GEOTHERMAL PLANT IN ICELAND

GEOTHERMAL ENERGY

Gaining Steam: A Regulatory and Policy Framework for Geothermal Energy Development in Alberta

Module 3: Policy Support for Geothermal Energy Development

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October 2020

Environmental Law Centre

Library and Archives Canada Cataloguing in Publication

Title: Gaining steam : a regulatory and policy framework for geothermal energy development in
Alberta / authored by Brenda Heelan Powell.
Names: Powell, Brenda Heelan, 1971- author. | Environmental Law Centre (Alta.), publisher.
Description: Includes bibliographical references.
Identifiers: Canadiana 20200384503 | ISBN 9781989522127 (PDF ; Module 3)
Subjects: LCSH: Geothermal resources—Law and legislation—Alberta. | LCSH: Geothermal resources—
Government policy—Alberta. | LCSH: Energy development—Law and legislation—Alberta. | LCSH:
Energy development—Government policy—Alberta.
Classification: LCC KEA376 .P69 2021 | DDC 346.712304/679—dc23

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Charitable Registration #11890 0679 RR0001

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ACKNOWLEDGEMENTS

The Environmental Law Centre would like to thank the Alberta Law Foundation for its support of this project.

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MODULE 3: POLICY SUPPORT FOR GEOTHERMAL ENERGY DEVELOPMENT

As discussed in *Module 2: The Missing Pieces in Alberta's Regulatory Landscape and a Path Forward for Geothermal Energy Development*, a comprehensive regulatory scheme is an essential foundation for the development of geothermal energy. However, that is not the only piece of the puzzle: policy support is essential as a means to reduce development risks and alleviate market pressures on a nascent industry.

Development of geothermal resources for electrical production proceeds in a staged approach: surface-based exploration, discovery and exploration drilling to confirm availability of the resource (2-3 years), drilling to build out the field and construct power plant (3-5 years), and operations.[1] The initial exploratory stages require significant up-front capital, have high drilling costs, and are subject to the risk of not hitting a productive resource.[2] Development of geothermal resources can be hindered by inadequate policies for support of the industry, high up-front costs to develop the field and power plant, the lack of availability of transmission to geothermal sites, a lack of infrastructure required for easy access to geothermal sites, and limited availability of technical expertise.[3]

[1] Subir K. Sanyal et al., Knowledge Series 024/16, Comparative Analysis of Approaches to Geothermal Resource Risk Mitigation: A Global Survey (2016: World Bank, Energy Sector Management Assistance Program) [Sanyal et al.].

[2] Justin Crewson and Alison Thompson, *International Geothermal Policy Mechanisms Best Practices: Identifying the Canadian Gap* (Calgary: 2015, CanGEA) [Crewson-Thompson].

[3] Sanyal et al., *supra*. note 1.

Risks may be off-set to some extent by existing oil and gas data.[4] Further, given similarities to oil and gas development, the experience managing risk for these developments may be applicable to managing risk of geothermal energy development.[5] As stated by Banks, other measures could be taken to achieve cost reductions:[6]

- Continued use of existing oil and gas exploration data, including well logs and seismic profiles, to reduce the risk of drilling dry wells;

- Repurposing existing oil and gas wells as geothermal slim holes for advanced exploration, reservoir productivity testing and, where possible, full-scale brine production and injection;

- Scaling up from pilot scale (1-2.5 MWe) to full field development (> 10 MWe);

- Creating a local manufacturing base for geothermal power plant components, including geothermal well casings, heat exchangers and organic Rankin cycle generators;

- Developing and optimizing low and ultra-low temperature differential heat engines.

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[4] Aletta Leitch and Jason Switzer, "The Missing Pieces in Alberta's geothermal puzzle: Alberta's strengths in oil and gas make geothermal a strong possibility, but it needs a push to get going" (December 18, 2017) Pembina Institute Blog [Leitch-Switzer].

[5] *Ibid*.

[6] Jonathon Banks, *Deep-Dive Analysis of the Best Geothermal Reservoirs for Commercial Development In Alberta: Final Report* (Edmonton: 2016, Earth and Atmospheric Sciences, Faculty of Science, University of Alberta) at 67 [Banks].

Despite these potential cost reductions, geothermal development in Alberta is at such early stages that significant financial risk still exists. This, in turn, can make it difficult to obtain private financing and investment.[7] Even in light of the synergies arising in Alberta due to the extensive oil and gas industry, it is still essential that policy tools designed to off-set or alleviate the inherent financial risks be developed to encourage geothermal energy development.[8]

1. Policy Support for Geothermal Energy Development: The Tools

Alberta has a history of using policy tools to help establish new industries. For instance, in the 1970s, a government-funded agency - the Alberta Oil Sands Technology and Research Authority (AOSTRA) was established to accelerate the development of oil sands technology.[9] The activities of AOSTRA included the construction of test facilities for new technology.[10] As well, the oil and gas industry currently receives a variety of subsidies in the form of royalty structures, tax provisions, and research grants.[11]

[7] Crewson-Thompson*, supra.*note 2.

[8] Bethany Speer et al., *Geothermal Exploration Policy Mechanisms: Lessons from International Application, Technical Report NREL/TP-6A20-61477* (Washington, D.C.: 2014, National Renewable Energy Laboratory) [Speer et al.]. See also Crewson-Thompson*, supra.* note 2.

[9] Gillian Steward, *Betting on Bitumen: Alberta's Energy Policies from Lougheed to Klein* (Ottawa: 2017, Parkland Institute and the Canadian Centre for Policy Alternatives).

[10] Earth Sciences Report 2000-05: *Historical Overview of the Fort McMurray Area and Oil Sands Industry in Northeast Alberta* (Calgary: 2005, Alberta Energy and Utilities Board).

[11] Environmental Defence Canada and Phillip Gass, *Doubling Down with Taxpayer Dollars: Fossil Fuel Subsidies from the Alberta Government* (Toronto: 2019, Environmental Defence Canada). See also Shelagh Whitley et al., *G7 fossil fuel subsidy scorecard: tracking the phase-out of fiscal support and public finance for oil, gas and coal* (London, UK: 2018, Overseas Development Institute).

