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Legal Obstacles to the Development of Geothermal Energy in Alberta

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Preface

After completion of the initial draft of this paper, I was offered a position as a Policy Advisor to the Canadian Geothermal Energy Association (CanGEA). In this role I have had the opportunity to engage directly with government decision makers across Canada who are in positions that can shape the role that geothermal energy will play in Canada's future energy mix. Some of the insights I have gained are applicable to the development of a geothermal policy and legislation in Alberta.

The only two Canadian jurisdictions that have provided for geothermal development in legislation are British Columbia and Nova Scotia. The respective acts are British Columbia's *Geothermal Resources Act* and Nova Scotia's *Mineral Resources Act*. Neither of these pieces of legislation has resulted in the development of any geothermal electricity projects yet. It was for this reason that the United States was considered, when researching this paper, for examples of geothermal legislation that have worked. In fact, at a recent high-level meeting that CanGEA held with British Columbia's Ministry of Energy and Mines, it was acknowledged by government officials that its *Geothermal Resources Act* needs to be revised. This candid acknowledgment reinforces the fact that if Alberta aims to design geothermal legislation or regulations, it will not want to base its legal framework solely on British Columbia's *Geothermal Resources Act*.

Another consideration for Alberta geothermal development is that Alberta's existing Offset Credit System has no approved quantification protocol for geothermal electricity generation. In Alberta:

> One option for large industrial emitters who need to comply with the province's greenhouse gas emissions reduction program is to purchase offset credits from other sectors that have voluntarily reduced their emissions in Alberta.
>
> Credits must be created using protocols approved by the Alberta government, which were developed in partnership with stakeholders and based on international research. The protocols outline how to quantify and verify emission reductions for different types of projects (e.g. no or reduced tillage, biomass and biofuels).*

Both solar electricity generation and wind-powered generation have approved protocols in Alberta, allowing them to create credits, but geothermal electricity generation does not. Developing a protocol would likely help promote the establishment of geothermal electricity in the province.

There are resources the province has at its disposal that could contribute to the development of a geothermal industry in the Province of Alberta. The means available to policy makers include, but are not limited to, aiming to "de-risk" the industry through investments in exploration, resource mapping, or even by establishing an insurance scheme

* Government of Alberta, "Alberta-based Offset Credit System" (2013), online: Alberta Environment <http://environment.alberta.ca/0923.html>.

to reduce the risk of drilling dry geothermal wells. Having noted the above obstacles, the focus of this paper is on legislative barriers to the industry so all of these alternatives will not be explored.

Some insight as to the likelihood of legislation in Alberta was provided in a letter to CanGEA dated December 4, 2013, in which then Energy Minister, Ken Hughes indicated that the alternative and renewable energy policy framework (the "framework"), which is discussed in the paper, "is not intended to immediately put forward specific policies, but rather highlight where focused work should occur. This would include potential opportunities around geothermal." In the next paragraph of the letter it was acknowledged that Alberta has "a well-developed process for licensing and leasing petroleum and natural gas owned by the Government of Alberta for development" but "Alberta does not yet have a process for permitting geothermal projects."

If one considers the above-mentioned statements it would appear that the Government of Alberta is certainly aware of the lack of a geothermal regime in the province, which means it is realistic that the omission may be identified as an area requiring "focused work" in the framework. If this does happen, Alberta may soon be exploring how to implement legislation and regulation tailored to the geothermal industry. Developing effective legislation is painstaking work, but this paper can serve as a starting point for any future work that takes place in this area. Any legislative work that does commence should involve thorough industry consultation.

On the Federal front, aside from renewed support from a program such as the former ecoENERGY for Renewable Power or renewed geological exploration, the Government of Canada has the power to promote geothermal development through amendments to the Federal *Income Tax Act* and its regulations. Specifically, the geothermal industry seeks to emulate certain tax advantages currently provided to the oil and gas industry. Current areas worth exploring include the use of flow-through shares and provisions allowing for accelerated capital cost allowance when dry wells are drilled. There has been some interest in the Senate of Canada about putting a bill forward, which would provide some of the tax advantages afforded to the oil and gas industry to the geothermal industry. In fact, on November 28, 2013 Senator Grant Mitchell gave a speech to the Canadian Senate for the purpose of calling attention to the important role that geothermal energy could play in Canada, although the speech does not specifically address the issue of tax incentives.**

** Senator Grant Mitchell, "Speeches – Geothermal Energy" (28 November 2013), online: Senator Grant Mitchell <http://senatorgrantmitchell.ca/speeches/20034.aspx>.

Acknowledgements

The Institute would like to thank Mitacs, the Canadian Geothermal Energy Association, the Alberta Law Foundation, and Cenovus Energy for their generous support in the development of this occasional paper.

List of Abbreviations

AER	Alberta Energy Regulator
AGS	Alberta Geological Survey
bbl	barrel
CanGEA	Canadian Geothermal Energy Association
CASA	Clean Air Strategic Alliance
CH_4	methane
CO_2	carbon dioxide
CSUR	Canadian Society for Unconventional Resources
DEEPCorp.	Deep Earth Energy Production Corp.
EGS	engineered geothermal systems or enhanced geothermal systems
eq/kWhe	equivalent per kilowatt hour electricity
ERCB	Energy Resources Conservation Board
GEA	Geothermal Energy Association
GHG	greenhouse gas
GJ	gigajoule
GSC	Geological Survey of Canada
GWh	gigawatt hour
kWh	kilowatt hour
M & IM Tenure Reg	*Metallic and Industrial Minerals Tenure Regulation*
MW	megawatt
MWe	megawatt of electricity
MWh	megawatt hour
MWth	megawatt of electricity of thermal heat
NPV	net present value
ORC	Organic Rankine Cycle
P & NG Tenure Reg	*Petroleum and Natural Gas Tenure Regulation*
PV	photovoltaic
REDA	*Responsible Energy Development Act*

SAAEP	Southern Alberta Alternative Energy Partnership
WCSB	Western Canada Sedimentary Basin

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1.0 What is Geothermal Energy?

The term "geothermal" simply means "earth heat".[1] This paper focuses on sources of heat energy that originate from the earth itself, rather than from solar energy, or waste heat from industrial processes. Specifically, "Direct Use" and high temperature power will be discussed. These are the technologies promoted by the Canadian Geothermal Energy Association (CanGEA). Direct Use involves using water that is between 20˚C and 150˚C in residential, industrial, or commercial applications.[2] High temperature power involves using higher temperature geothermal resources to generate electricity. Anywhere on Earth when a hole is drilled the prevailing temperature will increase with depth, an increase of approximately 30˚C/km is the global average.[3] It is this heat energy that can be extracted and put to use, that will be the subject of this paper.

2.0 Alberta's Geothermal Resources

Canada is endowed with substantial geothermal resources and Alberta is one of the provinces that has significant potential for generating geothermal electricity. The Geological Survey of Canada (GSC) has indicated that "in-place geothermal power exceeds one million times Canada's current electrical consumption". Factors such as drilling technology leave only a fraction of this amount accessible to developers. However, despite this, the geothermal resource available for development remains considerable.[4]

In May of 2006, *The PEG*, the official publication of the Association of Professional Engineers and Geoscientists of Alberta, reported on work completed by the Alberta Research Council and the Alberta Geological Survey. This work relates to the economic feasibility of harnessing the province's geothermal resources.[5] The preliminary estimates indicated that "given current technologies — the potential energy locked in Alberta's geothermal waters is two to five trillion barrels of oil equivalent."[6]

Alberta's mineral resources are located within the Western Canada Sedimentary Basin (WCSB). This basin ranges from northeast British Columbia, through to southern Saskatchewan, and encompasses almost the entire province of Alberta in-between.[7] At some locations, within this basin at depths of only 3 km, temperatures in excess of 150˚C

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[1] Canadian Geothermal Energy Association (CanGEA), "Geothermal Energy" (12 January 2013) [CanGEA, "Geothermal Energy"], online: CanGEA <http://www.cangea.ca/geothermal-energy/>.

[2] US Department of Energy, "Direct Use of Geothermal Energy" (3 August 2013) [US Dept of Energy, "Direct Use"], online: <http://www1.eere.energy.gov/geothermal/directuse.html>.

[3] CanGEA, "Geothermal Energy", *supra* note 1.

[4] S Grasby et al, *Geothermal Energy Resource Potential of Canada* (Ottawa: Natural Resources Canada, 2012) at VII, 218 & 219.

[5] The resources considered included both low temperature (10˚C to 40˚C) to medium temperature (40˚C to 140˚C) geothermal resources.

[6] SR Eaton, "Alberta Gets Into Hot Water" (May 2006) *The PEG*.

[7] Grasby et al, *supra* note 4.

can be found.[8] Northern Alberta contains many locations suitable for generating electricity. One reason for this is the basement heat-flow distribution, ranges from less than 40 MW/m^2 in southern Alberta to more than 80 MW/m^2 in northern Alberta.[9] A non-exhaustive list of locations that researchers have identified as being suitable for electrical generation include areas around Rainbow Lake, Fort Simpson, Watson Lake, Hay River, Lac La Biche, Hinton and Edson.[10]

In addition to providing co-production opportunities, the province's oil and gas industry has other spin off benefits that have the potential to help foster a provincial geothermal industry. The oil and gas industry has generated an immense amount of information about the WCSB.[11] For example, the Viking formation had been penetrated by 189,000 wells, as of 2006, this included 60,000 producing wells, 100,000 abandoned wells and 20,000 suspended wells. These wells have revealed that "from east to west geothermal potential — between 1,000 to 3,000 metres. Correspondingly, the Viking's geothermal aquifers range in temperature from 33 to 99C." *The PEG* has reported that the Viking Formation is "a prime candidate for geothermal energy extraction."[12] Even in Southern Alberta, where the geothermal resource is relatively cool, the Southern Alberta Alternative Energy Partnership (SAAEP) wants to take advantage of the efforts of the oil and gas industry. The SAAEP promotes the idea of using abandoned wells for Direct Use purposes.[13]

Recent work done by CanGEA indicates that Alberta has a significantly larger geothermal resource than previously thought. Previous estimates, based on work done by Dr. Mory Ghomshei, concluded that Alberta has the potential to produce between 500 and 1,000 MW of electricity from its high-grade conventional geothermal resources.[14] According to CanGEA at a depth of 2,500 metres, Alberta's theoretical geothermal resource potential is 41,000 MW and its technical geothermal resource potential is

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[8] Grasby et al, *ibid*.

[9] S Bachu & RA Burwash, "Chapter 30: Geothermal Regime in the Western Canada Sedimentary Basin" in G Mossop & I Shetsen, Comps, *Geological Atlas of the Western Canada Sedimentary Basin* (Edmonton: Alberta Geological Society, 1994), online: AGS <http://www.ags.gov.ab.ca/publications/wcsb_atlas/a_ch30/ch_30.html>.

[10] Grasby et al, *supra* note 4; J Majorowicz & S Weides, "Is it Feasible to Use Engineered Geothermal Systems to Produce Electrical Energy in the Alberta Basin" (Fall 2012) 3 CanGRC Review 2-3. Some of the listed locations would require the use of engineered geothermal systems (EGS) technology.

[11] Grasby et al, *ibid*.

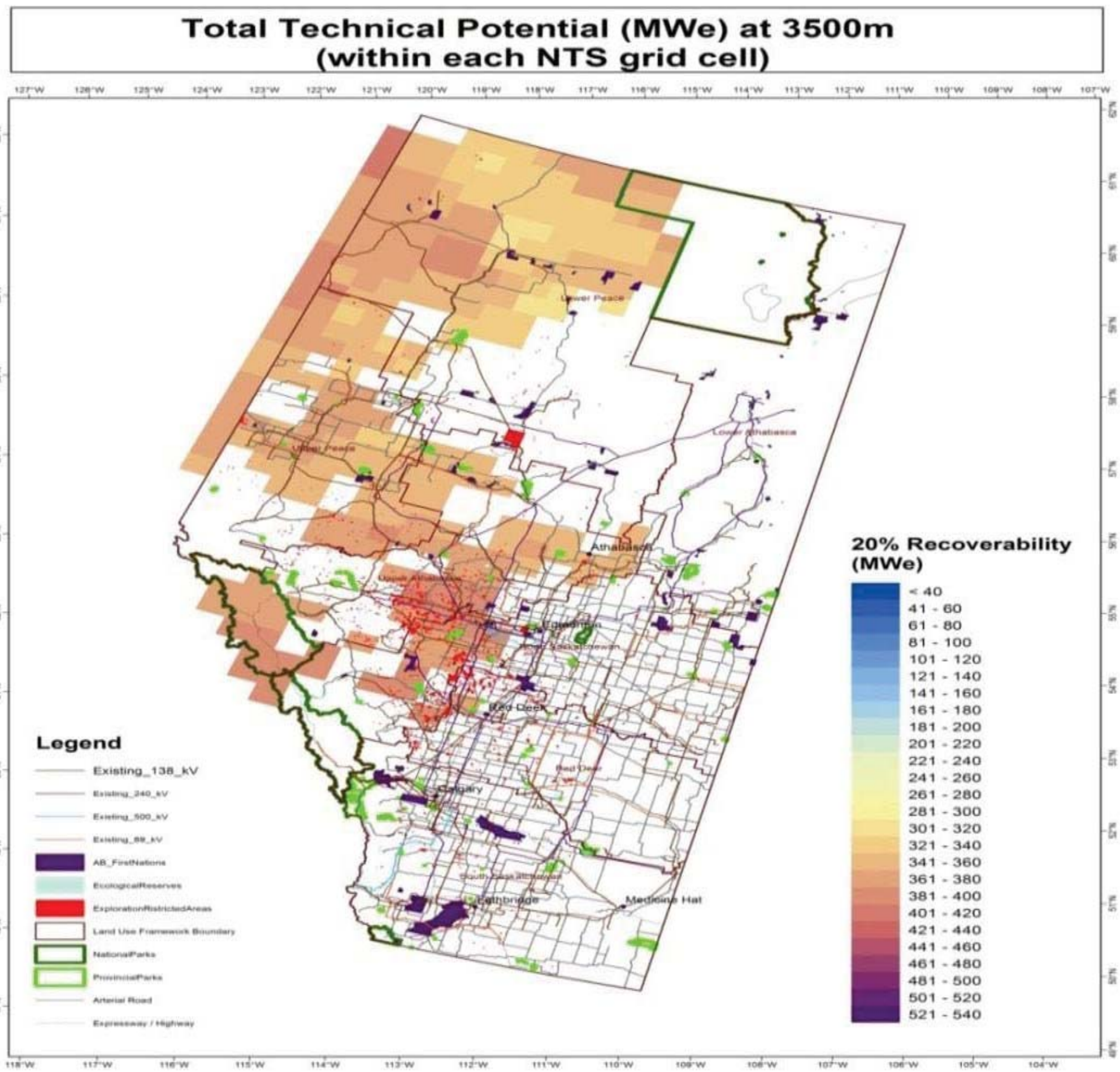
[12] Eaton, *supra* note 6.

