24.
69 *Geothermal Geophysical Exploration Regulation*, BC Reg 358/98; *Geothermal Operations Regulation*, BC Reg 79/2017; *Geothermal Resources General Regulation*, BC Reg 39/2017.
70 *Geothermal Resources General Regulation*, BC Reg 39/2017, ss. 12(1)-(2).
71 *Environmental Protection and Management Regulation*, BC Reg 200/2010, ss. 4-8, as modified by *Geothermal Resources General Regulation*, BC Reg 39/2017, ss. 12(8)-(10).
72 *Environmental Protection and Management Regulation*, BC Reg 200/2010, ss. 9-10, 12, 17, 19, as modified by *Geothermal Resources General Regulation*, BC Reg 39/2017, s. 12(7).
73 Environmental Assessment Act, SBC 2018, c. 51, ss. 1, 6; *Reviewable Projects Regulation*, BC Reg 243/2019.
74 *Reviewable Projects Regulation*, BC Reg 243/2019, Table 7.

Liability regime

Under the GRA, a company holding a permit or lease must keep all machinery, equipment, wells and other facilities on the location in a safe condition. This duty continues (even if the lease or permit expires or is terminated) until the BC OGC issues a certificate of restoration certifying that the land surface of the location has been restored to a satisfactory condition in accordance with the regulations, among other things. If, after the inspection of a location or well, the BC OGC considers that a method or practice being employed may constitute a hazard to the health or safety of any person or the public, a company may be liable for remediation and, if there is a delay in performing remediation, it may be ordered to cease all operations in the location or in connection with the well until remediation is completed to the BC OGC's satisfaction.[75]

Unless exempted by the BC OGC, a well authorization holder must deposit security with the BC OGC in the amount of $225,000 for a geothermal well and $7,500 for each thermal gradient well drilled with respect to the same formation (to a maximum of $50,000). There is no requirement to return the security unless and until a certificate of restoration has been issued in respect of all the company's authorizations or the security is no longer required to secure the company's obligations under the GRA.[76]

Responsibilities under the *Contaminated Sites Regulation* to remediate a contaminated site apply to a geothermal operation if there is a concentration of a substance in the soil or at the site that exceeds the prescribed standard or concentration for that substance.[77]

Saskatchewan

Saskatchewan does not have a dedicated regulatory regime for geothermal development, although geothermal projects have been accommodated to some extent within the existing oil, gas and mineral resource regulatory regimes.

Definition of the resource

In Saskatchewan, there is no statutory definition of geothermal resources and no legislation regulating geothermal projects specifically. Geothermal project applications can be submitted through the Government of Saskatchewan's Integrated Resource Information System, where geothermal projects are defined:

75 *Geothermal Resources Act*, RSBC 1996, c. 171, s. 16.
76 *Geothermal Operations Regulation*, BC Reg 79/2017, ss. 47-48.
77 *Contaminated Sites Regulation*, BC Reg 375/96, s. 22, Part 5.

> A geothermal project means a development where geothermal energy is recovered through deep well(s). There are two main types of geothermal project; open-loop and closed-loop. An open-loop system includes: (1) withdrawing formation water for the purpose of extracting geothermal energy as part of an industrial process, and (2) disposing the cooling fluids into subsurface following the extraction of its heat content. In a closed-loop system, the source fluids are circulated in a sealed wellbore – heat exchange loop and there are no formation fluids to be withdrawn or fluids to be disposed. The geothermal project application is only applied to the subsurface activities.[78]

In the Government of Saskatchewan's guidance for disposal wells, geothermal projects are defined:

> A geothermal project means a development that geothermal fluids are produced from a water source well, the geothermal energy is recovered at surface as part of an industrial process for any purpose, and the cooling fluids are disposed into subsurface through a waste disposal well.[79]

Based on these two definitions, the Government of Saskatchewan appears to apply a definition of geothermal resources that is based on depth ("geothermal energy is recovered through deep well(s)") and includes deep subsurface water with geothermal energy. Based on the approvals that have been issued for geothermal activities to date (discussed below), the Government of Saskatchewan appears to classify geothermal resources as minerals and as including minerals dissolved in deep subsurface water with geothermal energy.

Ownership and access to the resource

In Saskatchewan, there is no legislative statement regarding the ownership of geothermal resources; however, based on the approvals that have been issued for geothermal activities to date (discussed below), the Government of Saskatchewan appears to view geothermal resources as property of the provincial Crown. This is consistent with a classification of geothermal resources as minerals given that, in most cases, minerals in Saskatchewan are owned by the provincial Crown.[80] Crown ownership of geothermal resources is also supported by Crown ownership of all ground water (i.e., water beneath the surface of land) in the province, which could include deep subsurface water with geothermal energy.[81]

If geothermal resources are classified as minerals, authorization must be obtained under *The Subsurface Mineral Tenure Regulations* (SMTR) to explore for and produce them.[82] A lease of space would also be

78 Government of Saskatchewan, "Storage Project Application," https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/oil-and-gas/oil-and-gas-licensing-operations-and-requirements/oil-and-gas-drilling-and-operations/gas-storage-and-cavern-storage-disposal.