Policy tools have also been adopted in Alberta to encourage the development of renewable energy sources. The *Renewable Electricity Act*[12] establishes a provincial target that, by 2030, at least 30% of electricity being produced in Alberta will be from renewable energy resources.[13] Under that Act, renewable energy resources include "heat from the earth" (i.e. geothermal resources).[14] Until June 2019, this legislation was supported by a Renewable Electricity Program (REP) designed to encourage the development of new electricity capacity from renewable sources. A key component of this program was the use of an Indexed Renewable Energy Credit (a.k.a. contract for difference) which allowed developers to competitively bid for the all-in price they need to develop a project.[15] From the all-in price, the pool price is deducted and the difference is how much is paid in support (for the renewable attributes).[16] Three rounds of REPs were held and the cumulative target of 1,100 MW was exceeded (1,363 MW were bid).[17]Similar approaches can be applied to encourage the development of geothermal resources.

It has been long recognized that there is a need to encourage exploration, experimentation, and development with expanded federal-provincial grant programs, and tax incentives to encourage investment.[18] In some jurisdictions

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[12] *Renewable Electricity Act*, S.A. 2016, ch. R-16.5.

[13] *Ibid.*, s. 2.

[14] *Ibid.,* s. 1.

[15] AESO website at https://www.aeso.ca/market/renewable-electricity-program/about-the-program/.

[16] *Ibid*.

[17] AESO website at https://www.aeso.ca/market/renewable-electricity-program/rep-results/ provides results for the amount of electricity production developed through the REP. The cumulative target for the three rounds of REP held was 1,100 MW and the actual amount was 1,363 MW. Despite this success in developing electricity production from renewable resources, the REP has been cancelled.

[18] Judith A. Snider, *Geothermal Resources, an Overview* (November 1980, Energy Law).

cost-sharing programs have been implemented to encourage development of geothermal data and technology. Other financial mechanisms – such as government grants or government-backed loans (which can convert to grants), insurance, or reduced licensing fees and royalties – can be used to encourage development of geothermal facilities by de-risking geothermal activities. Development of geothermal generated electricity can be encouraged using feed-in-tariffs, renewable portfolio standards or both.

Whatever policy mechanisms are chosen, it is essential that there is express consideration and inclusion of geothermal resources. As stated by Crewson and Thompson:[19]

> It should be noted that in some cases geothermal energy projects are ineligible for policy support mechanisms that are available to other renewable energy sources, and in various jurisdictions they compete with fossil fuel projects, which do not have their negative externalities in terms of air and water pollution and GHG production accounted for competitively with international best practices. Moreover, the benefits of geothermal energy are not accurately weighed, which have particularly affected unconventional geothermal projects in Canada.

Crewson and Thompson suggest that, in order to level the playing field for geothermal developments, all social costs associated with fossil fuel generated electricity should be considered.[20] Alternatively, they suggest that the social benefits of geothermal electrical generation could be valued using feed-in-tariffs.[21]

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[19] Crewson-Thompson, *supra.* note 2 at 94 to 95.

[20] *Ibid*.

[21] *Ibid*.

1.1 Royalties

As a matter of policy, the issue of whether or not geothermal royalties are appropriate in Alberta should be considered. There has been suggestion that royalties are not appropriate for geothermal resources given no resource is being depleted.[22] However, geothermal developments can affect the resource in terms of "cooling of the reservoir, subsidence, reduction of fluid resulting in changes to surface feature and habitats, hydrothermal eruptions, interference with existing takes, and changes in location of heat and fluids"[23] and a royalty can encourage more sustainable development of geothermal resources.[24] Others have suggested[25] that royalty breaks or variable rates may be appropriate for geothermal resources.

Royalties are essentially a unique form of taxation on natural resources and may take different forms.[26] An **in rem tax** is "applied to production without considering the cost of operation or investment".[27] In rem taxes may take many forms but the types applicable to geothermal developments are:[28]

[22] Grant Van Hal, *Legal Obstacles to the Development of Geothermal Energy in Alberta, CIRL Occasional Paper #42* (Calgary: 2013, Canadian Institute of Resources Law).

[23] Sam Malafeh and Basil Sharp, "An Economic Analysis of Royalties: Application to Geothermal Development", (Proceedings World geothermal Congress, Melbourne, Australia, 19-25 April 2015) at 3 [Malafeh-Sharp].

[24] *Ibid*.

[25] Peggy Holroyd and Jennifer 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* (Calgary: 2011, Pembina Institute) [Holroyd-Dagg].

[26] Malafeh-Sharp, *supra.* note 23.

[27] *Ibid.* at 6.

[28] *Ibid*.

- Unit-Based Royalty which is a fee applied to production. The royalty payable is linked to the operation size and amount of extracted natural resource.

- Resource Rent Royalty (a.k.a. ad valorem royalty) which is a levy on net cash flow. The royalty payable is based upon the revenue gained from using the resource.

Another form of royalty is **in personam taxes** which is an income tax otherwise known as an accounting profits royalty.[29] The accounting profits royalty is calculated as a percentage of the operating profits. Such a royalty may be implemented on a scaling scale so that as profit increases, so does the percentage of the royalty.

1.2 Government Financial Support: Cost-Share Programs, Public Insurance, Early-Stage Fiscal Incentives

Government financial support may be offered to the geothermal industry in various forms: research and development, investment aid and operating aid (mostly for electrical operations).[30] For example, the Government of Iceland devotes a significant portion of its GDP to research and development for renewable energy sources including geothermal resources. Cost-share programs or publicly funded insurance programs can be used to reduce resource risk associated with geothermal exploration and development. Governments may also contribute to the development of associated

[29] *Ibid*.

[30] Philippe Dumas and Luca Angelino, "Financing Geothermal Energy" (Proceedings World Geothermal Congress, Melbourne, Australia, 19-25 April 2015) [Dumas-Angelino].

infrastructure – such as roads and transmission lines – which is especially helpful for geothermal development in remote areas.[31]

The United States serves as an example of a multi-pronged policy approach which successfully encouraged geothermal development using market tools and direct government support. The federal *Public Utilities Regulatory Policies Act* (PURPA) expanded the geothermal market by providing certainty to project investors.[32] By 2012, 30 states had enforceable renewable portfolio standards in place.[33] In addition, "research and development policies provided an investment of public dollars toward developing technologies and reducing costs over time to increase the market competitiveness of geothermal electricity".[34] For instance, the U.S.A. federal government provided loan guarantees for geothermal projects (both direct heat and electricity production) and provided investment tax credits.[35] As summarized by Crewson and Thompson:[36]

> The United States has a complex history of geothermal development. The government participated in resource development in the late 1960s with research and early drilling conducted by Federal and State agencies, and by independent parties. By the 1970s, several laws had been put in

[31] Sanyal et al., *supra.* note 1.