[13] Western Sky Management Associates Inc, *Geothermal Energy: Southern Alberta* (Lethbridge: SAAEP, April 2009), online: SAAEP <http://www.saaep.ca/geothermalenergy.pdf>.

[14] CanGEA, "CanGEA WREZ Qualified Resource Area" (5 December 2009), Western Governors Association <http://www.westgov.org/reports/search_result?search_phrase=cangea&catid=0&ordering=newest&search_mode=any&search_where%5B%5D=search_name&search_where%5B%5D=search_description>; AD Woodbury, "Commentary: What Ever happened to Geothermal Energy" (13 January 2013), online: <http://home.cc.umanitoba.ca/~woodbur/commentary.pdf>.

conservatively between 4,200 and 11,800 MW.[15] "Theoretical potential" is defined by "the physically usable energy supply over a certain time span in a given region. It is defined solely by the physical limits of use and thus marks the upper limit of the theoretically realizable energy supply contribution." Whereas, "technical potential" is defined as "the fraction of the theoretical potential that can be used under the existing technical restrictions

Figure 1: Total Technical Potential (MWe) in Alberta at 3500 m



*Reproduced with the permission of CanGEA.

[15] CanGEA, "Canadian National Geothermal Database – Alberta Favourability Map" (March 2013) [CanGEA, "Canadian Geothermal Database"], online CanGEA <http://www.cangea.ca/cngd-data/>.

… structural and ecologic restrictions as well as legal and regulatory allowances."[16] It is notable that all of CanGEA's recent figures were derived using *The Canadian Geothermal Code for Public Reporting* (the "Code"). The Code "outlines the requirements for reporting Exploration Results, Geothermal Resources and Geothermal Reserves and provides a minimum set of requirements for public reporting of Geothermal Resource and Reserves."[17] In 2009, prior to CanGEA's new estimates, PricewaterhouseCoopers LLP completed a report for Alberta Environment entitled, *Assessment of Selected Renewable Energy Technology and Potential in Alberta: Final Report*. In this report it was concluded that the physical characteristics needed to support Geothermal and EGS were "complementary to Alberta's existing physical environment."[18] CanGEA's recent estimates lend additional credence to the conclusion of PricewaterhouseCoopers. CanGEA has produced a favourability map that shows large portions of the province with technical potential within 3.5 km of the surface. See Figure 1 above.

2.1 Benefits of Using Geothermal Resources

2.1.1 Environmental Benefits

There are numerous benefits associated with geothermal relative to both fossil fuels and other renewables. Geothermal power plants often use no fresh water or in some cases a minor amount is used, relative to other forms of electrical generation.[19] Sedimentary basins, like the WCSB, tend to produce highly saline water or brine.[20] Further, closed-loop binary systems re-inject all of the water they use back into the formation it came from. Geothermal energy is also renewable, unlike some other resources such as oil and gas obtained from the earth's crust. However, this renewability depends on ensuring that the rate of energy extraction remains in balance with a reservoir's naturally occurring heat recharge rate. Geothermal plants do not have the problem of intermittency like solar and wind power and thus, can complement these other renewable resources. Geothermal plants provide 24/7 baseload power. Sources of electricity such as wind, solar PV (photovoltaic) and coal also have larger surface footprints than geothermal sources. Geothermal power needs about 1046 km^2 for each GWh (gigawatt hour) produced. The respective numbers for wind, solar PV and coal are 3,457.63 km^2, 8,384 km^2 and 9,433 km^2. Operating closed-loop binary systems can entirely eliminate greenhouse gas (GHG) emissions. Further, such binary

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[16] G Beardsmore et al, "A Protocol for estimating and mapping the global EGS potential" (2010) 34 Geothermal Resources Council Transactions 301-312.

[17] L Deibert et al, *The Canadian Geothermal Code for Public Reporting* (Calgary: CanGEA, 2010) [Code].

[18] PricewaterhouseCoopers LLP, Assessment of Selected Renewable Energy Technology and Potential in Alberta: Final Report (Edmonton: Alberta Environment, 2009) at 5.

[19] Canmet Energy, Sector Profile: An Assessment of the Geothermal Energy Sector in Canada – Now and in the Future (Ottawa: Natural Resources Canada, 2013).

[20] CanGEA, "Canadian Geothermal" (2012), online: <http://www.cangea.ca/canadian-geothermal/>.

systems have relatively low life cycle GHG emissions. Even solar PV produces four times the life cycle GHG emissions of a closed-loop geothermal system. Natural gas plants produce 6 to 20 times the life cycle GHG emissions of a closed-loop geothermal system. A closed loop geothermal system produces life cycle GHG emissions of only 50 g CO_2 eq/kWhe (equivalent per kilowatt hour electricity).[21] According to the CanGEA:

> Given some provinces heavy reliance on coal as an electricity source, if geothermal was to contribute to the grid, it is expected that for every 500 MW of installed capacity running at 90% uptime in Alberta, for example, 2.7 megatonnes of CO_2 equivalent would be averted.[22]

2.1.2 Potential Benefits for Northern and First Nations Communities

In Fort Liard, Northwest Territories, there is one proposed project that aims to fulfill the energy needs of the community by taking advantage of local geothermal resources. The project is a joint venture between the Acho Dene Koe First Nation and the company Borealis GeoPower, meaning the community is in a position to drive direct economic benefit. These joint venture partners are also collaborating with the Government of Canada.[23]

Phase I of the project would create approximately 1 MWe (megawatt of electricity) of electrical power delivered to about 750 homes and phase II would see about 1 MWth (megawatt of electricity of thermal heat) of direct heat delivered to these homes. At present negotiations are underway "with the federal government for formal contribution agreements and conditions on how funding will be delivered."[24]

According to Natural Resources Canada:

> This project will demonstrate how a northern community can use a Geothermal resource to generate electricity and heat thereby reducing the entire community's fossil fuel demand and reduce energy costs. A successful demonstration will provide a model for other Northern and First Nations communities with available geothermal resources.[25]

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[21] US Dept of Energy, Energy Efficiency & Renewable Energy, "Energy Basics" (24 January 2013), online: <http://www1.eere.energy.gov/geothermal/geothermal_basics.html>; P Holroyd & J Dagg, *Building a Regulatory Framework for Geothermal Energy Development in the NWT: A Report for the Government of Northwest Territories, Environment and Natural Resources Department* (Drayton Valley: The Pembina Institute, March 2011).

[22] CanGEA, *Canada Country Update: IEA-GIA Annual Report 2012* (2012), online: CanGEA <http://www.cangea.ca/wp-content/uploads/2013/06/2012-Ann-Rept-CanGEA_Short-Version.pdf>.

[23] Holroyd & Degg, *supra* note 21.

[24] CanGEA, *Canadian Geothermal Projects Overview 2013* (January 2013) at 20 [CanGEA, *Projects Overview 2013*], online: CanGEA <http://www.cangea.ca/wp-content/uploads/2013/01/CanGEA_Canadian GeothermalProjects2013_final.pdf>.

[25] Natural Resources Canada, "Renewable Energy and Clean Energy Systems Demonstration Projects" (April 2012), online: <http://www.nrcan.gc.ca/energy/science/programs-funding/1514#_Community-Based _Geothermal_Demonstr>.

The production of geothermal electricity also has a unique characteristic that makes it suitable for application in Canada's north. An increase in the difference between the temperatures of a geothermal resource and the ambient air results in increased electricity production. Thus, the colder it is outside the more electricity a geothermal power plant can produce.[26] This makes geothermal power ideal for northern communities for two reasons, peak power demand in the winter matches peak power production and the further north it is the colder the winters tend to be.

Given the northerly location of some of Alberta's best geothermal resources, there may be some potential to benefit First Nations communities in northern Alberta. However, unlike British Columbia, which has 86 off-grid communities, Alberta only has two off-grid communities, which are "non-Aboriginal settlements that are inter-tied together and are powered by a 1.45 MW diesel power plant supplying 533 persons". These communities are Peerless Lake and Trout Lake.[27] If suitable geology is present near these two communities, a Fort Liard like project may be possible. Further, there may still be advantages to developing combined heat and power projects in other northern and First Nations communities, even if they are connected to the grid. See Figure 1, which shows where First Nations Lands (in purple) are relative to Alberta's best geothermal resources.

2.1.3 Avoiding the Social Costs of Fossil Fuels

Currently, coal and natural gas are the source of most of the province's generating capacity. Although, some renewable energy exists in the province's power mix. Figure 2, below, shows the current mix of the province's generating capacity.

In addition to the electricity generated in Alberta, the province is also importing electricity from two other provinces. As of November 2012, Alberta was importing 750 MW from British Columbia and another 150 MW from Saskatchewan.[28]

In March of 2013, The Asthma Society of Canada, Canadian Physicians for the Environment, The Lung Association of Alberta and the Northwest Territories and the Pembina Institute issued a research report entitled, *A Costly Diagnosis: Subsidizing Coal Power with Albertans' Health* (the "Cost Report"). The Report concludes that there is a clear link between exposure to pollutants, from coal-fired electricity generation, and "higher morbidity and premature mortality from respiratory and cardiovascular illnesses". It is reported that as a result of these health consequences, the health related cost of coal-fired electricity generation, borne by Albertans, is 0.7 to 2.1¢/kWh (kilowatt hour).[29]

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[26] Holroyd & Degg, *supra* note 21.

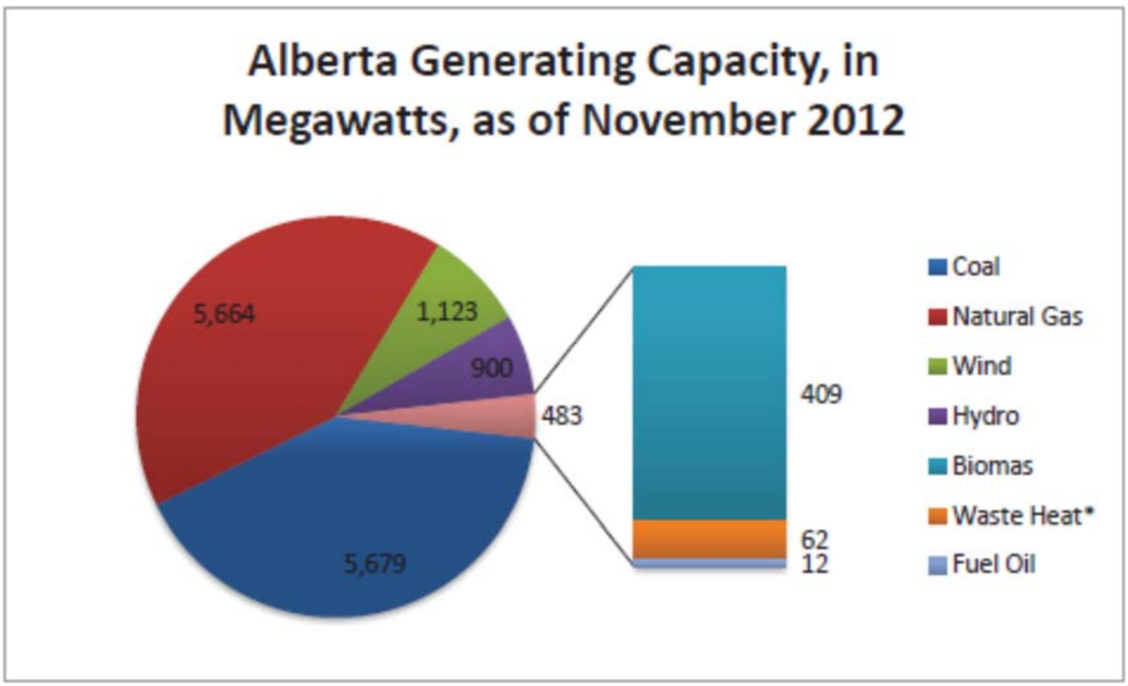
[27] Government of Canada, *Status of Remove/Off-Grid Communities in Canada* (August 2011), online: <http://publications.gc.ca/collections/collection_2013/rncan-nrcan/M154-71-2013-eng.pdf> at 4 &19.

[28] Alberta Energy, "Electricity", *infra* note 31.

[29] K Anderson et al, *A Costly Diagnosis: Subsidizing Coal Power with Albertan's Health* (The Pembina Foundation, The Asthma Society of Canada, The Canadian Association of Physicians for the Environment, The Lung Association, Alberta & Northwest Territories and The Pembina Institute, 2013) at 61-63 [Cost Report], online: Pembina Institute <http://www.pembina.org/pub/2424>.

The Cost Report also considers the "social cost of carbon" originating from coal-fired electricity generation in the province. The social cost of carbon takes into account the global costs associated with GHG emissions such as "changes in net agricultural productivity, effects on human health, property damages from increased flood risk, and the value of ecosystem services". The Report indicates that globally the social cost of carbon, from Alberta coal plants, amounts to between 2.9 to 11.6 ¢/kWh. These figures are added to the health care related costs, mentioned above, to arrive at the total societal cost of coal fired electricity in Alberta. The sums indicate that the total societal cost of coal is somewhere between 3.6 and 13.7¢/kWh. These figures can be added to the average pool price to find the total cost of the electricity, with the listed externalities factored in.[30]

Figure 2: Alberta Generating Capacity, in Megawatts, as of November 2012



*Waste heat generation is a system that produces electricity from a heat source that is a by-product of an existing industrial process, this heat would have been otherwise wasted).[31]

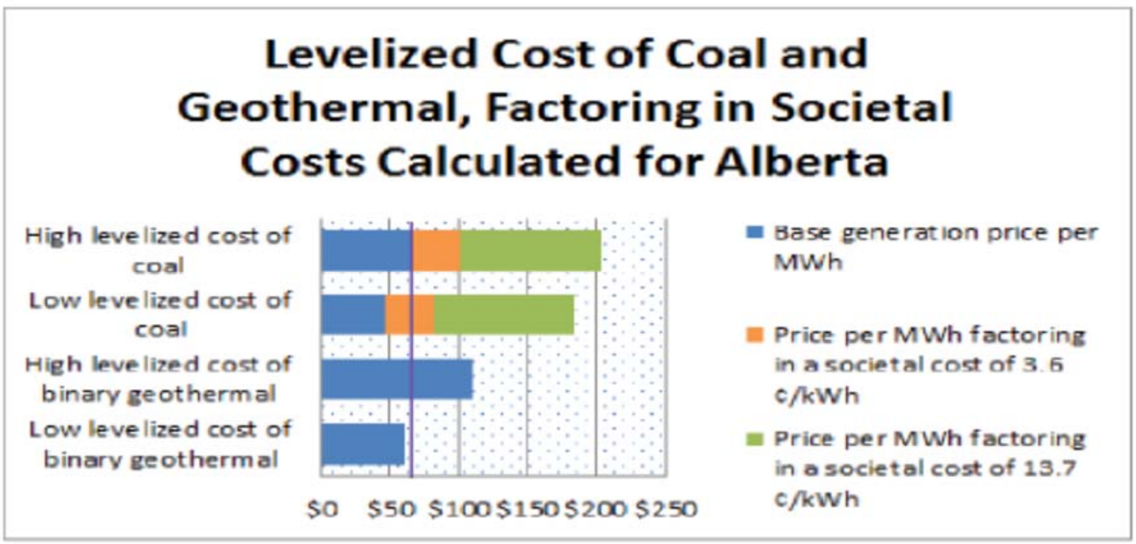
As mentioned earlier binary geothermal plants can run emission free. Thus, it is arguable that utilizing geothermal energy, instead of coal in Alberta could eliminate the negative externalities factored into the Cost Report. It is true that the levelized costs of producing electricity from of a binary geothermal plant do tend to exceed the levelized

[30] Cost Report, *supra* note 29 at 61-62.

