

## WHY IS CANADA FREEZING OUT GEOTHERMAL PPOWER?<sup>1</sup>

**Mitchell Anderson**<sup>©</sup>

Canadians are some world's best at advanced exploration and drilling technologies. Not surprisingly, members of the Canadian Geothermal Energy Association (CanGEA) also produce more than *20 per cent* of the world's geothermal energy. They just don't do it here. The almost complete absence of government support means that all of this green energy infrastructure is being installed somewhere else. That's right -- the total geothermal energy capacity in Canada is zero.

That is a shame, considering that geothermal energy is a clean, continuous base-load power whose source is the virtually unlimited heat from our planet's interior. Unlike other renewables such as wind or solar, geothermal plants can operate 24 hours a day, rain or shine. While the upfront costs for geothermal can be considerable, it is ultimately very cheap energy. According to CanGEA chair and founder Alison Thompson, "it has the *lowest* levelized cost of any power source in the world, even coal."



Geothermal has been called the 'holy grail' of renewable energy.

### Canada's Advantage

Thompson points out the ironic reason Canadians are so good at geothermal is because there has been so much focus here on fossil fuel extraction. "I come from the oil patch. We have developed enormous expertise in advanced exploration and drilling techniques. These are exactly the skills you need to develop geothermal resources." So if Canadians are among the best geothermal experts in the world, why aren't they doing business here? "Most of our

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<sup>1</sup> The Tyee, November 19, 2010

membership are die-hard Canadian entrepreneurs, but they are forced to operate in other countries because there is so little support for the industry here. We are just so frustrated that it doesn't need to be like this."

A good example is seen south of the border. U.S. federal and state governments aggressively support the industry through loan guarantees, grants, tax incentives and a streamlined permitting process. Countries like New Zealand and Iceland have invested vast resources developing their geothermal with big payoffs.

And here in B.C.? "The provincial government processes copious amounts of permits for oil, gas and mining development, while they only gave out four permits for geothermal in 2010 and that was after intense influencing from CanGEA," said Thompson. "These were also the first permits issued since 2004."

### **US Invests Millions in Geothermal Mapping**

Support for exploration is another big gap. The U.S. Geological Survey has invested millions in mapping identified geothermal targets that so far total 30,000 MW of potential generating capacity. This is more than all the coal-fired plants in Canada combined. In contrast the Canadian Geological Survey invests virtually nothing in this type of work. "We are very disappointed in the level of exploration support from the government thus far, but remain hopeful that they will soon see the value in assisting this emerging natural resource," said Thompson.

Canadian tax law is another obstacle that in some cases favours fossil fuels over clean energy. For instance, companies doing oil or gas exploration are able to write-off dry holes whereas geothermal companies are not. Likewise companies installing steam boilers for bitumen extraction can recover these expenses from their taxes while geothermal companies installing boilers for clean energy generation are out of luck. "Geothermal energy was never contemplated when they wrote these rules," said Thompson. "We'd like an equal playing field."

And what could Canada do with a major investment in our abundant and completely undeveloped geothermal resources? CanGEA estimates that for \$20 billion, we could install 5,000 MW of clean perpetual power, while creating 30,000 person years of manufacturing and construction employment and 9,000 permanent jobs. This could be achieved by 2015 if we start now. Interestingly, 5,000 MW of geothermal power would be almost six times larger than the generating capacity of the *Site C dam*, could be built in half the time, and would be 45 per cent more cost effective per unit of energy. And while \$20 billion sounds like a lot of money, it is less than two thirds what the Canadian taxpayer will provide over the next 10 years in *natural gas write-offs* for Alberta oil sands operators -- some of the wealthiest corporations in the world.

### **The 'Holy Grail' of Renewables?**

This is only scratching the surface. The figures from CanGEA only deal with near surface conventional geothermal. The emerging field of *enhanced geothermal* technology may access ancient heat from far greater depths and has the potential to transform energy use by tapping into virtually limitless power anywhere on the globe. This technology requires some of the *same skills* used in the controversial practice of *hydrofracking*. But instead of fracturing underground shale deposits to release trapped natural gas, enhanced geothermal tries to fracture hot granite formations at much greater depths to create closed loop water circulation for electricity

generation. Some consider this the holy grail of renewables due to the vast amount of clean continuous power that could be tapped, if it can be made to work.