[32] Elizabeth Doris, Claire Kreycik and Katherine Young, *Policy Overview and Options for Maximizing the Role of Policy In Geothermal Electricity Development, Technical Report NREL/TP-6A2-46653* (Washington, DC: 2009, National Renewable Energy Laboratory) [Doris et al.].

[33] Ingimar G. Haraldsson, "Government Incentives and International Support for Geothermal Project Development", presented at *Short Course VI on Utilization of Low-and Medium-Enthalpy Geothermal Resources and Financial Aspects of Utilization*, organized by UNU-GTP and LaGeo, in Santa Tecla, El Salvador, March 23-29, 2014 [Haraldsson]. See also Christopher Richard, "Developmental Barriers vs. Policy Incentives in Geothermal Power" (2012) 36 GRC Transactions 115.

[34] Doris et al., *supra.* note 32 at 1.

[35] *Ibid*.

[36] Crewson-Thompson, *supra.* note 2 at 23-24.

place - most importantly, the Public Utility Regulatory Policies Act (PURPA) - and sufficient knowledge had been developed regarding geo-thermal resources to spur a geothermal boom from 1980 to the late 1990s. As shown in Figure 4, the United States has had various forms of government cost-sharing and tax incentives, but has kept the majority of the development and capital investment directly with the private sector. In combination, policy decisions (PURPA and RPS, in certain states), some direct government support (in the form of cost-shared drilling), and a favorable tax climate have led to geothermal growth in the United States. While cost-shared drilling has been helpful throughout the history of geothermal development in the United States, it is important to note that PURPA was a major motivator for geothermal development through the early 1990s. Since then, tax credits in place since the 1990s have made taking early stage geothermal risk worthwhile for some IPPs, with some continued support from cost-shared drilling. A new round of cost-shared drilling (using slim holes to prove certain resources, including those with no surface expression) is under consideration at present.

Ultimately, rather than adopting a single form of government financial support, it is likely a suite of policy mechanisms will prove most effective. This suite could include cost-share programs, public insurance programs, and early fiscal incentives.

1.2.1. Cost-Share Programs

As noted by Sanyal et al., experience in other jurisdictions has shown that government financial support has been critical in overcoming barriers to geothermal development.[37] Government support is especially crucial in the early

[37] Sanyal et al., *supra*. note 1.

stages to offset resource risks and potential financial losses to geothermal developers.[38]

In some countries, much of the geothermal development can be credited to the government taking on the entire resource and project risk by virtue of taking on the role of project developer.[39] This is the case in New Zealand and Iceland.

In other jurisdictions, cost-shared programs have been used to shift some or all of the resource and development risks to the public sector.[40] Cost-shared programs often take one of two forms:[41]

- cost-shared exploration drilling where the government provides some portion of the risk-capital required for early stage exploration drilling; or
- government-led or funded exploration drilling to create certainty about the commercial viability of the geothermal resource.

In both cases, the goal is to reduce early stage risk thereby encouraging or facilitating private investment.[42] In some cases, cost-share programs may extend beyond the exploration stage in order to address post-exploration risks.[43] The cost-share programs are effectively government grants which reduce investment costs.[44]

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[38] *Ibid*.

[39] *Ibid*.

[40] *Ibid*.

[41] *Ibid*.

[42] *Ibid*.

[43] *Ibid*.

[44] Speer et al., *supra*. note 8.

According to Sanyal et al. cost-share programs are particularly successful where the government's goal is to quickly increase the amount of geothermal generation capacity in cooperation with the private sector.[45] A variety of cost-share programs have been used in the U.S.A., as well as in Japan.

1.2.2 Public Insurance

As stated by Dumas et al. "[u]nless the subsurface is particularly well explored and characterized for geothermal energy utilization…, the resource risk poses a formidable challenge and is the major barrier to entry for geothermal project developers in Europe but also worldwide".[46] In response, several countries have established public insurance programs for geothermal developments including Germany, Iceland, the Netherlands, France, Denmark and Switzerland.[47]

Typically, public insurance programs insure for the short-term risk that, after drilling, the geothermal resource is determined to not be commercially viable.[48] This risk is usually covered by insuring the drilling costs. Another potential risk with geothermal development is long-term depletion or degradation of the resource.[49] If an insurance program were to be established for this long-term risk, there would need to be conditions in place to ensure the depletion or degradation was not due to mismanagement of the resource.[50] However, as

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[45] Sanyal et al., *supra*. note 8.

[46] S. Fraser et al., *European Geothermal Risk Insurance Fund EGRIF, Deliverable No. 3.2* (Luxembourg: 2013, GeoElec, European Union) [Fraser et al.]

[47] Philippe Dumas et al., *Risk Mitigation and Insurance Schemes Adapted to Geothermal Market Maturity: The Right Scheme for my Market* (European Geothermal Congress, Den Haag, The Netherlands, 11-14 June 2019) [Dumas et al.].

[48] Fraser et al., *supra.* note 46.

[49] *Ibid*.

[50] *Ibid*.

mentioned, public insurance programs typically insure against the short-term risk associated with initial development rather than the long-term risk of resource degradation or depletion.

The public insurance programs tend to either (1) provide a payment once failure occurs (a.k.a. drilling failure insurance) or (2) provide a guaranteed loan which is forgiven if failure occurs (a.k.a. loan guarantees).[51] The advantage of the second approach is that payment is provided up-front which helps address the risk and the capital intensive nature of geothermal development. Risk insurance may also enable the developer to attract private investment capital which might not otherwise be available.[52]

In proposing risk insurance for geothermal development across Europe – a European GeoRisk Fund - several recommendations have been made:[53]

- Insurance premiums should be low, in the range of 3 to 7%.
- The minimum coverage adopted should be 60%. If possible, up to 90% coverage is recommended.
- While coverage of long-term risk is attractive, it is only sustainable if there are many projects applying.

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[51] *Ibid.* and Dumas et al., *supra.* note 47.