[31] Alberta Energy, "Electricity Statistics" (2013) [Alberta Energy, "Electricity"], online: <http://www.energy.alberta.ca/Electricity/682.asp>.

costs of coal-fired generation. In the United States, the average levelized production costs of a binary geothermal plant ranges from $60/MWh (megawatt hour) to $110/MWh. Whereas, the range for coal-fired generation is from $46/MWh to $66/MWh.[32] However, the above calculated societal cost of 3.6 to 13.7 ¢/kWh equates to an additional cost of $36/MWh to $137/MWh. For context the average electricity pool price in Alberta, for the years 2008 through to and including 2012, was $66/MWh. The levelized cost is being provided in US dollars, whereas, societal cost and pool prices are in Canadian dollars. Parity can be assumed given that in 2012 the average value of $1 US in Canadian dollars was $0.99958008.[33] Figure 3 shows that even when a price from the lowest end of the societal cost spectrum is considered, geothermal electricity becomes cost competitive.

Figure 3: Levelized Cost of Coal and Geothermal, Factoring in Societal Costs Calculated for Alberta



*Note that the purple line in Figure 3 represents the average pool price for the years 2008 through and including 2012. Further, note that for the purposes of Figure 3 it is being assumed that the Canadian and US dollars are at parity.[34]

Other studies have confirmed that electricity produced from coal-fired plants is associated with significant negative externalities relative to geothermal electricity. In a 2005 article published in *The Electricity Journal*, Alyssa Kagel and Carl Gawell quantify the positive economic externalities of avoided air emissions, attributed to installed geothermal electrical generation in the United States. The paper acknowledges the positive

[32] Levelized cost estimates are in US dollars/MWe. Canmet Energy, *supra* note 19.

[33] Bank of Canada, “Financial Markets Department Year Average of Exchange Rates” (2013), online: Bank of Canada <http://www.bankofcanada.ca/stats/assets/pdf/nraa-2012.pdf>.

[34] Canmet Energy, *supra* note 19 at 13-14; Cost Report, *supra* note 29 at 61-62; and Alberta Energy, “Electricity”, *supra* note 31.

externalities associated with, "the balance of trade and national security externality benefits of developing a domestic energy source like geothermal energy", but these benefits are not ultimately factored into their final figures. Rather their figures are exclusively associated with negative externalities from air emissions. Based on previous studies, the paper establishes a mid to low market price for nitrogen oxide ($2,250/ton), sulfur dioxide ($300/ton), and carbon dioxide ($10/ton). These figures were then multiplied by the total tonnage of avoided emissions in each category.[35] The final implications drawn are that "the total positive externality just from avoided air emissions is $255.4 million" and that:

> While this calculation is very rough, it provides an approximation of the externality value of geothermal power production. Assuming average annual geothermal power production of 15 billion kWhrs in the U.S., this equivalent air emissions total represents roughly 1.6 cents/kWh in value that is not recognized in the market price of geothermal power. If geothermal received a value such as this for its externalities, the U.S. would benefit from a dramatic increase in geothermal development.[36]

In April 2013, the Geothermal Energy Association (GEA), based in Washington DC, built on the work of Kagel and Gawell (the "GEA Report). The work by the GEA cites two significant deviations from the work of Kagel and Gawell. The first deviation is that updated emissions data is used. The second deviation is that the analysis goes into more depth by considering the emissions of additional pollutants and costs associated with both natural gas and coal. The GEA Report, for example, factors in CH_4 (methane) emissions.[37] The GEA Report also considers other costs associated with natural gas and coal, which include "the environmental, health, and security costs associated with generating power from fossil fuels instead of geothermal". With the consideration of these extra factors it was concluded that "the benefit of producing power using geothermal sources, as opposed to fossil fuels, is 0.1¢/kWh for natural gas, and 3.5¢/kWh for coal. Using these figures it was calculated that Nevada receives a $29.1 million externality benefit from geothermal power each year and California receives an $87.5 million benefit.[38]

Both the GEA Report and the Cost Report support the argument that an externality cost of approximately 3.5 ¢/kWh to 3.6 ¢/kWh can be attributed to coal fired generation. Alberta

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[35] A Kagel & K Gawell, "Promoting Geothermal Energy: Air Emissions Comparison and External Analysis" (August-September 2005) 18:7 The Electricity Journal 90-99 at 97 [GEA Report].

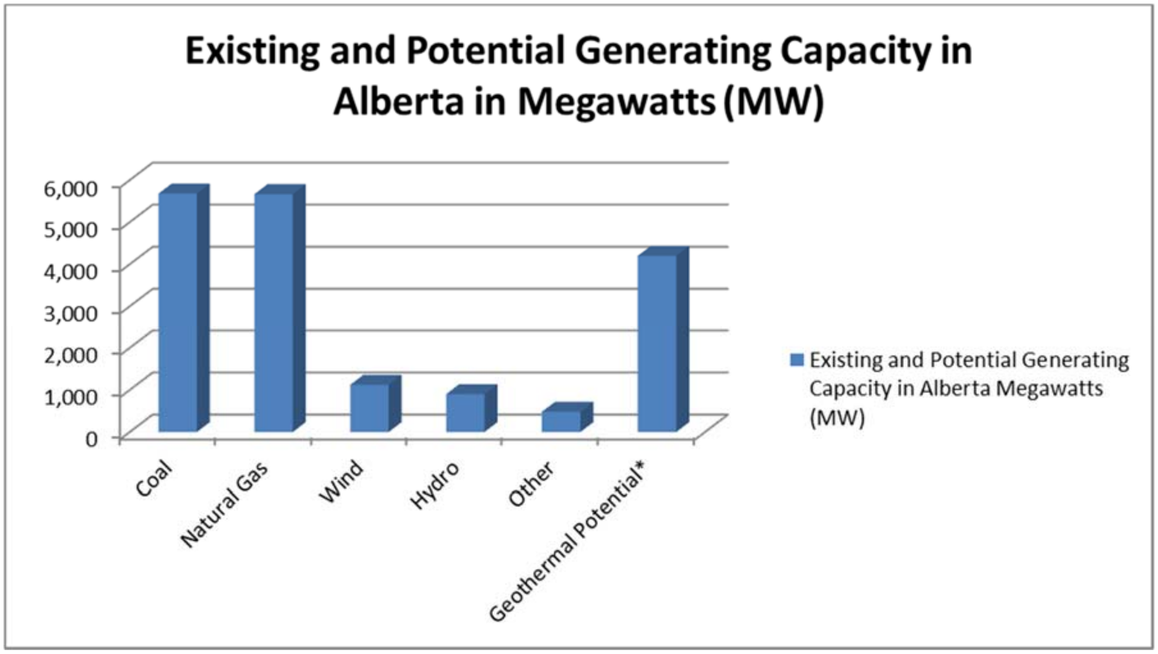
[36] GEA Report, *ibid* at 97.

[37] It is notable that CH_4 is a powerful GHG and, depending on the source cited, it has a global warming potential that is between 21 and 25 times greater than CO_2 (over a 100-year time scale), the former figure is provided by the United States Environmental Protection Agency and the latter is provided by the Intergovernmental Panel on Climate Change. US Environmental Protection Agency, "Overview of Greenhouse Gases: Global Warming Potential Describes Impact of Each Gas" (31 August 2012), online: EPA <http://www.epa.gov/climatechange/ghgemissions/gases.html>. Intergovernmental Panel on Climate Change, "Climate Change 2007: Working Group I: The Physical Science Basis", online: IPCC <http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html>.

[38] B Matek, Promoting Geothermal Energy: Air Emissions Comparison and Externality Analysis (Washington, DC: GEA, April 2013) at 10-11 & 13-14.

currently generates 5,679 MW of electricity from coal and estimates suggest that the province has technical geothermal resources of between 4,200 and 11,800 MW within 2.5 km of the surface. This serves to highlight the fact that it is realistic that Alberta could, in time, substantially replace coal fired electricity generation with geothermal generation.

Figure 4: Existing and Potential Generating Capacity in Alberta Megawatts (MW)



*Based on CanGEA's most conservative estimate.[39]

2.2 How is Geothermal Energy Accessed?

In certain locations, upon drilling deep into the earth's crust, porous rock is encountered and sometimes water is encountered within pore spaces. When this occurs at depths sufficient to heat the water to a useable temperature, specialized equipment can be used to extract the heated water so that it can be put to use for heating and electricity generation.[40]

In other locations, Enhanced Geothermal Systems (EGS) must be employed to access geothermal energy. EGS involves novel applications of technology and allows for the reintegration of depleted reservoirs or the utilization of drier reservoirs. First deep wells are drilled and fractured to increase porosity and permeability and then additional water is added to create a geothermal reservoir. Some attempts to apply these methods have met with success in Europe, Australia and the United States. By 2050, a study from the

[39] Alberta Energy, "Electricity", *supra* note 31; CanGEA, "Canadian Geothermal Database", *supra* note 15.

[40] CanGEA, "Geothermal Energy", *supra* note 1.

Massachusetts Institute of Technology predicts that approximately 100,000 MW of power supplied from EGS sites could be in place in the United States.[41]

2.3 Ways Geothermal Hot Water can be put to Beneficial Use

2.3.1 Direct Use

The temperature range of the geothermal water determines how it can be used. Again, water that ranges from about 20˚C to 150˚C can be put to Direct Use, in residential, industrial or commercial applications.[42] Some specific examples include fish farms, food processing facilities and greenhouses.[43] Direct Use applications use systems of piping, controls and heat exchangers to deliver heat to a space (i.e. a greenhouse), an industrial process or a district heating system. District heating systems distribute hot water, for space heating purposes, to several individual houses, buildings, or blocks of buildings.[44] A survey conducted in the United States identified:

> … 271 collocated sites — cities within 5 miles (8 kilometers) of a resource hotter than 122 degrees F (50 degrees C) — that have excellent potential for near-term direct use. If these collocated resources were used only to heat buildings, the cities have the potential to displace 18 million barrels of oil per year.[45]

2.3.2 Conventional/Flash System and Dry Steam Systems

Water that exceeds 180˚C can be used to produce electricity using a Conventional/Flash System or Dry Steam Systems. In Conventional/flash systems, once the hot water arrives at the surface it enters a low pressure chamber, which causes it to "flash" into steam. The resulting steam is used to drive a generator. Condensed steam is then released into the environment as water vapour or it is re-injected into the geothermal reservoir. Dual flash systems are designed in a manner that allows the fluid to be flashed twice. After being used in these systems the water can often still be used in a Direct Use system.[46] Dry Steam Systems are used when the resource yields steam that can directly drive a generator.[47] The largest share of the world's installed geothermal electric capacity is from high temperature (or high-enthalpy) geological sites (i.e. Italy, Iceland, United States and Indonesia).[48] It is at these high enthalpy sites that Conventional/Flash and Dry Steam Systems are used. In

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[41] Holroyd & Degg, *supra* note 21.
[42] US Dept of Energy, "Direct Use", *supra* note 2.
[43] Holroyd & Degg, *supra* note 21.
[44] US Dept of Energy, "Direct Use", *supra* note 2.
[45] US Dept of Energy, "Direct Use", *ibid*.
[46] Holroyd & Degg, *supra* note 21.
[47] Grasby et al, *supra* note 4.
[48] S Frick, M Kaltschmitt & G Shroder, "Life Cycle Assessment of Geothermal Binary Power Plants Using Enhanced Low-temperature Reservoirs" (May 2010) 35:5 Energy 2281-2294; Grasby et al, *ibid*.

fact, approximately half of the world's geothermal electricity is produced at just six high temperature fields.[49]

2.3.3 Binary Systems

When the above described water to steam cycle is not practical, it is considered technically and economically feasible to use a binary Organic Rankine Cycle (ORC).[50] One alternative binary system is the proprietary Kalina Cycle. Lower temperature (low-enthalpy) geothermal resources, typically 150˚C or less, use binary systems to produce electricity.[51] The lowest temperature at which a binary system has been successfully used is 74˚C; this was done at the Chena Hot Springs Resort in Alaska.[52]

How a typical binary plant works can be explained in general terms. The first thing to note is that throughout the process the geothermal water is transported in a closed pipeline. This means that the geothermal water remains in the same piping from the time it exits the production well until the time it reaches a reinjection well. This piping first transports the water from the production well to heat exchangers. The heat exchangers transfer heat energy to a secondary working fluid that has a lower boiling point than water, such as an organic fluid. This second fluid remains in a separate system of pipes. The transfer of heat causes the secondary fluid to evaporate and the resulting vapour drives a turbine generator unit. The secondary fluid is then condensed and reused. Sometimes the geothermal water is then run through a second heat exchanger downstream, if it is being used in a Direct Use scheme. Finally, the geothermal water is pumped back into a reinjection well.[53] The closed-loop system ensures that emissions are low or negligible and it reduces the risk that any other sources of water could be contaminated.[54]

Binary geothermal plants are not exceptionally efficient systems, but this means there is room for improvement. Currently, the efficiency at which a typical binary geothermal plant converts heat into work energy is only about 8-12%.[55] Ultimately, it takes about 3,785 litres/minute of geothermal water at 120˚C to produce a single megawatt of electrical power.[56] Relative to a theoretically idealized plant existing binary plants have only

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[49] Grasby et al, *ibid*.

[50] R Gabbrielli, "A Novel Design Approach for Small Low Enthalpy Binary Geothermal Power Plants" (December 2012) 64 Energy Conservation and Management 263-272.

[51] R DiPippo, "Second Law Assessment of Binary Plants Generating Power from Low Temperature Geothermal Fluids" (2004) 33:5 Geothermics 565-586 [DiPippo, 2004].