A recent study (Addendum #1) found that enhanced geothermal could potentially supply all of Canada's electrical generating capacity. A similar report from MIT predicted the U.S. could realistically meet close to 10 per cent of its generating requirements by 2050 using this technology, and this clean capacity would be cheaper than either nuclear or carbon capture at coal plants. Of course drilling holes more than five kilometers down to make enhanced geothermal a commercial reality is very challenging, requiring great skill and experience. There is a good chance that the first team to pull off this historic milestone will be Canadian. It's virtually a sure thing they will be doing it somewhere else.

*[Editor's note: The geothermal energy generation source discussed in this article is not to be confused with ground source pumps tapped a few meters underground and used for heating and cooling, which The Tyee reported on [here](#).]*

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## ADDENDUM #1

### GEOTHERMAL COULD MEET CANADA'S POWER NEEDS<sup>2</sup>

Tyler Hamilton<sup>©</sup>

Canada could technically meet all its electricity needs and dramatically lower greenhouse-gas emissions if it moved aggressively to develop enhanced geothermal power projects, according to the first comprehensive assessment of the country's deep geothermal resources. The study, published online in the *Journal of Geophysics and Geoengineering*, reports on the potential of using enhanced geothermal systems (EGS) to tap hot temperatures kilometres below the earth's surface as a way of generating clean electricity. It found that the most promising Canadian sites are located in parts of British Columbia, Alberta and Saskatchewan at depths ranging from 3.5 to 6.5 kilometres. Drill deeper, however, and the potential extends right across the country – including parts of Ontario.

“At 10 kilometres we can expect EGS temperatures in the 150 to 200 degrees C range across most of Canada, except some areas of the Canadian shield,” wrote Stephen Grasby, a geologist with the Geological Survey of Canada, and co-author Jacek Majorowicz, an Alberta-based geothermal consultant. “Given the widespread distribution of geothermal energy, and the high energy content, the potential geothermal resource in Canada is significant,” they concluded. The findings aren't surprising – I've been pounding on this drum for several years now. But it's encouraging to finally see it expressed in a peer-reviewed journal. Canada, shamefully, is the only country along the so-called Pacific Ring of Fire that has yet to switch on a *conventional* geothermal power plant.

The irony is that Canada is home to several of the continent's leading geothermal power developers. Problem is they're mostly developing in Nevada, California, Nicaragua, Iceland, Chile – everywhere except Canada, where no formal development program exists. Maybe now the federal and provincial governments will take the issue more seriously. This new Canadian

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<sup>2</sup> Thestar.com, May 17, 2010

study comes three years after the release of a groundbreaking U.S. study led by experts at the Massachusetts Institute of Technology. Their research suggested EGS in the United States could realistically supply about 100,000 megawatts of power generation capacity by 2050, assuming the proper policies and R&D investments were committed.

For comparison, 100,000 megawatts – or 100 gigawatts—is roughly 80 per cent of Canada’s current power generation capacity. It’s about one-twelfth of current U.S. capacity. And the MIT-led group predicted it could be built less expensively than building new nuclear plants or investing in carbon capture and storage technologies for coal plants. When the MIT-led study came out I lamented that Canada didn’t have similar research to spur development of “heat mining” projects on our own turf, particularly in Alberta where most of the electricity comes from coal-fired power plants.

I should clarify that not all geothermal power plants are created equally. Conventional geothermal projects, like those found in places such as California or Iceland, benefit from ideal rock conditions – that is, porous rock that water can penetrate. They also have naturally occurring hot-water reservoirs. EGS is more complex. These “enhanced” projects must be engineered to create the conditions required for generating power. Subsurface rock must be hydraulically fractured to create cracks that water can travel through. An outside source of water is also required, adding to the cost of the venture. Under the EGS scenario, water is pumped into a well and forced to seep into cracks and pores in the rock, where the temperature is ideally above 150 degrees C. The water absorbs the heat in the rock and is pumped back to the surface through a return well. Heat exchangers then extract the heat from the water to create steam, which turns an electricity-generating turbine. The water is then pumped back underground as part of a continuous cycle.

The Canadian Geothermal Association believes Canada, if determined, could develop 5,000 megawatts of geothermal power by 2015 – and that’s just conventional geothermal with temperatures above 200 degrees C and wells less than three kilometres deep. This is the low-hanging fruit we’ve left dangling for decades. Add to the equation the new technologies that make EGS possible and geothermal power could play the kind of role that hydroelectric power has historically played in Canada, particularly in western Canada’s many hot spots.

Grasby and Majorowicz estimate that 2 per cent of the entire resource could be recovered for electricity generation. It may sound like a small number, and even that could take many decades to develop, but don’t let that fool you. “This would still provide a significant contribution towards Canadian energy consumption.” Maybe it’s time we prove it.