[52] Sanyal et al., *supra.* note 1.

[53] Fraser et al., *supra.* note 46. See also Christian Boissavy, *Report reviewing existing Insurance schemes for geothermal, Deliverable number D3.1* (Luxembourg: nGEORISK, European Union) available at https://www.georisk-project.eu/wp-content/uploads/2020/02/D3.1_Report-reviewing-geothermal-risk-mitigation-schemes-v2.pdf [Boissavy].

- The coverage should be increased in areas with poor geological information.
- The insurance program should apply to electrical, heat, and cogeneration plants.
- An obligation should be imposed to disclose data collected, although there may be a period of confidentiality before the data must be made publicly available.
- Impose time limits for exploration and drilling to be undertaken and completed.
- Participants in the insurance program should be subject to reporting obligations.

It has been recommended that the proposed European GeoRisk Fund should be initially supported by public funds and eventually phased into private insurance schemes.[54] Dumas et al.[55] state that risk mitigation schemes should reflect market maturity: in juvenile markets grants are more appropriate (starting with direct grants and progressing to repayable grants), in intermediate markets public insurance is appropriate, and finally in near mature markets it is appropriate to have public-private partnerships for risk insurance.

1.2.3 Early Stage Fiscal Incentives

Fiscal incentives can be a complement to more comprehensive risk reduction programs (such as cost-sharing or insurance). At an early stage, fiscal incentives

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[54] Fraser et al., *supra.* note 46.

[55] Dumas et al., *supra.* note 47.

such as exemptions from duties or tax credits can reduce the financial exposure of geothermal developers.[56] Examples of such fiscal incentives can be found in the U.S.A. and the Philippines.

1.3 Market Incentives: Feed-in Tariffs, Renewable Portfolio Standards

Other policy tools - such as feed-in-tariffs (FIT) and renewable portfolio standards (RPS) programs – are complementary to government financial support discussed above, tending to provide support later in the development stages.[57] Both FIT and RPS programs operate to "level the playing field" for emerging renewable energy sources thereby making them competitive with traditional fossil fuels.[58] These types of policy instruments may require legislative underpinning. For example, a RPS program requires clear targets for renewable energy production and penalties for failure to meet such targets.

Worldwide, the dominant policy tools to facilitate renewable energy development and to bring renewable energy resources to market are FIT and RPS programs.[59] It is essential that such policy tools be in place for multiple years given the timeline for development of geothermal energy projects (at least 8-10 years).[60]

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[56] Sanyal et al., *supra.* note 1.

[57] *Ibid*.

[58] Dumas-Angelino, *supra.* note 30.

[59] Toby D. Couture et al., *A Policymaker's Guide to Feed-In Tariff Policy Design* (Washington, D.C.: 2010, National Renewable Energy Laboratory) [Couture et al.].

[60] Doris et al., *supra.* note 32.

1.3.1 Feed in Tariffs

FITs are the world's most widely used policy for increasing renewable energy use.[61] Other policy goals – such as increasing energy security, climate mitigation, environmental protection and job creation – may also be achieved using FITs and the particular policy goals will determine the objectives of a particular FIT program.[62]

FITs are used to set a guaranteed price for sellers of renewable energy and to guarantee access to the electrical grid. A FIT program consists of three key components: guaranteed access to the electrical grid; stable, long-term purchase agreements; and payment levels based on the cost of renewable energy generation.[63] A key policy choice in FIT programs is whether or not the payment levels will depend on market price, that is "fixed-price" versus "premium-price".[64] A fixed-price FIT program sets the payment independently of the market price and remains constant for a fixed period of time whereas a premium-price FIT program determines total payment by adding a premium tariff to the market price of electricity (the premium tariff may either be constant or sliding).[65] The premiums may be imposed as a tariff on downstream customers or on utilities, and guarantee a minimum price per kilowatt-hour above the average grid electricity price.[66] The rationale for premiums is to assist renewable

[61] Couture et al., *supra.* note 59.

[62] *Ibid*.

[63] *Ibid*.

[64] *Ibid.* at vii.

[65] *Ibid*.

[66] Allan Ingelson and Christopher Phillip, "Chapter 5: Policies and Laws and Island Environments" in Mary-Ellen Tyler (ed.) *Sustainable Energy Mix in Fragile Environments: Frameworks and Perspectives* (Switzerland: 2018, Springer International Publishing) [Ingelson-Phillip].

energy power developers in recovering their upfront capital costs which are often substantially higher than for fossil-fuel based plants.[67]

Several key issues should be addressed in a FIT program.[68] These include eligibility for participation in the program, the role of the utility, the length of purchase agreements (often 15-20 years), whether caps should imposed on the capacity of renewable energy allowed or the project size, and funding for the program. As well, there should be clear protocols on transmission and interconnection issues.[69]

A variety of options exist for each component of a FIT program. Firstly, FIT payments may be set as:[70]

1. A percentage of retail price. This approach was used historically in Europe but is no longer in use.

2. A fixed price approach where the FIT payments are independent of the market price for electricity. A guaranteed payment is offered for a set period of time. It should be noted that adjustments may be made over the course of the FIT program for inflation, cost reductions, to encourage certain behaviours and so forth however, the key is that the FIT is independent of the market.

3. A premium price approach where the FIT payment is a premium paid on top of the market price for electricity. This means the FIT payment is directly tied to market fluctuations. There are mechanisms that can be

[67] *Ibid.*

[68] Couture et al., *supra.* note 59.

[69] *Ibid*.

[70] *Ibid*.

used to index the premium paid to prevailing electricity prices (to avoid overcompensation in the case of high electricity prices) which are referred to as sliding premiums.

Most countries have selected the fixed price approach (i.e. FIT independent of market price) and have been used in Germany and Canada (Ontario).[71] Numerous program design choices can be made for both fixed price and premium price approaches. For instance, the FIT payment may be differentiated on the basis of technology or fuel type, project size, resource quality, or the specific location of the resource. As pointed out by Couture et al. these "design options can be used in various configurations to achieve particular policy goals".[72]

Other program choices include:

1. Tariff degression in which there are decreases in payment levels at predetermined points of time, at predetermined capacity levels, or according to the rate of market growth.

2. Inflation adjustment.

3. Front-end loading which provides proportionally higher tariff in the initial period accompanied by proportionally lower tariff in the remaining project life.