[52] J Plaskov, "Geothermal's Prior Appropriation Problem" (Winter 2011/2012) 8:2 U Colo L Rev 257-306.

[53] Frick, Kaltschmitt & Shroder, *supra* note 48.

[54] Holroyd & Degg, *supra* note 21.

[55] DiPippo, 2004, *supra* note 51.

[56] K Callison, "Water and Geothermal Energy Development in the Western US: Real World Challenges, Regulatory Conflicts and Other Barriers, and Potential Solutions" (2009-2010) 22:2 Pacific McGeorge Global Business & Development Law Journal 301-322.

achieved efficiencies of about 55% ± 10%.[57] However, according to the GEA binary plant technology has improved significantly over the years and the trend is expected to continue. For example binary systems now operate at lower temperatures than scientists ever thought was possible.[58] Looking forward, Ormat (the world's largest binary plant manufacture) indicates that improvements can be made to the ORC. Ormat notes that "[t]he recuperated Organic Rankine cycle is typically 10-15% more efficient than the simple Organic Rankine cycle", and that an advanced Organic Rankine Cycle using a secondary organic loop, "generates an additional 5 to 8% electrical power".[59] A study published in the journal *Geothermics* indicated that a Kalina Cycle plant can produce 3% greater electrical outputs than an ORC plant, provided the same heat input. The article in *Geothermics* further points out that ORC technology is significantly more mature than the Kalina Cycle technology.[60]

If geothermal electricity is produced in Alberta then binary cycle plant technology will be used.[61] Exploration will focus on the discovery of geothermal aquifers, in the WCSB that exceed 80˚C.[62] For this reason Alberta stands to benefit from the expected improvements in binary technology.

2.3.4 Co-production

The binary units described above, in certain scenarios, can be utilized in oil and gas development. Given the size of the oil and gas industry in Alberta, co-production represents a major opportunity for the province. A substantial amount of water is often produced along with oil and gas. Prior to refining, this water must be removed from the oil or gas. Currently, the water is considered a waste product and it is associated with unwelcome disposal costs. If the "waste water" is warm enough, it is possible prior to disposal or reinjection to run it through a binary system to generate electricity. This is a relatively simple process that eliminates the need for major expenses such as drilling and hydrofracturing operations. The electricity generated can then be used in existing systems needed for oil and gas extraction; thus, reducing the energy demand of a specific well.[63]

There is ground breaking work being completed on co-production in the United States. In Casper, Wyoming, at the Rocky Mountain Oil Testing Center, a 0.25 MW geothermal hydrocarbon coproduction unit has been installed. It is estimated that the unit will pay for itself, within seven years, and that it has the potential to turn a profit of $2.5 million over

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[57] R DiPippo, "Ideal thermal efficiency for geothermal binary plants" (June 2007) 36:3 Geothermics 276-285.

[58] A Kagel, *The State of Geothermal Technology* (Washington, DC: GEA, 2008).

[59] U Kaplan, *Advanced Organic Rankine Cycles in Binary Geothermal Power Plants* (Reno, NV: Ormat Technologies, November 2007), online: <http://www.ormat.com/research/papers/papers3>.

[60] DiPippo, 2004, *supra* note 51.

[61] Grasby et al, *supra* note 4.

[62] CanGEA, *Projects Overview 2013*, *supra* note 24.

[63] Grasby et al, *supra* note 4.

25 years.[64] In North Dakota, the University of North Dakota is developing two ORC demonstration projects that "will demonstrate the use of binary, [ORC] technology to produce electricity from low temperature fluids." One will have an estimated capacity between 0.35 and 0.568 MW and the other one will have an estimated capacity of 0.25 MW.[65]

One project utilizing co-production has been proposed in Alberta, but at present is not proceeding, due to non-technical reasons. The proposed project was to be located in the Swan Hills area, northwest of Edmonton.[66] This region has particularly high temperatures (more than 120˚C) at the base of the sedimentary column.[67] Borealis GeoPower, Free Energy, Devon (Canada) and the Alberta government were collaborating on this research effort.[68] The GSC indicates that this project has the potential to "support growth for geothermal power production in oil fields across other regions of Canada where temperatures and flow rates support such technology."[69]

3.0 Addressing the Legislative Vacuum

A legislative vacuum currently exists in Alberta. Neither legislation nor regulation has contemplated how one can go about developing Alberta's geothermal resources to produce electrical power. This places Alberta at a similar stage of development as many American states were in the early 1980's, when there was a growing awareness that "[g]eothermal power is a significant potential source of energy" yet, they were facing "a significant legal problem in this area [being] the classification of geothermal power within the existing frame work of water law."[70] There is more work that needs to be done in this area even in the United States, but as a result of the work done in the country thus far:

> Over the last three decades the United States [US] [*sic*] geothermal power-generation industry has grown to be the largest in the world, with over 3,152 MWe of installed electrical capacity. This development is located predominately in the Western United States, in California, Nevada, and Utah, but geothermal energy development has also recently occurred in Alaska and Hawaii.[71]

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[64] Plaskov, *supra* note 52 at 303.

[65] GEA, *2013 Annual US Geothermal Power Production and Development Report* (Washington, DC: GEA, April 2013) at 29, online: <http://geo-energy.org/pdf/reports/2013AnnualUSGeothermalPowerProductionandDevelopmentReport_Final.pdf>.

[66] CanGEA, *Projects Overview 2013*, *supra* note 24.

[67] Bachu & Burwash, *supra* note 9.

[68] CanGEA, *Projects Overview 2013*, *supra* note 24.

[69] Grasby et al, *supra* note 4.

[70] WC Dresser, "The Effects of Geothermal Classifications on the Use and Development of Water: Conflicts between State and Federal Laws" (1981-1982) 33 Hastings LJ 427-455.

[71] CanGEA, *CanGEA Presents Policy Recommendations for Advancing Geothermal Energy in Canada* (Calgary: CanGEA, 2010) at 95 [CanGEA, *Policy Recommendations*].

Due to the successes achieved in the Western United States, this region will serve as the primary point of reference for this section of the paper. Back in 1985, Gordon Bloomquist, of the Washington State Energy Office indicated that:

> From an examination of how the state and federal governments have addressed the varying needs of geothermal development and how courts have interpreted some of their decisions, it is clear that in order to ensure that the legal and institutional framework is adequate to serve the needs of geothermal development, it must address, at minimum, the following topics: (1) providing developers with access and a priority right to carry out exploration and development activities; (2) characterization of the resource so as to minimize conflicts with other natural resources; (3) establishing ownership; and (4) giving careful consideration to such lease terms and rentals and royalties, lease renewals, and diligence requirements.[72]

Before any aspect of Bloomquist's framework is discussed it is important to outline geothermal energy's place in Alberta's political discourse, and which level of government is responsible for establishing a legislative framework for geothermal energy in Canada.

3.1 Geothermal Energy and Alberta Politics

In the 1970's, politicians were starting to take note of geothermal resources and the opportunities the source of energy played to help power our society. A 1970's quote, credited to United States congressman John P. Saylor, indicates that "geothermal resources promise to be a relatively pollution-free source of energy, and their development should be encouraged."[73] In 1977, Alberta MLA Frederick Bradley, a man who would eventually serve as Alberta's Minister of Environment, made the following remarks in the province's legislature:[74]

> In a province such as Alberta, blessed as we are with an abundance of energy resources, we are committing, along with the federal government, major funds to research enhanced recovery of oil and other alternatives to provide energy for the future as our non-renewable resources decline. There are several alternatives: solar, wind, geothermal, nuclear, and biomass to name a few.[75]

Since the time of Bradley's remarks geothermal remains one of the unrealized renewable energy options in Canada generally and in the Province of Alberta. In fact, Canada is one of the only countries in the Pacific Rim that is not producing electricity from its geothermal

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[72] GR Bloomquist, *A Review and Analysis of the Adequacy of the Legal and Institutional Framework for Geothermal Development in Washington State* (Olympia, WA: Washington State Energy Office, 1985), Abstract.

[73] Plaskov, *supra* note 52 at 257.

[74] J Glenn, *Once Upon an Oldman: Special Interest Politics and the Oldman River Dam* (Vancouver: UBC Press, 1999).

[75] Government of Alberta, *Alberta Hansard* (7 March 1977) at 156, online: <http://www.assembly.ab.ca/Documents/isysquery/1faec5f5-0c05-402a-95be-90cbd3280563/1/doc/19770307_1430_01_han.pdf#xml=http://www.assembly.ab.ca/Documents/isysquery/1faec5f5-0c05-402a-95be-90cbd3280563/1/hilite/>.

resources.[76] Worldwide in excess of 11,000 MW of installed geothermal electricity generation capacity exists.[77] This figure is projected to grow to 18,500 MW by 2015. As of 2011, 24 countries are using geothermal power for electricity and 72 use it for direct heating (or "Direct Use").[78] Direct heating is something utilized in Canada, however, the focus is primarily limited to recreational and therapeutic uses, while potential industrial and commercial applications are ignored.[79] There are politicians in Alberta that have persistently remained conscious of Alberta's tendency to leave the full potential of this energy resource untapped. In 1989, MLA Jerry J. Doyle stated the following in a session of Alberta's legislature:

> Mr. Speaker, I would hope that sometime in the near future this government will address the question of alternate sources of energy. Throughout West Yellowhead we have the greatest potential for geothermal energy of any place in the province. We have temperatures exceeding 100 degrees Celsius. In foreign countries — the U.S., Iceland, and others — people use this geothermal resource for medical reasons, agriculture, and for recreation. This government has failed to assist us in putting any money towards these projects in our area. Also, Mr. Speaker, geothermal is a renewable resource. It's available, and environmentally clean.[80]

The term "geothermal" has been mentioned in Alberta's legislature on 68 separate occasions since 1977.[81] Most recently, in November of 2012, MLA David Eggan indicated that geothermal energy belongs in the "basket of a distributive and diversified electricity generation system", as a way to "strengthen [the] electricity system through diversity."[82]

In recent years, the Alberta government has shown signs that it may be ready to tap into the province's geothermal resources. In the Alberta Government's *Alberta's 2008 Climate Change Strategy* Report (the "2008 Report"), one of the province's three goals was to "transform the way we produce and to introduce cleaner, more sustainable approaches to energy production." The province aims to stabilize GHG emissions by 2020 and by 2050 the goal is to reduce emissions to levels that are 14% below 2005 levels.[83]

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[76] R Libbey, Y Proenza & L Patsa, "Canadian Geothermal Council Mission Statement" (2003 Fall) 3 CanGRC Review 1, online: <http://www.cangrc.ca/images/images/cangrc_review/CanGRC%20Review%20Fall%202012%20web.pdf>.

[77] GEA, *Geothermal: International Market Overview Report* (Washington, DC: GEA, May 2012), online: <http://geo-energy.org/pdf/reports/2012-GEA_International_Overview.pdf>.

[78] Holroyd & Degg, *supra* note 21.

[79] CanGEA, *Projects Overview 2013*, *supra* note 24.

[80] Government of Alberta, *Alberta Hansard* (6 June 1989) at 99, online: <http://www.assembly.ab.ca/Documents/isysquery/b1ebc706-b763-4ecf-b765-991604f492c7/2/doc/19890606_2000_01_han.pdf#xml=http://www.assembly.ab.ca/Documents/isysquery/b1ebc706-b763-4ecf-b765-991604f492c7/2/hilite/>.

[81] Government of Alberta, "Assembly Documents and Records", online: <http://www.assembly.ab.ca/net/index.aspx?p=adr_home>.

[82] Government of Alberta, *Alberta Hansard* (21 November 2012) at 950, online: <http://www.assembly.ab.ca/Documents/isysquery/f4a25569-d054-486b-afc6-d292e42be411/2/doc/20121121_1930_01_han.pdf#xml=http://www.assembly.ab.ca/Documents/isysquery/f4a25569-d054-486b-afc6-d292e42be411/2/hilite/>.

[83] Government of Alberta, *Alberta's 2008 Climate Change Strategy* (Edmonton: Alberta Environment,

When discussing the means that would be used to achieve the referred to reductions, the 2008 Report indicates they could include, "expanding our use of alternative sources of energy, including wind and solar power, hydrogen and geothermal energy – tapping into the energy stored deep under the earth's surface."[84]

The Alberta Government's *Energy Annual Report 2011-2012* (the "2011-2012 Report") specifies that the province is developing an *Alternative and Renewable Energy Policy Framework* (the "Framework"). The goal of the Framework is to help "drive innovation in the energy sector, diversify Alberta's energy resource base and contribute to Alberta's clean energy future, through areas such as improved measurement, design and planning." In the 2011-2012 Report, geothermal is listed among wind, bioenergy, waste-to-energy, residue gasification, and carbon capture and storage as avenues that the province is pursuing to meet its goals.[85] It has been reported that there will be a new framework governing electrical generation in the province as early as 2014.[86]

The 2008 Report indicates that the message from Albertans was to "[b]e proactive. Act fast with meaningful first steps. Convert ideas into actions. Be innovative, strong and determined to demonstrate leadership on behalf of all current and future Albertans."[87] On April 11, 2013, Alberta's Energy Minister said, "I've put the challenge out to the renewable industry to bring forward proposals and ideas that might help us continue to green the grid" and it was indicated that the government will be "… open to any specific suggestions proposed, including policy that boosts the use of renewable power."[88] One of the aims of this paper is to propose meaningful first steps that can provide a boost to the geothermal industry, which will help Alberta to both green the grid and meet its climate change strategy goals.

3.2 Which Level of Government is Responsible for Regulating Geothermal Resources?

In the United States, many states have set up legislative regimes that deal with geothermal resources. Though, in the United States sometimes jurisdictional questions still arise with respect to whether it is the state government or the federal government that has the right to legislate geothermal resources development. These jurisdictional questions primarily arise due to the existence of the Federal Reserved Water Doctrine and remaining legal questions

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2008) at 7 [2008 Report], online: <http://environment.gov.ab.ca/info/library/7894.pdf>.

[84] 2008 Report, *ibid* at 19.

[85] Ministry of Energy, *Energy Annual Report 2011-2012* (Edmonton: Government of Alberta, 2012) at 12 [2011-2012 Report], online: <http://www.energy.alberta.ca/Org/Publications/AR2012.pdf>.

[86] K Kleiss, "Alberta ponders renewable energy strategy: clean electricity standard could come in 2014", *Edmonton Journal* (4 May 2013).

[87] 2008 Report, *supra* note 83 at 10.

[88] J van Loon, "Alberta Looks at Renewable Energy Amid Push for Keystone", *Bloomberg* (12 April 2013), online: <http://www.bloomberg.com/news/2013-04-12/alberta-looks-at-renewable-energy-amid-push-for-keystone.html>.

with respect to whether and to what extent the *Geothermal Steam Act* of 1970 and the *Homestead Act* of 1916 may have reserved geothermal resources to the federal government.[89] From a jurisdictional perspective the situation in Canada is relatively simple and provides the government of Alberta with a clear path to legislate in this area.