79 Government of Saskatchewan, "Disposal Wells," https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/oil-and-gas/oil-and-gas-licensing-operations-and-requirements/oil-and-gas-drilling-and-operations/disposal-injection-wells.

80 *See The Crown Minerals Act*, SS 1984-85-86, c. C-50.2 and *The Provincial Lands Act*, SS 2016, c. P-31.1.

81 *The Water Security Agency Act*, SS 2005, c. W-8.1, s. 38(1).

82 *The Subsurface Mineral Tenure Regulations*, RRS, c. C-50.2 Reg 30, ss. 8, 20.

necessary for subsurface access.[83] For surface access, the company must obtain the written consent of the owner and occupant or, if they are unable to do so, a company may apply to the Board of Arbitration for an order granting surface rights.[84]

Licensing regime

Saskatchewan does not have legislation establishing a dedicated licensing regime for geothermal projects. Geothermal operations have been regulated through existing mineral legislation and there are provisions in *The Oil and Gas Conservation Act* (SKOGCA) that may be used to regulate aspects of the geothermal industry.

Saskatchewan has used lease of space agreements under *The Crown Minerals Act* (CMA) to facilitate geothermal operations.[85] For example, the developer of a geothermal power demonstration plant in South Saskatchewan applied for, and obtained, a lease of space agreement.[86] As noted above, a lease of space agreement allows subsurface access, such as for geothermal resource activities.

Substances from the geothermal industry may be regulated under SKOGCA[87] in a number of ways:

- The minister may make orders, and the Lieutenant Governor in Council may make regulations, respecting containment, storage, handling, transportation, treatment, processing, recovery, reuse, recycling, destruction and disposal of substances from the geothermal industry at a licensed facility or well or associated site.[88]
- The Lieutenant Governor in Council may make regulations respecting the injection, disposal and storage of substances from the geothermal industry in subsurface formations.[89]
- The Lieutenant Governor in Council may make regulations authorizing or requiring the drilling, casing, cementing, operation and plugging of wells in accordance with good practices and in any matter as to prevent the harmful intrusion of water and substances from the geothermal industry into the environment and the pollution of fresh water supplies by such substances.[90]

In Saskatchewan, there is no legislative statement regarding the ownership of geothermal resources.

83 *The Crown Minerals Act*, SS 1984-85-86, c. C-50.2, s. 27.2.
84 *The Surface Rights Acquisition and Compensation Act*, RSS 1978, c. S-65, ss. 24-25.
85 A. Thompson, F. Bakhtheyar and G. Van Hal, "A Qualitative Assessment of Major Barriers Facing the Geothermal Industry In Canada" (2014) 38 GRC Transactions 71 at 72.
86 DeepCorp, "DEEP Drills 4 New Geothermal Wells and Increases Subsurface Rights by 700%," https://deepcorp.ca/deep-drills-4-new-geothermal-wells-and-increases-subsurface-rights-by-700/.
87 *The Oil and Gas Conservation Regulations, 2012*, RRS c. O-2 Reg 6, s. 4(1) defines "non-oil-and-gas substances" for the purposes of *The Oil and Gas Conservation Act* (including the above-listed order and regulation making powers) as include substances from the geothermal industry.
88 *The Oil and Gas Conservation Act*, RSS 1978, c. O-2, ss. 17(1)(k), 18(ff).
89 *The Oil and Gas Conservation Act*, RSS 1978, c. O-2, s. 18(ff).
90 *The Oil and Gas Conservation Act*, RSS 1978, c. O-2, s. 18(a)(v).

Currently, the only provisions in regulations made pursuant to the SKOGCA which apply in respect of non-oil-and-gas substances (including from the geothermal industry) deal with

- preventing operators of oil and gas and certain other types of wells (not including geothermal wells) from allowing such substances to constitute a hazard to public health or safety or contaminate fresh water or arable land[91]
- prohibiting any earthen structure or excavation from being used as a receptacle for such substances[92]

If a geothermal project involves a waste disposal well, detailed requirements in respect of such a well are outlined in *Directive PNG008: Disposal and Injection Well Requirements.*[93]

91 *Oil and Gas Conservation Regulations, **2012***, RRS c. O-2 Reg 6, ss. 2(1)(aa), 2(1)(xx), 53(4).
92 *Oil and Gas Conservation Regulations, **2012***, RRS c. O-2 Reg 6, s. 60(2).
93 Government of Saskatchewan, *Direction PNG008: Disposal and Injection Well Requirements* (March 29, 2018), https://publications.saskatchewan.ca/api/v1/products/76172/formats/85298/download.

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