4. Changes in tariff with time of delivery where higher tariffs are offered during peak demand period.

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[71] *Ibid*.

[72] *Ibid.* at 35.

5. Bonus payment options to encourage certain types of technologies or behaviours (might be based on fuel streams, high-efficiency systems, revitalization of old projects, local ownership, use of innovative technologies, early implementation of technology).

Couture et al. note that these program design elements can apply to both fixed-price and premium-based FITs.[73] However, given that premium-based tariffs reflect market price and fixed-price tariffs do not, different considerations will apply. In the case of premium-based tariffs, the premiums may be constant or sliding.[74] A constant premium provides a non-variable adder to the market price whereas a sliding premium fluctuates with the market price (i.e. premium decreases as market price increases to prevent windfalls).

Aside from the amount of the FIT payments, the design of a FIT program may vary in many other aspects as well. Couture et al. describe these as implementation options:[75]

1. Eligibility Criteria
   These criteria determine who can participate in the FIT program and may place limitations on qualifying projects.

2. Purchase Obligations
   Utilities or transmission system operators may be required to purchase electricity from eligible projects or to guarantee grid connection.

3. Non-Utility Purchase Agreements
   This allows the option of sale of electricity to third-parties (i.e. not utilities)

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[73] *Ibid*.

[74] *Ibid*.

[75] *Ibid.* at Part 5.0.

which enables forward supply contracts rather than sales on the open market.

4. Contract-Related Design Elements
   This can include the requirement to use standardized power purchase agreements, the required length of contracts (usually 15-25 years), or other unique contract considerations.

5. FIT Policy Adjustments
   This relates to the frequency and methodology for review and adjustment of the FIT program over time.

6. Caps on FIT Policies
   These may include project or program caps such as total capacity, maximum individual project size, or total program cost. Such caps can be important to control overall costs at the outset to ensure a sustainable, functional program.

7. Forecast Obligations
   This relates to variable renewable energy sources such as a wind and solar. Given that geothermal energy output has constant output this is less of a concern.

8. Transmission and Interconnection Issues
   There may be need for system-wide planning and coordination to ensure sufficient transmission capacity. This may raise issues such as allocation of the infrastructure costs, interconnection costs, and queuing procedures.

Whatever the design of the FIT program, appropriate funding of the program is essential. A FIT program could be funded by the ratepayer, the taxpayer and/or supplementary means such as the auction of carbon allowances.[76] Ratepayer funding involves integration of "any added costs directly into the rate base, and share them among all the electricity customers and classes".[77] Along with passing on costs to the ratepayers, it is important that cost savings from renewable energy deployment are also passed on. Ratepayer funding can distribute costs evenly across each individual customer class, share costs differentially across customer classes, or use a specific benefits charge added to customers' bills.[78] Germany is an example of a jurisdiction where incremental costs are incorporated into the rate base. Further, in Germany there is a mechanism to ensure that costs are shared among all ratepayers in order to equalize investment costs across the country (because renewable energy development may be concentrated in one region or one electricity supplier).[79]

Taxpayer funding is accomplished via imposing an additional tax or using existing government revenues. The Netherlands uses tax revenues to finance its FIT program. Spain uses a combination of both incremental costs added to the rate base and tax revenue. Supplementary means for FIT program funding can include the use of greenhouse gas auction revenue or utility tax credits (i.e. allow utilities offset tax liabilities so they can purchase renewable electricity).[80]

After comprehensive review of the experience with FIT programs worldwide, Couture et al. distilled several best practices for FIT program design:[81]

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[76] *Ibid.* at 92.

[77] *Ibid.* at 92.

[78] *Ibid.* at 92.

[79] *Ibid*.

[80] *Ibid*.

[81] *Ibid.* at 99 to 103.

1. Ensure policy stability and price certainty.

2. Differentiate FIT payments according to renewable energy generation costs (i.e. cost-covering compensation). This may include setting payment levels by reference to technology, project size, location, and resource quality.

3. Encourage innovation and technological change. This can be accomplished using tariff degression (to reflect cost reductions that occur through economies of scale, technological learning, and technological change.

4. Differentiate FIT prices by time of delivery, that is, offer higher payment levels for production during peak demand. This design element is generally applicable only to those resources that can modulate supply such as hydropower, biomass, and biogas.

5. Use bonus payments to target certain policy objectives (such as use of innovative technologies, re-powering old sites and so forth).

6. If a premium-price FIT program is adopted (as opposed to a fixed-price), then a sliding premium should be used. The sliding premiums offer more investment security and reduce the chances of over- or under-compensation.

In terms of implementation, best practices for FIT a program include:[82]

1. Grid access should be guaranteed and non-discriminatory. Renewable energy can be accelerated by granting priority access for renewable energy sources.

2. Include a utility purchase obligation as a means to provide higher degree of certainty for renewable energy developers.

3. Clarify transmission and interconnection rules, including streamlined interconnection processes for smaller installations.

4. Share costs, especially transmissions costs, across all electricity customer classes. Most commonly this is done by integrating added costs directly into the rate base for all customers.

5. Require generation forecasts. This is a best practice for renewable energy sources with variable outputs (such as wind) but is not really relevant to geothermal electrical production which typically has constant output.

6. Progress reports outlining milestones, anticipated revisions, unresolved issues, and recommendations should be required of utilities or appropriate regulatory bodies.

It is essential that the FIT program developed be in place for a significant period of time to provide certainty necessary to encourage investment in a nascent industry.

[82] *Ibid.* at 99 to 103.

1.3.2 Renewable Portfolio Standards

In order to encourage development of renewable energy resources, the government may establish renewable energy targets using a variety of mechanisms: government announcements, renewable energy action plans, and RPS programs.[83] Unlike government announcements or renewable energy action plans, an RPS program is an enforceable renewable energy target. Under an RPS program, the government sets renewable energy goals as a percentage of annual electricity generation to be achieved within a certain time-frame.[84] The requirements set by an RPS program are mandatory and failure to meet RPS requirements will result in a penalty (typically, a fine or other fiscal consequence).[85]

The design of a particular RPS program may vary depending upon political motivations, target types and technology approaches.[86] However, there are some commonalties throughout RPS programs:[87]

- Targets are typically set as production targets (as opposed to capacity targets). Production targets are more desirable because they incentivize use of equipment that maximize renewable energy generation. Although less administratively complex, capacity targets do not necessarily incentivize development of high quality resulting in curtailed renewable generation.