The provinces have primary jurisdiction over mineral and water resources. The federal government's sphere of influence over water is limited to its role over transboundary waters, navigation, fisheries, and international treaties.[90] Whereas, section 92 of Canada's *The Constitution Act, 1867*, gives the provinces control of, among other things, "Property and Civil Rights in the Province" and "Generally all Matters of merely local or private Nature in the Province".[91] It is arguable that these two heads of power establish provincial jurisdiction over both direct use of, and power production from, geothermal resource waters. In 1930, the Canadian federal government passed the *Alberta Natural Resources Act*, which arguably solidified the provinces' jurisdiction over all of water resources, section 1 reads:

> In order that the Province may be in the same position as the original Provinces of Confederation are in virtue of section one hundred and nine of the *British North America Act, 1867*, the interest of the Crown in all Crown lands, mines, minerals (precious and base) and royalties derived therefrom within the Province and the interest of the Crown in the waters and water-powers within the Province under the *North-west Irrigation Act*, 1898, and the *Dominion Water Power Act*, and all sums due or payable for such lands, mines, minerals or royalties, or for interests or rights in or to the use of such waters or water-powers …[92]

The present *Dominion Water Power Act*, governs water power derived from, "any force or energy of whatever form or nature contained in or capable of being produced or generated from any flowing or falling water in such quantity as to make it of commercial value."[93] Pursuant to section 4 of the *North-west Irrigation Act, 1898*, this Act dealt with:

> The property in and the right to the use of all the water at any time in any river, stream, watercourse, lake, creek, ravine, [canyon], lagoon, swamp, marsh or other body of water shall, for the purposes of this Act, be deemed to be vested in the Crown; unless and until and except only so far as some right therein, or to the use thereof, inconsistent with the right of the Crown, and which is not a public right or a right common to the public, is established …[94]

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[89] Callison, *supra* note 56.

[90] L Nowlan, "Out of Sight, Out of Mind? Taking Canada's Groundwater for Granted" in K Bakker, *Eau Canada: The Future of Canada's Water* (Vancouver: UBC Press, 2007) 55-83 at 57.

[91] *The Constitution Act, 1867*, 30 & 31 Vict, c 3.

[92] *Alberta Natural Resources Act*, SC 1930, c 3.

[93] *Dominion Water Power Act*, RSC 1985, c 4-4.

[94] OW MacLaren, "Leaky Legislation: Preservation of Indigenous Water Rights Through Canada's Legislative Framework" (Presentation delivered at the Canadian Institute of Resources Law (CIRL) Aboriginal Peoples and the Future of Water Management Conference, Grant MacEwan University, Edmonton, 10-11 June 2010) at 5, online: CIRL <http://www.cirl.ca/system/files/OLIVER+MacLAREN-EdmConf-2010June_0.pdf>.

An argument can be made that the *Alberta Natural Resources Act* transferred, from the federal government to the province, jurisdiction over water generally, and specifically, flowing water from which commercial quantities of energy can be derived. Geothermal water flowing through a binary plant, or a Direct Use system, would logically fit into both categories. Ultimately, there is little doubt that the province has jurisdiction over water within the province and that this would include water associated with geothermal resources. In fact, section 3 of Alberta's *Water Act*, declares that "[t]he property in and the right to the diversion and use of all water in the Province is vested in Her Majesty in right of Alberta except as provided for in the regulations."[95]

As previously mentioned, utilizing EGS can involve the use of relatively dry geothermal resources, which requires the introduction of water into a formation. In such circumstances it is debatable whether the water is the actual resource being harvested. However, it is notable that section 92A of *The Constitution Act, 1867*, gives the province control of, "development, conservation and management of sites and facilities in the province for the generation and production of electrical energy."[96] This means a plant generating electricity as a result of the application of any EGS methods would still remain under the jurisdiction of the province. Further, there is a strong argument that geothermal resources should not be categorized as water, but as a mineral, being another substance controlled by the province as a result of the *Alberta Natural Resources Act*.[97]

The argument that geothermal resources should be considered to be a mineral is most extensively considered in California case law. The Court in *United States v. Union Oil Company of California*[98] ruled that geothermal resources did not pass to the title holders as part of their right to use underground water. The court reasoned that geothermal resources do nothing to increase the capacity of the surface estate to i.e. sustain livestock and that these resources are "depletable subsurface reservoirs of energy, akin to deposits of coal and oil, which it was the particular objective of the reservation clause to retain in public ownership". As a result, it was determined that geothermal resources constitute part of the reservations of "all the coal and other minerals".[99] Although, this issue has never arisen in an Alberta court, it is easy to see the persuasiveness of the California court's reasoning. This is especially true given that in 1916, the Supreme Court of Canada noted in *Alberta Drilling Co. v. Dome Oil Co.*, that "[t]he word 'minerals' in a statute bears its widest signification unless the context or the nature of the case requires it to be given a restricted meaning."[100] Therefore, even if geothermal resources were not considered to be water, then a strong argument exists that in 1930, geothermal resources still passed to the province along with the mineral rights.

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[95] *Water Act*, RSA 2000, c W-3.

[96] *The Constitution Act, 1867*, *supra* note 91.

[97] *Alberta Natural Resources Act*, *supra* note 92.

[98] Cal 549 F2d 1271 (9th Cir 1977).

[99] K. DuVivier, ed, *The Renewable Energy Reader* (Durham, NC: Carolina Academic Press, 2011) 249-250.

[100] *Alberta Drilling Co v Dome Oil Co* (1916), 52 SCR 561.

It is clear that the Province of Alberta has sufficient jurisdiction to pass legislation regulating the utilization of geothermal resources. The only caveat that must be made is that if a geothermal aquifer crosses either a provincial boundary or an international boundary, it will trigger federal jurisdiction. The basis for this jurisdiction would be the Government of Canada's power over transboundary waters and possibly its power over international treaties.

3.3 Providing Developers with Access and a Priority Right to Carry out Exploration and Development Activities

3.3.1 The Quest for an Effective, Efficient and Fair System

After completing a jurisdictional review that included a literature review and interviews with experts, the Pembina Institute reported that several routes can be used to provide developers with the requisite rights needed for exploration and development activities. The literature review included an important CanGEA report entitled *Policy Recommendations for Advancing Geothermal Energy in Canada* (the "CanGEA Policy Report"). The CanGEA Policy Report includes a comprehensive policy overview of all jurisdictions considered by the Pembina Institute, except for Iceland. It is notable that the chair of CanGEA and the authors of the CanGEA Policy Report were among the Pembina Institute's interviewees.[101]

The jurisdictional review considered nine jurisdictions in seven countries (the United States Federal Government, Nevada, California, British Columbia, Australia, New Zealand, Italy, Iceland, and Germany). In these jurisdictions there were four types of legislation where geothermal provisions exist. In both South and Western Australia the provisions were found in the state petroleum legislation. In Germany, Iceland, Nevada (US), New South Wales (AU) and Tasmania (AU) mineral legislation was used to regulate geothermal resources. Water legislation was used in New Zealand. Finally, British Columbia, the United States Federal Government, California (US), Queensland (AU), and Victoria (AU) have adopted geothermal specific legislation.[102]

The Pembina Institute interviewed 13 geothermal experts from around the world; one question that was asked was, "if geothermal energy resources should be covered under existing legislation for other resources or if separate legislation should be developed." Several of the responses to this question indicated indifference to the approach used and instead emphasized the need for an effective legislative regime. Effectiveness involves clearly defined roles for the regulating agency and a timely process for issuing tenure and permits, although, some interviewees did advocate for special legislation that reflects the unique nature of the industry. Still, incorporating geothermal regulations into existing

[101] Holroyd & Degg, *supra* note 21; C Dunn & T Thompson, *Policy Recommendations for Advancing Geothermal Energy in Canada* (Calgary: CanGEA, 2010) [CanGEA Policy Report].

[102] Holroyd & Degg, *ibid*.

legislation can be seen as an interim solution that allows the industry to mature before specific geothermal energy legislation is enacted.[103]

The Pembina Institute concluded that having an "effective, efficient and fair system", was the most critical issue any geothermal regime must address. One solution proffered in the Pembina Institute's report was a single window for project applications, such as the system used in South Australia, so that permits would not be needed from separate agencies. The single agency would be responsible for conducting the necessary reviews and coordinating public consultation. Involving multiple agencies was cited as an impediment that "can be confusing and time consuming". A lack of clear deadlines was indicated to be another impediment. The permitting process in South Australia averages four months compared to the process in BC that can take several years.[104]

Establishing an effective, efficient, and fair system is a critical element that is required to attract geothermal energy investment from the private sector. This is because:

> Mining companies explore for mineral deposits and develop mines in the expectation of making profits. Consequently, several assessments must be made before deciding where and when to carry out activities and invest. In a survey conducted by Otto for the United Nations, a ranking was made of sixty investment criteria used by mining companies. In addition to the most important criteria concerning geological potential for target minerals, of the top ranked twenty criteria, ten percent related to government policies and regulatory systems. From the perspectives of miners and mining companies, predictable systems which reduce uncertainty are important [citations omitted].[105]

Establishing a sound regime is a critical element that has also been proven to encourage investment in the U.S. geothermal industry. This was shown in the United Sates after the passage of the federal *Energy and Policy Act*:

> In the omnibus [Energy and Policy] Act of 2005, the federal government laid much of the groundwork for the current upswing in interest in investment in geothermal energy production through its new leasing system. Under the EP Act of 2005, if a developer wants to lease land, she must nominate the land to be leased. Thereafter a competitive bidding process is required. Once the land is leased, the developer has exclusive rights to develop that resource for ten years with the ability to extend the lease [citations omitted].[106]

3.3.2 Expanding the Definition of the Term "Mineral"

It can be said that "[a]n important role of mining legislation during recent decades has been to provide a framework of rules and incentives for private investment in mineral

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[103] Holroyd & Degg, *ibid* at 39-40.

[104] Holroyd & Degg, *ibid* at 41 & 43.

[105] EL Johnson, *Mineral Rights: Legal Systems Governing Exploration and Exploitation* (Doctoral Thesis, Stockholm Royal Institute of Technology (KTH), School of Architecture and the Built Environment, Department of Real Estate and Construction Management, Real Estate Planning and Land Law, 2010) at 8.

[106] Plaskov, *supra* note 52 at 270.

exploration and exploitation."[107] The extraction of mineral resources is something that has historical significance in the development of civilization and thus, mining law tends to reward and encourage the exploration and extraction of these resources. In contrast, it has been said, in an American context, that "[w]estern water laws … circumscribe ownership interests to reflect the public's continuing interest in, and substantial control over, the resource".[108] Alberta's water laws have comparable goals to those in the western states. The province's *Water Act* is designed to, "support and promote the conservation and management of water, including the wise allocation and use of water …."[109] Rather than rewarding and encouraging exploration and development, the water laws focus on conservation.

Arguably, little harm would result if geothermal resources were incorporated into the province's mineral legislation and exempted from the protection of the province's *Water Act*. It was mentioned earlier that geothermal power plants use less fresh water than conventional forms of electricity production.[110] Further, the geothermal waters used in Alberta would be from the WCSB and, rather than being fresh, in many cases probably highly saline.[111] In any event, when binary plants are used the water is reinjected into the same formation that it came from.[112]

If the aim is to promote geothermal energy development it may be better to regulate the industry as an extractive industry, under the provinces mining legislation. Amending subsection 1(1)(p)(i) of Alberta's *Mines and Minerals Act* would be a positive first step for Alberta's geothermal industry. This section defines the term "minerals" and currently reads:

> "minerals" means all naturally occurring minerals, and without restricting the generality of the foregoing, includes:
>
> i. gold, silver, uranium, platinum, pitchblende, radium, precious stones, copper, iron, tin, zinc, asbestos, salts, sulphur, petroleum, oil, asphalt, bituminous sands, oil sands, natural gas, coal, anhydrite, barite, bauxite, bentonite, diatomite, dolomite, epsomite, granite, gypsum, limestone, marble, mica, mirabilite, potash, quartz rock, rock phosphate, sandstone, serpentine, shale, slate, talc, thenardite, trona, volcanic ash, sand, gravel, clay and marl, but
>
> ii. does not include:
>
> (A) sand and gravel that belong to the owner of the surface of land under section 58 of the *Law of Property Act*,

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[107] Johnston, *supra* note 105 at 3.
[108] Callison, *supra* note 56 at 312.
[109] *Water Act*, *supra* note 95.
[110] Canmet Energy, *supra* note 19.
[111] CanGEA, "Canadian Geothermal", *supra* note 20.
[112] Frick, Kaltschmitt & Shroder, *supra* note 48.

(B) clay and marl that belong to the owner of the surface of land under section 57 of the *Law of Property Act*, or

(C) peat on the surface of land and peat obtained by stripping off the overburden, excavating from the surface, or otherwise recovered by surface operations …[113]

It would benefit Alberta Geothermal energy development if subsection 1(1)(p)(i) was amended to include a substances such as “geothermal waters” or “geothermal resource”. Doing this would clarify that the owner of a mineral also owns geothermal resources. Such an amendment would not be unique in the history of the *Mines and Minerals Act*. On October 28, 2010, then Minister of Energy Ron Liepert noted in the Alberta Legislature with respect to coalbed methane:

> Bill 26, the *Mines and Minerals (Coalbed Methane) Amendment Act, 2010*, clarifies CBM mineral ownership by indicating that CBM is and always has been a natural gas for both Crown and freehold minerals. CBM is therefore owned by the natural gas mineral owner and not the coal mineral owner. ...
>
> There have been precedents for this type of legislation in Alberta, previous declaratory statutes enacted to clarify ownership rights, including declaring that sand and gravel belonged to the surface rights owner in 1951, declaring that clay and a fine-grained carbonate-rich mud known as marl belonged to the surface rights owner in 1961, and declaring that a large list of natural substances belonged to the mineral owner, also in 1961.[114]

Once “geothermal water” or “geothermal resource” are added to the definition of the term “minerals”, the most important steps that would remain are to provide the selected term with a definition and to establish a tenure system applicable to the new mineral. This last issue will be dealt with first and the former issue will be dealt with in Section 3.4.

3.3.3 Possible Tenure Systems

British Columbia created the *Geothermal Resource Act*, however, in Alberta, managing geothermal development through regulation seems to be the most efficient avenue. This is primarily because section 5 of Alberta’s *Mines and Minerals Act*, gives the Lieutenant Governor in Council wide powers to make regulations respecting everything from exploration for and development of minerals, to rental rates, and the collection of royalties, which may negate the need for passing a Bill.[115]

This paper has already discussed why incorporating geothermal regulation into water law is undesirable, if the aim is to promote geothermal development. This means that three

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[113] *Mines and Minerals Act*, RSA 2000, c M-17.

[114] Government of Alberta, *Alberta Hansard* (28 October 2010) at 1012-1013, online: <http://www.assembly.ab.ca/Documents/isysquery/c3757921-76b6-4e86-8250-4317895eb5a6/2/doc/20101028_1330_01_han.pdf#xml=http://www.assembly.ab.ca/Documents/isysquery/c3757921-76b6-4e86-8250-4317895eb5a6/2/hilite/>.

[115] *Mines and Minerals Act*, *supra* note 113.

options remain. The first option is to incorporate geothermal regulation within Alberta's metallic and industrial minerals regulations. The second option is to integrate new geothermal provisions into the existing petroleum and natural gas regulations. Lastly, new regulations tailored to the geothermal industry could be enacted by the Lieutenant Governor in Council.

Once a substance is deemed a mineral, the Minister has significant powers as to how the mineral will be regulated. It is important to recognize that Alberta Energy "manages the development of province's non-renewable resources including coal, minerals, natural gas, petrochemicals, conventional oil and oil sands and renewable energy (wind, bioenergy, solar, hydro, geothermal, etc.)" and "grants industry the right to explore for and develop energy and mineral resources". Alberta Energy also "establishes, administers and monitors the effectiveness of fiscal and royalty systems".[116]

The *Metallic and Industrial Minerals Tenure Regulation* (*M & IM Tenure Reg*)[117] and the *Petroleum and Natural Gas Tenure Regulation* (*P & NG Tenure Reg*)[118] are the most relevant administrative regulations that may be applicable if geothermal rights were going to be granted under the mineral or petroleum regulations. Thus, the question becomes should geothermal resources be regulated under one of these two existing mineral tenure regulations or should a new geothermal tenure regulation be passed.

The following analysis is not meant to be a definitive overview of the implications associated with encompassing geothermal resources within any regulatory regime. Rather, the purpose is to explore how it might be done and to initiate a dialogue about the pros and cons entailed.

3.3.3.1 Regulating Geothermal Resources under the Metallic and Industrial Minerals Tenure Regulation

Bringing i.e. "geothermal waters" into the purview of the *M & IM Tenure Reg* would be relatively easy. Subsection 1(j) defines "metallic and industrial minerals", as:

> minerals within the meaning of section 1(1)(p)(i) of the Act that are vested in or belong to the Crown in right of Alberta but does not include petroleum, asphalt, bituminous sands, oil sands, natural gas, coal or ammonite shell.[119]

This means that by simply being defined as a mineral in the *Mines and Minerals Act*, i.e. "geothermal waters" would be governed by the *M & IM Tenure Reg*, as long as it is not listed as an exemption under subsection 1(j) of the *M & IM Tenure Reg*. The most recent version of the *Alberta Mineral Development Strategy* (the "Strategy") provides a thorough,

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[116] Alberta Energy, "About Alberta Energy" (2013), online: <http://www.energy.alberta.ca/AboutUs.asp>.

[117] Alta Reg 145/2005 [*M & M Tenure Reg*].

[118] Alta Reg 263/1997 [*P & NG Tenure Reg*].

[119] *M & M Tenure Reg*, *supra* note 117.

yet succinct, overview of the tenure system implemented under the *M & IM Tenure Reg* regime:

> Alberta does not use the traditional physical claim-staking and free entry system that some other provinces and territories have retained. Rather, the province uses a map staking system, where mineral rights are applied for and granted under ministerial discretion. In certain circumstances, the rights may be posted and bids taken.
>
> The Regulation provides for two types of agreements: permits (for exploration) and leases (for development). The objective of the mineral tenure system is to make mineral rights available to individuals and companies that want to explore for and develop minerals. To ensure that the agreement holder is actively working at discovering, evaluating or developing minerals on their agreement, the permits have work expenditure commitments, which escalate during the term. The work performed by the permit holder must be filed as an assessment report, which becomes public after one year of confidentiality.[120]

The typical route, used to obtain a metallic and industrial minerals lease, is explained by Garth Anderson and Amy-Lynn Smith of Blake Cassels & Graydon LLP as follows:

> … metallic and industrial minerals are typically leased by first applying for a permit for mineral exploration rights, fulfilling the terms and conditions of such permit and then applying for a metallic and industrial minerals lease. The lease grants the lessee the exclusive right to develop and mine the metallic and industrial minerals in a specified location. However, a mineral surface lease granting approval to occupy the location and conduct mining activities is also required. Mineral surface leases can be obtained through the Alberta Sustainable Resource Development.[121]

It is also notable that before any disposition, such as a lease or a transfer, can occur Alberta's *Land Titles Act* mandates that:

> … the land titles office must conduct a mineral search and issue a mineral certificate. A mineral certificate verifies the proper ownership of the mines and minerals and it is only issued in conjunction with a disposition document, such as a transfer or a lease, which has been submitted to the land titles office.[122]

There is no obvious reason that the *M & IM Tenure Reg* system could not be applied to geothermal resources. However, one problem associated with this option is that Alberta Energy "keeps track of all Crown mineral dispositions and administers a separate process for each type of mineral (i.e. coal, metallic and industrial minerals, ammonite shell, oil

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[120] Alberta Energy, *Alberta Mineral Development Strategy 2002* (Edmonton: Alberta Energy, 2003) [Strategy], online: <http://www.energy.alberta.ca/minerals/pdfs/Mineral_Strategy.pdf>.

[121] G Anderson & AL Smith, "Obtaining, transferring and securing mining rights in Alberta" (12 July 2012), online: Lexology <http://www.lexology.com/library/detail.aspx?g=ae16004a-31e8-4ffa-aafa-134b1d30c016>; now Alberta Environment and Sustainable Resource Development.

[122] Service Alberta, "Mineral Certificate" (2013), online: Service Alberta <http://www.servicealberta.gov.ab.ca/839.cfm>.

sands, etc.).”[123] The nature of, and the means used to explore for, geothermal resources are closer to oil and gas than metallic and industrial minerals. It is possible that this could lead to a situation where the specific individuals responsible for metallic and industrial minerals do not have the, “capacity and knowledge of regulators to manage geothermal energy development.” This exact issue was raised, as something to be cautious of, by some of the geothermal experts that were interviewed by the Pembina Institute.[124]

3.3.3.2 Regulating Geothermal Resources under the Petroleum and Natural Gas Tenure Regulation

The methods used to access geothermal resources are more like those used in the petroleum and natural gas sector, but paradoxically there is no intuitive way to integrate geothermal resources into the *P & NG Tenure Reg*. Part 4 of Alberta’s *Mines and Minerals Act* is designed in lock step with the *P & NG Tenure Reg* and that is where the definitions of the terms “natural gas” and “petroleum” are found. Subsection 80(2) of the *Mines and Minerals Act* reads:

> Subject to the regulations, in this Part and in an agreement granting rights to petroleum or natural gas, or both,
>
> (a) “natural gas” means the production from any well that, in the opinion of the Minister, initially produces gas either alone or with oil at a gas-oil ratio of 1800:1 or higher, but does not include any production that may be recovered from any well that, in the opinion of the Minister, initially produces gas with oil at a lower gas-oil ratio;
>
> (b) “petroleum” means the production from any well that, in the opinion of the Minister, initially produces oil either alone or with gas at a gas-oil ratio of less than 1800:1, but does not include any production that may be recovered from any well that, in the opinion of the Minister, initially produces oil with gas at a higher gas-oil ratio.[125]

Given that the entirety of both Part 4 of the *Mines and Minerals Act* and the *P & NG Tenure Reg* are based on these definitions, at first blush, it seems a rewrite of the *Mines and Minerals Act* and the regulation would be needed to properly fit geothermal resources into Alberta’s petroleum and natural gas tenure regime.[126] However, one possibility may be to add to Part 4 a definition of a “geothermal resource”, being defined as a ratio of “geothermal waters” to “gas plus oil”. The term “geothermal waters” could take on a definition such as water exceeding 80˚C. Then if, for example, this ratio was 10 to 1, the resource could be deemed a geothermal resource. Completing a thorough review of whether such a change would render any sections of the *Mines and Minerals Act* or

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[123] Anderson & Smith, *supra* note 121.
[124] Holroyd & Degg, *supra* note 21 at 42.
[125] *Mines and Minerals Act*, *supra* note 113.
[126] *P & NG Tenure Reg*, *supra* note 118.

regulations inoperable is beyond the scope of this paper. Ultimately, it seems unlikely that this route would be feasible.

3.3.3.3 A Specific Geothermal Resource Tenure Regulation

Adopting a new regulation, pursuant to section 5 of the *Mines and Minerals Act*, to create a specific geothermal tenure system would arguably serve the long term interest of geothermal development. If this was done the new regulation could be tailored to the unique needs of the energy resource.

When drafting the new tenure regulation the two leasing systems, utilized in the jurisdictions reviewed by the Pembina Institute, would need to be considered. Specifically, mineral rights acquisition processes were reviewed. The bidding process was named as being something that was detrimental to the process in British Columbia. BC Hydro has described the problem as follows:

> [The] proponent must secure tenure to the land and acquire necessary permits for early stage reconnaissance. In B.C., the tenure process requires applicants to request a parcel of land be put up for tenure and must win the rights through a sealed bid auction. The uncertainty related to the auction process is a disincentive for some geothermal developers to invest efforts to investigate new potential sites. Since 2002, the Province has awarded geothermal permits for 12 locations and there is only one active geothermal lease at South Meager Creek.[127]

Some interviewees suggested a staking system would be a better method, as it was less onerous and time consuming. Although, bidding systems are viewed as a good means to ensure a company has the needed financial resources to develop a project, in a jurisdiction with a conservative demand for leases, such systems may be too onerous. For these reasons it is arguable that a staking system would, at least initially, be more tailored to the circumstances in Alberta. However, if a bidding system is used the responsible agency needs to ensure available leases are posted at regular intervals to ensure that interested companies can plan properly.[128] In any event, it is arguable that consideration will need to be given to aspects such as, which company has the best development plan, and access to the proper financing. These factors are important because if early projects are not successful it could leave a cloud over the entire industry in the province. CanGEA recommends, "Awarding geothermal permits and leases on the basis of the strongest team, best overall workplan [sic] for identifying and exploiting the resource, and commitment to the workplan [sic]."[129]

Further, if new regulations are being drafted, consideration should be given to how the geothermal industry will co-exist with the province's oil and gas industry. One issue that

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[127] BC Hydro, *2013 Resource Options Report Update* (Vancouver: November 2013) at 5-46, online: <http://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/regulatory-planning-documents/integrated-resource-plans/current-plan/ror-update-report-20131115.pdf>.

[128] Holroyd & Degg, *supra* note 21.

[129] CanGEA, *Policy Recommendations, supra* note 71 at 150.

should be addressed is how the use of co-produced fluids can be facilitated. Another issue that will need to be considered is what happens if geothermal mineral rights and development activities conflict with an existing oil or natural gas lease. For example, in Queensland, Australia, legislation has recognized the potential for conflicts between companies with geothermal drilling rights and those with oil drilling rights, for example when drilling operations are likely to conflict with each other. The solution utilized is that the first company to engage in exploration activity will preserve their rights and conflicting rights will be suspended.[130] It is also possible that subsurface rights could conflict. In South Australia legislation does not recognize the possibility of subsurface rights conflicting rather the legislation mandates that "any non- geothermal subsurface right must co-exist with any geothermal subsurface right on the same land".[131]

3.3.4 Once Tenure is Established

The *Responsible Energy Development Act* (*REDA*), which established the Alberta Energy Regulator (AER), "does not include mineral tenure and Surface Rights Board functions".[132] However, once tenure is obtained a geothermal company will need to "receive approval from the AER before it can begin the construction phase of a project".[133] The need for AER approval is clear because geothermal resources would automatically fall under the mandate of the AER, as subsection 2(1) of the *REDA* reads:

> The mandate of the Regulator is:
>
> (a) to provide for the efficient, safe, orderly and environmentally responsible development of energy resources in Alberta through the Regulator's regulatory activities, and
>
> (b) in respect of energy resource activities, to regulate
>
> (i) the disposition and management of public lands,
>
> (ii) the protection of the environment, and
>
> (iii) the conservation and management of water, including the wise allocation and use of water, in accordance with energy resource enactments and, pursuant to this Act and the regulations, in accordance with specified enactments.[134]

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[130] CanGEA, *Policy Recommendations*, *ibid*.

[131] CanGEA, *Policy Recommendations*, *ibid* at 12.

[132] Government of Alberta, Resource Revenue and Operations Tenure Branch, *Mineral Rights Information Bulletin 2013-01: April 16, 2013 Alberta Tenure Information Exchange* (23 May 2013), online: CAPL <http://www.landman.ca/pdf/2013/AB%20Mineral%20Rights%20Information%20Bulletin%202013-01.pdf>.

[133] Alberta Energy Regulator (AER), "Application Process" (2013), online: AER <http://www.aer.ca/applications-and-notices/application-process>.

[134] *Responsible Energy Development Act*, SA 2012, c R-17.3 [*REDA*].

The phrase "energy resources" is defined as "any natural resource within Alberta that can be used as a source of any form of energy, but does not include hydro energy as defined in the *Hydro and Electric Energy Act*."[135] Thus, pursuant to this definition, geothermal resources would logically be considered an energy resource, bringing it under the mandate of the AER.

3.4 Defining the Resource

3.4.1 Defining Geothermal Resources: The Basics

Using the common bundle of sticks analogy "geothermal resources" have been defined as including heat energy, steam, hot waters, brines, and other products, but what the bundle includes varies from jurisdiction to jurisdiction. However, one general theme is that the bundle does not include the rights to any oil, natural gas, or any other hydrocarbon substance.[136] For example, the United States' *Geothermal Steam Act* of 1970 defines geothermal resources as:

> (i) all products of geothermal processes, embracing indigenous steam, hot water and hot brines;
>
> (ii) steam and other gases, hot water and hot brines resulting from water, gas, or other fluids artificially introduced into geothermal formations;
>
> (iii) heat or other associated energy found in geothermal formations; and
>
> (iv) any byproduct derived from them.
>
>> (d) "byproduct" means any mineral or minerals (exclusive of oil, hydrocarbon gas, and helium) which are found in solution or in association with geothermal steam and which have a value of less than 75 per centum of the value of the geothermal steam or are not, because of quantity, quality, or technical difficulties in extraction and production, of sufficient value to warrant extraction and production by themselves.[137]

One of the most common ways to define a geothermal resource is by using specific temperatures such as all water over 80˚C. This can be a problem because as technology improves lower temperature resources may become economical to utilize. The state of Washington has taken an innovative approach to this problem. The state's definition of the geothermal resource reads:

> Only that natural heat energy of the earth from which it is technically practical to produce electricity commercially and the medium by which such heat energy is extracted from the earth, including

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[135] *REDA*, *ibid*.
[136] DuVivier, *supra* note 99.
[137] Holroyd & Degg, *supra* note 21 at 21.