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[83] Jenny Hester, Bethany Speer, and Mark B. Glick, *International Best Practices for Implementing and Designing Renewable Portfolio Standard (RPS) Policies* (Washington, D.C: 2019, National Renewable Energy Laboratory) [Hester et al.].

[84] Ingelson-Phillip, *supra.* note 66.

[85] Hester et al., *supra.* note 83.

[86] *Ibid*.

[87] *Ibid*.

- Targets are usually set on an annual basis with a year-end target.
- The program provides a list of eligible technologies and may include temporal constraints (i.e. only new production).
- The program will indicate whether or not renewable energy imports are eligible.
- A compliance and enforcement structure. This requires a clear methodology for assessing and verifying compliance, as well as enforcement mechanisms such as penalties.
- Most RPS targets are applied to electricity suppliers, although this should be specified in the policy.

Further, an RPS program should include mechanisms to ensure "customers are protected from excessive cost increases associated with the policy".[88] There are two options for cost containment:[89]

1. An Alternative Compliance Payment (ACP) approach places a ceiling on the cost of compliance as entities can pay the ACP in lieu of contracting for renewable generation. This acts as a cap because obligated entities will not pay more for renewable energy credits than the ACP.
2. Cost cap retail rate caps ensure that end-use consumer electricity rates do not rise above a specified percentage of dollar amount. Obligated entities are exempt from RPS procurement to the extent that incremental costs exceed the retail rate cap.

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[88] *Ibid*.

[89] *Ibid*.

The RPS – both interim and upper limits - should be set via analysis of technical, economic, market, or resource potential of renewable resources.[90] Gathering stakeholder input is also essential in developing RPS targets.[91] It is important to remember that RPS programs typically do not operate in isolation but are designed to interact with other policy mechanisms such as tax incentives, financial incentives, carbon reduction policies, and energy efficiency mandates.[92]

1.4 Research and Data

Although there is subsurface data available in Alberta as a result of the significant amount of oil and gas activity in the province, there is still uncertainty about the geothermal resources. This data gap can be addressed by government led or funded research and development (which results in publicly available information).

In addition, as a matter of policy, requirements can be imposed on private entities to publicly release data. This has been done, for example, in the U.S.A., the Netherlands, and Sweden. The 1978 federal industry-coupled case studies program established in the U.S.A. required participants to put together an acceptable data package which was made publicly available.[93] Aside from encouraging exploration and development of geothermal resources, the collection of data was an important outcome of that program.

There are similar data sharing requirements under the Swiss geothermal risk guarantee program (which will cover up to 60% of geothermal exploration costs

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[90] *Ibid*.

[91] *Ibid*.

[92] *Ibid*.

[93] Bethany et al., *supra.* note 8.

in case of failure).[94] Within 6 months of completion of surface exploration activities, all geodata must be transferred to the Swiss Geological Survey.[95] Further, all geological and drilling data is to be published not later than 24 months after completion.[96]

In the Netherlands, the *Mining Act* requires that all exploration and production data of deep mining activities becomes part of the public record after 5 to 10 years.[97] This includes data associated with terrestrial heat and boreholes.[98]

2. A Path Forward for Geothermal Energy Development in Alberta

The International Energy Agency has recommended several components that should be adopted into a policy framework designed to encourage development of geothermal resources including:[99]

- Targets should be set for the production of electricity and heat by geothermal resources. There should be medium-term targets for (nearly)

[94] Boissavy, *supra.* note 53.

[95] Boissavy, *supra.* note 53.

[96] Boissavy, *supra.* note 53.

[97] *Mining Act 2003*, art.123 and *Mining Decree 2003 of 6 December 2002* (State Gazette 604), art. 116. See also Victor van Heekeren and Guido Bakema, *The Netherlands Country Update on Geothermal Energy* (Proceedings World Geothermal Congress, Melbourne, Australia, 19-25 April 2015).

[98] Mining Decree 2003 of 6 December 2002 (State Gazette 604), art. 119.

[99] International Energy Agency, *Technology Roadmap: Geothermal Heat and Power* (Paris, France: 2011, International Energy Agency).

mature geothermal technologies and long-term targets for advanced geothermal technologies.

- Introduce differentiated economic incentives (such as RPS or FIT programs) using a transparent and predictable regulatory framework.

- Introduce economic incentives for geothermal resource use.

- Introduce policies to cover the financial risk involved in geothermal exploration such as insurance or grants.

- In the case of EGS technology, protocols must be developed and used to create community support for the technology and understanding about micro-seismicity.

- Enhance training, education and awareness for skilled work forces and expand outreach to related professional groups.

- There should be research, development, and demonstration support provided by the government.

As can be seen in *Module 4: Regulation of Geothermal Energy in Other Jurisdictions*, several of these components have been adopted elsewhere. The precise mix and design of economic incentives – such as grants, FITs, RPS, grants and risk insurance - requires economic analysis guided by clear policy priorities (such as increasing the use of renewable energy and other socio-economic benefits). While we do recommend adoption of economic incentives in Alberta, we cannot do so with precision as that involves economic analysis outside the scope of this project.

2.1 Royalties

Assuming Crown ownership of geothermal resources (which we recommend),[100] the issue of whether or not royalties are appropriate should be considered. There has been suggestion that royalties are not appropriate for geothermal resources given no resource is being depleted.[101] Others have suggested[102] that royalty breaks or variable rates may be appropriate.

Sections 33 to 43 of the *Mines and Minerals Act* enable the collection of royalties on minerals, and we recommend that these provisions should be amended as appropriate to apply to geothermal resources. This provision would enable the collection of royalties on geothermal resources. In the initial development of the geothermal industry, it is likely appropriate to not impose a royalty in order to encourage development. However, the authority to impose royalties should exist as royalties may become appropriate in later stages of industry development.

In our view, royalties are appropriate for geothermal resources even though it is a renewable resource (much like a stumpage fee is charged for timber which, if sustainably managed, is a renewable resource). Even though geothermal resource development may be renewable, it still entails use of a Crown resource to create a product (electricity). Having said that, lower royalty rates than those applied to an extractive industry are likely appropriate and only once the industry is well established.

[100] In the case of private ownership of geothermal resources, then any royalties/lease payments to be made for the resource would be a matter of contractual negotiation between the owner and developer.

[101] Van Hal, *supra*. note 22.

[102] Holroyd-Dagg, *supra.* note 25.

It is recommended that Alberta, via legislation, maintain the authority to impose a royalty on the use of deep geothermal resources (assuming Crown ownership of such resources). However, it is also noted that imposition of a royalty in the early stages of the industry is likely not conducive to encouraging development of geothermal resources in Alberta. The precise appropriate form, level, and timing for imposition of a royalty on geothermal resources (if at all) will require economic analysis beyond the scope of this project.

2.2 Market Incentives: Renewable Energy Portfolio Standards and Feed-in-Tariffs

Outside of the actual geothermal resource operations, there needs to be consideration of the end product – electricity. While the ELC recommends that development of geothermal resources be regulated by the AER (due to the technology, skill and knowledge overlaps between oil and gas development and geothermal development), the end product will fall into the jurisdiction of the Alberta Electric System Operator (AESO) which manages and operates the provincial power grid under the authority of the *Electric Utilities Act*. The AESO is responsible for ensuring the connection of electrical generators to the grid (transmission system) in a safe and reliable manner. The ELC recommends that the AESO grant grid access to electricity from geothermal resources on the same basis as other energy sources. That is, there should be no additional requirements put into place for electricity generated from geothermal resources.

In addition, there may need to be policy instruments implemented, such as FIT or RPS programs, to minimize some of the financial risks associated with geothermal resource development and to encourage development of this resource.

Programs using FITs have been used in the Germany, Denmark and Ecuador.[103] In the U.S.A., the use of FITs is seen as the greatest single incentive for development of geothermal power.[104] The *Public Utilities Regulatory Policy Act of 1978* guarantees a price to producers for electricity provided to the grid from a geothermal source thereby guaranteeing a market for electricity generated by geothermal resources. [105] A FIT program generally involves requiring grid operators or utilities to connect renewable energy projects to the central grid and to pay a premium (the FIT). The FITs paid by the grid operators or utilities are recovered from downstream customers via a renewable energy surcharge.

In order to be effective, FITs must be carefully designed and implemented.[106] The FIT program implemented in Ontario to encourage renewable energy development proved controversial and was blamed for excessively high power costs.[107] Nic Rivers concludes that the transformation of the Ontario electricity sector was at a higher cost than necessary as a result of ancillary objectives embedded in the procurement policies (such as job creation), a lack of competition in procurement, and a lack of sensitivity towards the intermittent nature of renewables.[108] As has been pointed out by Sarah Hastings-Simon and Steven Cretney, Ontario (as least initially) set a fixed price for power which led to

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[103]Ingelson-Phillip, *supra*. note 66.

[104] Haraldsson, *supra.* note 33.

[105] *Ibid*.

[106] See J.R. DeShazo and Ryan Matilda, *Best Practices for Implementing a Feed-In-Tariff Program* (Los Angeles: 2009, Luskin Centre for Innovation, UCLA Luskin School of Public Affairs) which provides best practices and includes a review of Ontario's FIT program.

[107] Brian Hill, "Ontario Energy minister admits mistake with green energy program" (February 24, 2017) Global News available at https://globalnews.ca/news/3272095/ontario-energy-minister-admits-mistake-with-green-energy-program/.

[108] Nic Rivers, *Lessons Learned from a decade of promoting renewable energy in Ontario* (Ottawa: 2015, Graduate School of Public and International Affairs and Institute of the Environment, University of Ottawa) available at https://carleton.ca/ces/wp-content/uploads/ontario_renewables2.pdf.

a lack of competition to achieve the lowest market price.[109] In addition, the increased power costs were attributable to other factors such as deferred grid infrastructure investment.[110]

As summarized by Justin Crewson and Alison Thompson:[111]

> It should also be noted that one of the primary criticisms of Ontario's FIT programs has been the cost of carbon displaced, seeing as intermittent energy sources such as wind and solar dominate the programs. It is argued that due to the lack of reliability and intermittency of these technologies, generated power is often dumped. Moreover, critics cite that the power produced from these sources rarely serves to displace fossil fuel sourced generation technologies, given the significant capacities of hydro and nuclear power in the province in lieu of coal. Geothermal energy, had it been included, would not have been prone to such criticisms as a result of its high capacity factor and its dispatchable generation capability. [references removed]

Given the success and experience in other jurisdictions, it is recommended that a FIT program be developed to encourage the development of geothermal electrical generation in Alberta.

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[109] Sara Hastings-Simon and Steven Cretney, "What Ontario has taught Alberta about renewable energy: Infographic" (November 2, 2016) Pembina Institute available at https://www.pembina.org/pub/cheap-re.

[110] *Ibid*.

[111] Crewson-Thompson, *supra.* note 2 at 26.

The precise details of the program – including appropriate tariff amounts – requires economic analysis which goes beyond the scope of this project. It is essential that the FIT program developed be in place for a significant period of time to provide certainty necessary to encourage investment in a nascent industry.

Under an RPS program, the government sets renewable energy goals as a percentage of annual electricity generation to be achieved by a certain date.[112] Utilities are able to either develop renewable energy projects to add to their portfolio mix or to purchase renewable electricity certificates from third party developers to claims as credit equivalents to their RPS requirements.[113] A failure by a utility to meet its RPS target results in a fine or other fiscal consequences.[114] There is strong precedent for the use of RPS programs in the United States (33 states), Japan and Chile. [115]

As mentioned, policy mechanisms have been used in Alberta to encourage the development of renewable energy sources. The *Renewable Electricity Act* establishes a provincial target that, by 2030, at least 30% of electricity being produced in Alberta will be from renewable energy resources, including geothermal resources.[116] Until June 2019, this legislation was supported by a Renewable Electricity Program (REP) designed to encourage the development of new electric capacity from renewable sources.[117] In order to actually achieve the target established by the *Renewable Electricity Act*, we recommend the

[112] Sho Sato and Thomas D. Crocker, "Property Rights to Geothermal Resources", (1977) 6 Ecology L.Q. 247.

[113] *Ibid*.

[114] *Ibid*.

[115] *Ibid*.

[116] *Renewable Electricity Act*, s. 2.