> liquids or gases, as well as any minerals contained in any natural or injected fluids, brines and associated gas, but excluding oil, hydrocarbon gas and other hydrocarbon substances.[138]

The above definition uses technology as the criteria to distinguish whether temperatures are sufficient to define geothermal resources. In the end, there are a number of ways that geothermal resources can be defined, but the most important factor is how the definitions impact players, such as companies, in the real world.

3.4.2 Utah, Wyoming and Colorado

An article by Justin Plaskov that appeared in the *Colorado Law Review* in 2012, provides insight into what elements make geothermal legislation work effectively. One of the primary conclusions is that geothermal resources should be exempted from state regimes. Utah, Wyoming and Colorado are states that fail to exempt geothermal resources from water laws.[139] This is how Plaskov refers to the Utah legislative regime:

> Utah defines a geothermal resource as "heat energy". Ownership of heat associated with geothermal resources "derives from an interest in land and not from an appropriative right to geothermal fluid." However, it expressly excludes any ownership rights to subsurface waters associated with heat. Rather, geothermal resources are deemed a special kind of groundwater resource. As such, development of those resources requires the developer to publically advertise the application and to have a hearing for any protests of such appropriation [citations omitted].[140]

The root of the problem being described is that a failure to exempt geothermal waters from the legislation that governs water creates unnecessary bureaucratic obstacles. As of 2012, despite such obstacles, Utah has 42 MW and is developing another 628-883 MW.[141]

Wyoming defines geothermal resources as groundwater and extracting heat from water, is considered to be a beneficial use. As a result geothermal resources are encompassed in Wyoming's water regime and a water permit is needed before a geothermal well can be constructed. Yet, developers of minerals, gas and oil do not need the same permitting before boring a hole. As of 2012, Wyoming had a mere 0.28 MW of installed geothermal power and another 0.28 MW in development.[142]

As in Wyoming, geothermal development in Colorado is considered to be a beneficial use. This means that geothermal developers must apply to the State Engineer to appropriate geothermal fluids. The need for the permit may be waived by the State Engineer when there is a "diversionary utilization method which is non-consumptive and which will not impair valid, prior water rights". This language is suited ideally to qualify closed-loop binary system development for the exemption, because such use is non-consumptive.

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[138] Callison, *supra* note 56 at 310.
[139] Plaskov, *supra* note 52.
[140] Plaskov, *ibid* at 279.
[141] Plaskov, *ibid*.
[142] Plaskov, *ibid*.

Unfortunately, the relevant administrative regulations fail to address the exemption and as a result the permit exemptions are not being granted. As of 2012, Colorado had 0 (zero) MW of installed capacity and 10 MW in development.[143]

3.4.3 New Mexico, Oregon and Idaho

The legislation in some U.S. states recognizes that water resources over a certain temperature are unlikely to be used for other purposes, and therefore these states exempt very hot water from the existing water permitting regimes. New Mexico, Oregon, and Idaho are included among these states.[144]

If fluids exceed 250˚F, in New Mexico it is considered to be a mineral resource and at less than 250˚F it is a water resource. As of 2012, installed geothermal power capacity in this state is 0.24 MW and 35 MW is under development.[145]

The State of Oregon also uses 250˚F for the purpose of delineation. However, the legislation outlines that if there is interference between a geothermal well and an existing water appropriation, the Water Resource Director is to determine the matter, after considering the most beneficial use of the water and the heat resources. Oregon had 0.28 MW of installed capacity, as of 2012, and there is 342-473 MW in development.[146]

Idaho uses 212˚F to define a geothermal resource, however, geothermal resources are considered to be *sui generis* (neither water or a mineral resource). Therefore a developer does not need a permit to appropriate water. Idaho had an installed capacity of 15.8 MW and another 413-676 MW in development as of 2012.[147] Given the novel *sui generis* definition used by Idaho, it is informative to look at this state's definition of a geothermal resource:

> [T]he natural heat energy of the earth, the energy, in whatever form, which may be found in any position and at any depth below the surface of the earth present in, resulting from, or created by, or which may be extracted from such natural heat, and all minerals in solution or other products obtained from the material medium of any geothermal resource. Ground water having a temperature of two hundred twelve (212) degrees Fahrenheit or more in the bottom of a well shall be classified as a geothermal resource.[148]

With respect to the temperature based definitions it is important to realize that 212˚F is 100˚C. This means that even Idaho's definition excludes a large portion of the available geothermal resource. Recall that a binary system has been successfully operated using a

[143] Plaskov, *ibid* at 280-281.
[144] Plaskov, *ibid*.
[145] Plaskov, *ibid*.
[146] Plaskov, *ibid*.
[147] Plaskov, *ibid*.
[148] Callison, *supra* note 56 at 311.

geothermal resource of 74˚C in Chena, Alaska. This situation emphasizes the usefulness of a technology based definition like the one used in Washington State.

3.4.4 Suggestions for Alberta

The ultimate goal is to facilitate geothermal development without jeopardizing the provinces fresh water resource. The province should be informed by the legislative efforts of other jurisdictions without being limited by the options these efforts contain. If geothermal resources are limited, by definition, to resources from which electricity can be derived one is inadvertently excluding a sizable part of the resource that can be used for Direct Use purposes. Thus, it is arguable that a geothermal resource definition should encompass all geothermal resources that can be used economically for Direct Use or High Temperature Power. In this way all economically viable resources could be governed under an applicable tenure regulation. Once this is done science based decisions can be made with respect to which parts of the geothermal resource can safely be exempted from Alberta's water laws. The basis for such exemptions could be high temperature, high salinity or non-consumptive use.

These exemptions can be made with minor amendments to the province's water legislation. One of the regulations under the Province's *Water Act* is the *Water (Ministerial) Regulation*.[149] This regulation contains various schedules, the most relevant are Schedules 1 and 3. Schedule 1 enumerates all activities that do not need approvals under the *Water Act* and Schedule 3 lists which diversions of water or operations are exempt from the need for water licences. For example, under Schedule 3, diversions of or works associated with saline ground water do not require a water licence. Subsection 1(1)(z) defines "saline groundwater" as water that "has total dissolved solids exceeding 4000 milligrams per litre."[150] This is notable because the fact is that most geothermal waters are highly saline, meaning Alberta's current legislation could already exempt some, or even most, geothermal development from requiring a water licence. However, it is likely that other exemptions can also be justified based on high temperature or non-consumptive use.

Unlike most of the examples given the above suggestions would not limit the definition of a geothermal resource to those from which electricity can be derived. However, even these suggestions may lead to a situation where high temperature resources are more likely to be exempted, from conservative water laws, than lower temperature resources that can be used for Direct Use applications. Given Alberta's legislative framework this appears to be a practical approach.

[149] *Water Act*, *supra* note 95.
[150] *Water (Ministerial) Regulation*, Alta Reg 205/1998.

3.5 Establishing Ownership

3.5.1 Nevada and California

There are two states that according to Plaskov did an even better job of creating their geothermal regime than New Mexico, Oregon and Idaho. These are the states of Nevada and California, in addition to clearly defining what the resource constitutes, they have also designated which party owns the state's geothermal resources.[151] Plaskov's position is supported by a 2011 report from the Pembina Institute, entitled, *Building a Regulatory Framework for Geothermal Energy Development in the NWT: A Report for the Government of Northwest Territories, Environment and Natural Resources Department*. This report suggests that, "Ownership of geothermal resources should be defined by law. The legislation should clarify who is responsible for issuing the right to explore, develop and produce geothermal energy." This is because a "Lack of clarity on ownership can lead to conflict among surface and subsurface owners, as well as delays for project companies that can affect their ability to attract and maintain investors."[152]

Pursuant to legislation in Nevada, "The owner of real property owns the rights to the underlying geothermal resources unless they have been reserved by or conveyed by another person."[153] In other words, the surface owner owns the resource. Nevada defines a geothermal resource as:

> … the natural heat of the earth and the energy associated with that natural heat, pressure and all dissolved or entrained minerals that may be obtained from the medium used to transfer that heat, but excluding hydrocarbons and helium.[154]

It is also important that in Nevada, an exemption from the existing water regulation regime exists, as long as the water is reinjected into the same source (a non-consumptive use). The language in Nevada's legislation also makes the exemption mandatory, unlike in Colorado where the language is discretionary. Previously, Nevada subjected the geothermal industry to water permitting regimes, but has since changed course to promote the development of the industry. Nevada has an installed capacity of 433.4 MW and another 2120.4-3686.4 MW in development, as of 2012.[155]

In California, the *Public Resources Code* indicates that geothermal resources are:

> … the natural heat of the earth, the energy, in whatever form, below the surface of the earth present in, resulting from, or created by, or which may be extracted from, such natural heat, and all minerals in solution or other products obtained from naturally heated fluids, brines, associated gases, and

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[151] Plaskov, *supra* note 52.
[152] Holroyd & Degg, *supra* note 21 at 40-41.
[153] Plaskov, *supra* note 52 at 283.
[154] Holroyd & Degg, *supra* note 21 at 24.
[155] Plaskov, *supra* note 52.

> steam, in whatever form, found below the surface of the earth, but excluding oil, hydrocarbon gas or other hydrocarbon substances.[156]

In California, it is not only well drafted legislation that has made a positive impact on the legal framework governing the geothermal industry, but case law has also made a significant contribution. Earlier it was mentioned that the courts in California have classified geothermal resources as being minerals. In 1980, the courts took it a step further, when the California Court of Appeal in the case of *Pariani v. the State of California*[157] accepted the lower court's argument that the "fluid component of the resource, including the steam, is distinctly separate and different from, and is not the 'water' which is the subject of the California water law."[158] As of 2012, California currently had 2565.5 MW of geothermal power and another 16097-1997.7 MW in development.[159]

3.5.2 Ownership of Geothermal Resources in Alberta

How Alberta eventually decides to classify geothermal resources will impact ownership of the resource. If geothermal resources are added to the definition of the term mineral in Alberta's *Mines and Minerals Act* then ownership of the resource will belong to mineral owners. In Alberta, the provincial crown owns 81% of mineral rights, the federal crown owns 10.6% (in national parks and lands held in trust for First Nations) and 8.4% are held as "freehold rights" by individuals and corporations.[160] If, however, the province took the position that geothermal resources are indivisible from the water from which the resource is extracted, the province may retain 100% of the resource. (Although, the legal status of EGS resources could arguably still be open to interpretation.) Remember that section 3 of Alberta's *Water Act*, declares that "[t]he property in and the right to the diversion and use of all water in the Province is vested in Her Majesty in Right of Alberta except as provided for in the regulations."[161]

If the province chose this latter approach, two major issues would likely arise. Firstly, the government risks opposition, especially from "freehold rights" owners. Groups such as the Alberta Landowners Council may frame the issue as expropriation without compensation, as they did in reaction to Bill 24 (the *Carbon Capture and Storage Act*), which vested pore space with the Crown.[162] Such opposition may also arise if Alberta

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[156] Holroyd & Degg, *supra* note 21 at 23.

[157] (1980) 105 Cal App 3d 923 [164 Cal Rptr 683] [*Pariani*].

[158] Pariani, *ibid*.

[159] Plaskov, *supra* note 52 at 284-285.

[160] Royalty Review Secretariat, *Royalties in Alberta: Background Information* (Edmonton: of Alberta, 2007).

[161] *Water Act, supra* note 95.

[162] K Wilson, "What the Alberta Government plans to do – Full steam ahead" (Presentation delivered at the Alberta Land Owners Council in Lethbridge, 15 March 2012), online: Alberta Land Owners Council <http://www.albertalandownerscouncil.com/ALC_Wilson_Presentation%20to%20Lethbridge_March%2015_2012.pdf> (retrieved 8 September 2013).

followed the lead of British Columbia and simply vested all geothermal resources with the government.[163] Secondly, allowing geothermal resources to be governed within the province's conservative water regime instead of its *Mines and Minerals Act*, may hinder geothermal development.

3.6 Lease Terms, Rentals and Royalties

3.6.1 Using Royalties to Incentivize the Private Sector

The more favourable the private sector finds lease terms, rental rates, and royalty regimes will promote geothermal development in Alberta. The focus of this section will be on royalty regimes. However, it is important to keep in mind, that if the lease terms or rental rates are made more attractive to the private sector this will also spur on geothermal development.

Royalties are the payments made to the owner of the resource. Typical geothermal royalty rates range from "0.5 to 5.5% of the price of power and typically account to 10-15% of [operational and maintenance] costs". In 2004, the average effective royalty rate charged on federal lands, globally, was 3.94%. Often royalty schemes are on a sliding scale, for example, charges may initially amount to 1.75% of a geothermal company's annual income for the first 10 years, and then increase to something near 3.5% for every year after.[164] A low initial rate serves as an incentive to the private sector to develop projects. Some jurisdictions have taken it a step further and currently offer the geothermal industry royalty holidays. For example, the state of Queensland, in Australia, has approved a royalty holiday:

> The royalty holiday is designed to stimulate the rate of exploration and production by providing an opportunity for early movers to have a royalty-free period in the critical start-up stages. Following the cessation of the royalty holiday, a royalty of 2.5 per cent of the wellhead value will apply to geothermal production and no royalty will be payable where the production revenue generated is less than $32,400. A review of the royalty arrangements will be carried out after 5 years.[165]

CanGEA suggests that:

> Royalty schemes on geothermal power production have not shown themselves to be effective in developing the geothermal industry. There is no factual basis for their application, as no resource is

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[163] *Geothermal Resources Act*, RSBC 1996, c 171, s 2, online: <http://www.canlii.org/en/bc/laws/stat/rsbc-1996-c-171/latest/rsbc-1996-c-171.html>.

[164] A Kagel, *A Handbook on the Externalities, Employment, and Economics of Geothermal Energy* (Washington, DC: GEA, October 2006) at 39 [Kagel, *Handbook*].

[165] Queensland Government, *Geothermal Energy Bill 2009: Consultation Paper* (Department of Natural Resources, Mines and Energy, August 2009) at 13, online: Anti Mining Group <http://anti-mining.com/articles/geothermal_consultation_paper_august_2009.pdf>.

being depleted. Rather, developers would simply prefer to work within the standard corporate tax regimes resident within each jurisdiction.[166]

3.6.2 Geothermal Royalties in Alberta

It is again notable that section 5 of Alberta's *Mines and Minerals Act*, gives the Lieutenant Governor in Council broad powers to make regulations respecting rental rates and the collection of royalties, with respect to substances that are classified as minerals.[167] If it decided that the geothermal industry needs its own tenure regulation it would also make sense to pass a corresponding royalty regulation. If this is not done, the challenge again becomes deciding whether it practical to apply the royalty regimes applicable to metallic and industrial minerals or petroleum and natural gas to the geothermal industry.

When this issue is analysed it again appears that the geothermal industry would fit more comfortably within the metallic and industrial mineral regime. The *Metallic and Industrial Minerals Royalty Regulation* provides that initially a mining project is subject to a royalty of 1% of a mine's gross revenues (minus some specified deductions). Whereas, at the point in time that the mine's gross revenues equals, "the costs incurred in the exploration, development, recovering, processing, transportation or disposition of a leased substance, and any allowances for the costs that may be deducted from gross revenue for the purpose of determining net revenue". A new royalty terms are applicable. At this point in time the 1% gross revenue rate continues, unless, 12% of the mines net revenues exceeds 1% of the gross revenues. If 12% of the mines net revenues is a larger figure this rate becomes the new royalty rate.[168] In the event that 1% of the revenue from the geothermal power (or heat), sold by a geothermal plant, is collected in royalties, then this charge is consistent with the global average. Globally, 0.5 to 5.5% of the price of power is charged in royalties.[169]

Fitting geothermal royalties into the natural gas and petroleum royalty regimes would be a more significant challenge. "Gas royalties are set by a sliding rate formula sensitive to price and production volume. New royalty rates will range from 5% to 50% with rate caps at $17.75 Cdn/GJ (gigajoule)." Conventional oil, "[r]oyalties are set by a sliding rate formula containing separate elements that account for oil price and well production. Royalty rates will range up to 50%, with rate caps at $120 per barrel (bbl)."[170] It is unlikely that the formulas used to calculate royalties for natural gas or oil could be applied in a practical manner to the geothermal industry.

Geothermal development would be best served by a geothermal regulation. This would make it easier for the government to implement a royalty regime that is tailored to the geothermal industry. It would also provide the Alberta Government greater flexibility to

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[166] CanGEA, *Policy Recommendations, supra* note 71 at 150.

[167] *Mines and Minerals Act*, *supra* note 113.

[168] *Metallic and Industrial Minerals Royalty Regulation*, Alta Reg 350/1993.

[169] Kagel, *Handbook*, *supra* note 164 at 39.

[170] Alberta Energy, "Talk about royalties" (September 2012).

adopt a royalty holiday akin to one existing in Queensland, as a means to help establish this fledgling industry. However, as an interim measure it may be feasible to utilize the royalty regime used for metallic and industrial minerals.

3.7 Other Notable Legislation, Regulation and Directives

3.7.1 The Municipal Government Act

The *Municipal Government Act* contains exemptions that benefit the oil and gas industry by reducing the bureaucracy that oil and gas developers must deal with when they plan on drilling a well. Subsection 618(1)(b) indicates that the part of the Act dealing with planning and development does not apply "when a development or subdivision is affected only for the purposes of … a well or battery with the meaning of the *Oil and Gas Conservation Act* …."[171]

Subsection 1(eee) of the *Oil and Gas Conservation Act* defines the term "Well" as:

> Section 1(eee) of the *Oil and Gas Conservation Act* defines the term "Well" as "… an orifice in the ground completed or being drilled (i) for the production of oil and gas, (ii) for injection to an underground formation, (iii) as an evaluation well or test hole, or (iv) to or at a depth of more than 150 meters, for any purpose, but does not include one to discover or evaluate a solid inorganic mineral and that does not or will not penetrate a stratum capable of containing a pool or oil sands deposit;[172]

Subsection 1(oo) defines the term "pool" as:

> … (i) a natural underground reservoir containing or appearing to contain an accumulation of oil or gas, or both, separated or appearing to be separated from any such accumulation, or (ii) in respect of an in situ coal scheme, that portion of a coal deposit that has been or is intended to be converted to synthetic coal gas or synthetic coal liquid …[173]

According to the Canadian Society for Unconventional Resources (CSUR):

> A standard single well lease site for conventional oil or gas will typically affect a surface area measuring 100 meters by 100 meters. The lease site will typically hold the drilling rig and additional equipment along with supervisory accommodation and material storage. If multiple wells from a single pad are planned, the surface area of the lease site would be larger; in some cases as much as double the size. (100 meters by 200 meters).[174]

Thus, depending on how many wells are drilled on a given lease, the dimensions provided above equate to between 2.47 acres and 4.942 acres. For one geothermal project in Nevada

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[171] *Municipal Government Act*, RSA 2000, c M-26.

[172] *Oil and Gas Conservation Act*, RSA 2000, c O-6.

[173] *Oil and Gas Conservation Act*, *ibid*.

[174] Canadian Society for Unconventional Resources (CSUR), "Well Construction", online: CSUR <http://www.csur.com/sites/default/files/Well_Construction_v2_wBleed.pdf>.

the estimated size of each proposed geothermal well pads was 2.8 acres.[175] This suggests that the surface footprint of a fossil fuel well and a geothermal well can be nearly identical. This paper has also discussed the relatively benign impact geothermal operations have on the environment. Therefore, it can be argued that geothermal wells should benefit from a similar exemption.

There may also be an argument that a geothermal plant should benefit from the same exemption given to an oil and gas battery, under the *Municipal Government Act*. Subsection 1(g) the *Oil and Gas Conservation Act* defines the term "Battery" as:

> … a system or arrangement of tanks or other surface equipment receiving the effluents of one or more wells prior to delivery to market or other disposition, and may include equipment or devices for separating the effluents into oil, gas or water and for measurement.[176]

According to information provided by the United States Department of Energy a 20 MW geothermal binary plant (excluding wells) will have an approximate land footprint of 1,415 m^2/MW.[177] This amounts to about 7 acres of land. It is likely that geothermal plants in Alberta would be significantly smaller than 20 MW. Initially most projects in Alberta would be similar in size to the 1 MW plant proposed for Ft. Liard, or the 5 MW project that Deep Earth Energy Production Corp. (DEEPCorp.) is currently planning, near Estevan, Saskatchewan.[178] This means the footprint of such power plants is likely to be substantially smaller than 7 acres. It is quite possible that the footprint and environmental impact, of such power plants, would be less than many exempted oil and gas batteries.

3.7.2 Environmental Protection and Enhancement Act

Section 59 of Alberta's *Environmental Protection and Enhancement Act*, indicates that "The Lieutenant Governor in Council may make regulations (a) designating mandatory activities; (b) exempting proposed activities or classes of proposed activities from the application of the environmental assessment process."[179] Schedule 2 under the *Environmental Assessment (Mandatory and Exempted Activities) Regulation* exempts "the

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[175] US Department of the Interior, Bureau of Land Management, *Silver Peak Area Geothermal Exploration Project: Environmental Assessment* (Tonopah, NV: US Dept of the Interior, Bureau of Land Management, October 2012) at 6.

[176] *Oil and Gas Conservation Act*, *supra* note 172.

[177] US Department of Energy, Energy Efficiency & Renewable Energy (EERE), "Chapter 8: Environmental Impacts, Attributes and Feasibility Criteria" in *The Future of Geothermal Energy: Impact of Enhanced Geothermal Systems (EGS) on the United States in the 21st Century* (Massachusetts: MIT, 2006), online: EERE <http://www1.eere.energy.gov/geothermal/pdfs/egs_chapter_8.pdf>.

[178] Saskatchewan Ministry of Environment, *Deep Geothermal Energy Potential Initiative* (Saskatoon: goGreen, Government of Saskatchewan, nd); DEEPCorp, "Saskatchewan Geological Survey – Open House" (November 2011), online: DEEPCorp <http://economy.gov.sk.ca/adx/aspx/adxGetMedia.aspx?DocID=12209,12205,12203,11265,11254,11228,3385,5460,2936,Documents&MediaID=38962&Filename=5_Marcia_2011_Open_House.pdf>.

[179] RSA 2000, c E-12.

drilling, construction, operation or reclamation of an oil or gas well" from the need for an environmental assessment.[180] Applying the same reasoning that was used in reference to the exemptions under the *Municipal Government Act*, it is arguable that the "the drilling, construction, operation or reclamation", of a geothermal well should enjoy a similar exemption from environmental assessments. Even back in the 1980's academics recognized that, "although high environmental quality must be maintained, it does not seem that the level of regulation necessary for other forms of generation is mandatory with regard to geothermal energy."[181]

3.7.3 Small Power Research and Development Act

Alberta's *Small Power Research and Development Act* is credited with having, "jump-started several of the province's current renewable energy companies and spurred the renewable electricity sector in general." This Act provided favourable rates for electricity produced from specified sources.[182] Under this Act those who produce electric energy from solar, wind, hydro, geothermal, biomass or peat resources were included in the definition of "eligible power production facility", provided that the plant nameplate capacity was no more than 2.5 MW or it was a pilot project and the regulations did not otherwise disqualify a particular power facility.[183] This Act remains in force but the program that supported it is now closed.[184] The government has stopped awarding contracts under this Act.[185]

Although, included under this Act it was impossible for the geothermal industry to take advantage of the benefits it provided. Until the industry has a means to obtain a geothermal lease, including the industry in such legislation will have no real world impact. The geothermal industry is also advocating for "provincial and federal incentives to increases market penetration for their industry", such as tax incentives offered for other renewable energy technologies.[186] The minimum cost being associated with the negative externalities related to coal is about 3.5¢/kWh, and producing geothermal electricity can help avoid these externalities. For these reasons an argument can be made that incurring a certain level of cost, to incentivize the geothermal industry, can be justified. Other industries have already benefited from the *Small Power Research and Development Act* and it is likely that the geothermal industry will need similar assistance to gain a foothold in the province. Ideally future programs would include larger facilities than a mere 2.5 MW, because then

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[180] Alta Reg 111/1993.

[181] MJ Pasqualetti, "Geothermal Energy and the Environment: The Global Experience" (1980) 5 Energy 111-165 at 160.

[182] MM Wenig et al, *Legal and Policy Frameworks for Renewable Energy in Alberta*, ISEEE Energy Paper #12 (Calgary: Institute for Sustainable Energy, Environment and Economy, 2007) at 31.

[183] *Small Power Research and Development Act*, RSA 2000, c S-9.

[184] J Krivitsky, *Wind Power and Renewable Energy in Alberta*, Occasional Paper #30 (Calgary: Canadian Institute of Resource Law, 2010).

[185] Wenig et al, *supra* note 182.

[186] Wenig et al, *ibid* at 31.

they would encompass projects in Alberta that may be modelled after the 5 MW project that DEEPCorp. is developing in Saskatchewan.

3.7.4 Micro-generation Regulation

Under Alberta's *Electric Utilities Act*, the *Micro-generation Regulation* has been adopted.[187] According to the Government of Alberta, "[t]his regulation is a set of rules that allows Albertans to generate their own environmentally friendly electricity and receive credit for any power they send into the electricity grid, otherwise known as micro-generation."[188] As in the *Small Power Research and Development Act*, the drafters of this regulation had the foresight to include geothermal power. However, for a facility to be included under this act its nominal capacity cannot exceed 1 MW.[189] Again, until leases for the geothermal industry are available, this regulation cannot serve the industry and ideally such legislation would include a higher nominal capacity.

3.7.5 AER Directive 060: Upstream Petroleum Industry Flaring, Incinerating, and Venting

The purpose of *Directive 060* is to "eliminate or reduce the potential and observed impacts associated with these activities [oil and gas] and ensure that public safety concerns and environmental impacts are addressed prior to commencing flaring, incinerating, and venting activities." The requirements under this directive were developed in consultation with the Clean Air Strategic Alliance (CASA).[190] In 1998, the CASA Flaring and Venting project team made the recommendation that "Alberta strive toward an overall goal of the eventual elimination of routine solution gas flaring."[191] By 2011, the volumes of flared solution gas were reduced by 67.6% compared to a 1996 baseline. Volumes of vented gas were reduced by 50.3% compared to a 2000 baseline. The provinces success has been recognized internationally. Alberta was invited by the World Bank to be part of global gas flaring reduction initiative, and is providing ongoing technical assistance with respect to

[187] *Micro-generation Regulation*, Alta Reg 27/2008.

[188] Alberta Energy, "What is Micro-Generation?" (2013) [Energy, "Micro-Generation"], online: Alberta Energy <http://www.energy.alberta.ca/Electricity/microgen.asp>.

[189] *Micro-generation Regulation*, *supra* note 187.

[190] AER, *Directive 060: Upstream Petroleum Industry Flaring, Incinerating, and Venting* (3 November 2011) [*Directive 060*], online: AER <http://www.aer.ca/documents/directives/Directive060.pdf>.

[191] Alberta Environment, Air Policy Section, *Air Management in Alberta* (Edmonton: Alberta Environment, 2009) at 24, online: Alberta Environment <http://environment.gov.ab.ca/info/library/8137.pdf>.

developing global standards.[192] One of the innovative measures required under *Directive 060* is that:

> … all solution gas flares or vents releasing more than 900 m^3/day (32 thousand [103] cf) must be economically evaluated to see if gas conservation is viable. If the NPV [net present value] of the gas conservation project at crude oil batteries is found to be greater than negative $50,000, the well or battery must not be produced until the gas is conserved. At crude bitumen batteries, as soon as gas flow rates exceed an average of 900 m^3/day for any consecutive three-month period within a rolling six-month window, operators have up to six months to conserve the solution gas if the NPV of the gas conservation project is greater than negative $50 000. Prior to 2007, Directive 060 required at minimum a neutral NPV (i.e., $0.00) before solution gas conservation was necessary.[193]

It is possible that this might be a model that could be applied to co-produced geothermal fluids, as a means of preventing waste. Currently, usable energy in the form of heat is simply being treated as waste. Moving forward this form of regulatory innovation could again earn the province positive recognition on the world stage.

4.0 Conclusion

By the late 1970's, Alberta politicians were aware that geothermal resources represented an untapped source of energy in the province. However, to date, the province still lacks even basic legislation that would allow developers to obtain the permits and leases from the provincial government needed to develop the province's substantial geothermal resources. Creating the requisite legislative pathway would help the province meet its goal to diversify its energy supply, while simultaneously bringing the province closer to achieving its GHG reduction targets. There are no jurisdictional barriers that would prevent the province from implementing a geothermal regulatory regime. In fact, much of the work could be accomplished by adopting a regulation. The development of the *Alternative and Renewable Energy Policy Framework* represents a significant opportunity to move forward with the steps required to help foster geothermal energy development in the province.

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[192] Energy Resource Conservation Board (ERCB), *ERCB ST60B-2012: Upstream Petroleum Industry Flaring and Venting Report – Industry Performance for Year Ending December 31, 2011* (September 2012) [ERCB ST60B-2012], online: AER <http://www.aer.ca/documents/sts/st60b-2012.pdf>.

[193] Note that NPV stands for "net present value". *ERCB ST60B-2012*, *ibid* at 5.

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