[117] AESO website at https://www.aeso.ca/market/renewable-electricity-program/about-the-program/.

addition of specific, enforceable targets, as well as enabling a market for trading credits. In addition, there must be supporting programs in place such as the REP described above or a FIT program.

The ELC recommends that the *Renewable Electricity Act* be maintained as it establishes a legislated target for developing electrical capacity from renewable resources. The Act could be enhanced by placing specific, enforceable requirements on individual utilities, as well as enabling a market for trading RPS credits. Further, policies and programs must be put into place in order to actually achieve the target established by the *Renewable Electricity Act*.

2.3 Government Financial Support: Cost-share programs, public insurance and early fiscal incentives

Aside from establishing robust RPS and FIT programs, development of geothermal resources likely requires financial incentives. The U.S.A. has used a variety of government cost-sharing programs and tax incentives in the development of its geothermal resources.[118] For instance, the U.S.A. implemented a variety of cost-shared drilling programs such as the Industry-Coupled Drilling Case Studies program (designed to accelerate exploration and obtain data), and the Geothermal Resources Exploration and Definition program (designed to identify and verify performance of new resources), see

[118] Sanyal et al., *supra*. note 1.

discussion in California section of *Module 4: Regulation of Geothermal Energy in Other Jurisdictions*.[119]

The Industry-Coupled Drilling Cases Studies program was initiated in 1977. The program had two objectives "1) accelerate exploration of new high-temperature areas by furnishing a cost-share for drilling of reservoir confirmation boreholes, and 2) obtain data held as confidential in company files for public release".[120] This program led to eight developments by the private sector (located in Utah and Nevada). Participation in the Industry-Coupled Drilling Case Studies program required public release of a data package. Exploration for lower temperature resources, suitable for direct use, was also supported through the State-Coupled Geothermal Mapping Program which led to significant expansions of the inventory of known geothermal occurrences throughout the U.S.[121]

These programs allowed significant amounts of research into geothermal exploration, reservoir engineering and drilling technology.[122] An important result of this research was the collection of publicly available data. In conjunction with the Industry-Coupled and State-Coupled programs, since the 1970s, the U.S. Department of Energy (and its predecessors) has conducted research and development activities with national laboratories, universities and contractors under the Geothermal Technologies Program (valued at $1.3 billion). [123]

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[119] U.S. Department of Energy, *Exploration 1976-2006: A History of Geothermal Energy Research and Development In the United States* (September 2010) available at https://www1.eere.energy.gov/geothermal/pdfs/geothermal_history_1_exploration.pdf.

[120] *Ibid*. at 2.

[121] *Ibid*.

[122] *Ibid*.

[123] *Ibid*.

The Canadian Geothermal Energy Association has recommended both a cost sharing approach with government for exploratory wells, as well as, having the government play a role in insuring against risk related to geothermal developments.[124] In effect the association argues that the government should accept a portion of the risk associated with geothermal well exploration based on models found in other jurisdictions.

Aside from cost-sharing programs, other financial incentives can include: [125]

- Loans which are backed by the government or are directly provided by government to geothermal developers (because access to capital may be an issue for geothermal development).

- Insurance which absorbs the economic setbacks associated with drilling failures. This can include loans which convert to grants in the face of drilling failures.

- Early fiscal incentives such as easing import duties on machinery and equipment; reduced license fees, and tax credits.

It is recommended that Alberta develop programs which provide government financial support to the nascent geothermal industry. It is important that any policy support programs established be stable and predictable since longer term incentives are more effective.[126] These programs should include cost-share

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[124] Zach Harmer and Christal Loewen, Written Submission for the Standing Committee on Finance's Pre-Budget Consultations 2020 (August 2, 2019) Canadian Geothermal Energy Association available at https://www.ourcommons.ca/Content/Committee/421/FINA/Brief/BR10596374/br-external/CanadianGeothermalEnergyAssociation-e.pdf.

[125] Haraldsson, *supra.* note 33.

[126] *Ibid*.

programs and publicly funded insurance to reduce the risks associated with exploration and development of geothermal resources and encourage private investment. While such programs do transfer risk to the public purse (contrary to the polluter pays principle), it is done so to achieve other social goals such as increased renewable energy sources. The appropriate level of risk (that is, the level of support) will be a matter of assessing the various policy goals of the program.

Other complementary early stage fiscal incentives – such as tax credits and tax exemptions – should be considered as well. The precise mix of policy tools – including appropriate timing and level – requires economic analysis which goes beyond the scope of this project. We note that there is precedent for government financial support for new resources in Alberta as similar approaches were adopted in the early days of oil-sands development.

Policy supports should include cost-share programs and publicly funded insurance to reduce the risks associated with exploration and development of geothermal resources and encourage private investment. Other complementary early stage fiscal incentives – such as tax credits and tax exemptions – should be considered as well. The precise mix of policy tools – including appropriate timing and level – requires economic analysis which goes beyond the scope of this project.

2.4 Research and Data

Although there is subsurface data available in Alberta as a result of the significant amount of oil and gas activity in the province, there is still uncertainty about the geothermal resources. This data gap can be addressed by government led or funded research and development (which results in publicly available information).

In addition, it is recommended that Alberta consider opportunities to increase access to exploration data, including making data public after a prescribed time. This could be accomplished by a legislative or regulatory provision similar to that in the Netherlands which makes all seismic and drilling data public after 5 to10 years. Indeed, there is precedent in Canada requiring the public release of offshore seismic data (on timelines ranging from 5 to 15 years).[127] At the very least, participation in a provincial scheme such as cost-shared drilling or risk insurance should be conditional upon a requirement to publicly release data.

It is recommended that Alberta consider opportunities to increase access to exploration data, including making data public after a prescribed time. At the very least, participation in a provincial scheme such as cost-shared drilling or risk insurance should be conditional upon a requirement to publicly release data.

[127] See *Geophysical Service Incorporated v EnCana Corporation,* 2017 ABCA 125 (CanLII), <http://canlii.ca/t/h3jnp>, retrieved on 2020-10-26. Appeal to the SCC denied. *Geophysical Service Incorporated, et al. v. Murphy Oil Company Ltd., et al.*, 2019 CanLII 45275 (SCC), <http://canlii.ca/t/j0f1v>, retrieved on 2020-10-26.