# Geothermal for Canada – Questions and Challenges

The Green Party “Mission Possible: The Green Climate Action Fund” platform advocates for the use of geothermal energy as a replacement for hydrocarbon/fossil fuel-based electricity and heat generation for Canada.  The Green Party platform assumes that we can ‘harness abandoned deep oil wells, wherever feasible, for geothermal energy, using workers who drilled the wells to manage the renewable energy generation.’  On the surface, this appears to be a sensible ‘repurposing’ of similar drilling skills, by simply transferring these workers into geothermal as energy generation experts.

But things are not so simple when it comes to geothermal.

Like many forms of power generation, geothermal is location specific.  To further confuse the public, geothermal is a term that is attached to two different forms of energy supply.  One form is that of direct heat, where bore holes into the earth at a relatively nominal depth, capitalize on extant heat as a means of providing stable heat source.  This heat source can be best used with a system of electrical pumps, where the earth becomes a storehouse of hot and cold air, cycled by electrical pumps to act as an HVAC system.  In some geographic locations, this set-up has benefits and, depending on the cost of electricity (to run the pumps that cycle the air) and depending on the stability and ambient temperature differential fluctuations, this can be a cost-efficient form of heating/cooling.

At first glance, parts of Alberta have excellent geothermal heating potential.  However, a complicating factor is the often wildly fluctuating ambient temperatures due to Chinook winds, where temperatures can go from minus 20°C to plus 20°C in the space of a few hours.  The response time of geothermal heating systems can be slow to keep up with this instability; likewise, the electrical energy required to pump the geothermal heat can be very expensive.

Another application for geothermal is that of electrical generation.  Here, the Green Party ‘makes hay’ by claiming that using existing deep wells for geothermal would be an easy way to put lots of unemployed oil and gas workers back to work.  The assumption is that these workers have similar skills used in drilling, that can easily be transferred to managing deep oil wells for geothermal electrical generation.  This is a questionable assumption because electrical generation is quite different than oil well drilling – and to date, there is no assurance that such deep oil geothermal electricity generation potential exists anywhere but a few places in Alberta, BC and NWT, and some possible spots in Quebec. (Smart Prosperity just posted a blog on the first such initiative in Saskatchewan. A pilot project is in development at Swan Hills)

The Green Party’s “Mission Possible” also states in point 7 that it will ‘ban fracking’ with no exceptions.  However, deep well geothermal electrical generation relies on fracking in order to expose the ‘hot rocks’ to the cold water that is pumped down into the borehole. When the cold water hits the hot rocks, steam is produced, and this steam is pumped up to the surface to drive power generation turbines.

There is a new, untested, alternative method proposed by geothermal proponents in Canada – but the problem is that this form is untested.  There is no large scale geothermal in operation in Canada at present and no pilot project of this alternative method. Therefore, it is not reasonable to set a nation’s energy generation and employment policy based on something that does not exist, and that requires a process that the Green Party election platform strictly forbids, that being fracking.

Furthermore, as with many ‘nature-driven’ power generation proposals like wind and solar, proponents often say geothermal will tap into ‘free’ energy from the earth.  A study by Majorowicz and Grasby (2019) indicates that geothermal energy simply cannot compete with the power generation provided by conventional fossil fuels, and the costs are exorbitant, except in certain unique geographic situations.

As with all forms of power and heat generation, there are potential applications for geothermal in Canada – but there are serious limitations as well.  It is extremely unlikely that the mass of ~100,000 unemployed oil workers could be put back to work in a geothermal industry, nor do their skills directly transfer to geothermal power generation.  Likewise, the temperature differentials in Canada make geothermal only a potential provider of supplementary power, not a main provider.

I reached out to Dr. Majorowicz by email, a specialist in the field of geothermal, to ask for additional insights. He wrote that:

“… the real potential for geothermal based power production is only in the western and northwestern deep part of the Western Canada Sedimentary Basin (WCSB) basin where temperatures most suitable for that purpose can be found >150°C. [Temperatures of] >120°C can also be considered if very large flow rates secured.

The difference [between geothermal and oil/gas] is in energy density and, in order to compare apples to apples, exergy (which is discussed it in our paper) is couple orders of magnitude and therefore it will take several doublet geothermal well systems to replace one average producing oil and gas energy in the WCSB.

We also need to remember that pumping and reinjecting [to geothermal wells] all take large amounts of [electrical] power.

Also, thermal efficiency of geothermal power plants is some 10% +/- 4% depending on temperature of running fluid used.

It is at least 3 times that or more in coal power plants….”

(Wikipedia reports: Typical thermal efficiency for utility-scale electrical generators is around 37% for coal and oil-fired plants, and 56 – 60% (LEV) for combined-cycle gas-fired plants.)

Aside from these energy density and location issues, it is unclear how the Green Party can reconcile their absolute rejection of fracking with their demand for geothermal.

To further the public understanding of geothermal power generation, we have reissued our 2016 report – “Geothermal for Alberta? A Case for Caution.” (Download link at the top of the page)

Also, posted below is a plain language “Speakers’ Corner” debate between Thana Boonlert (now Green Party candidate for Calgary Centre @Thana4yyc ) and me, Michelle Stirling (Communications Manager for Friends of Science Society @stirlingmg @FriendsOScience), on the topic of geothermal as a replacement or complement to coal-fired power generation in Alberta. (Aug. 2016)

Members of the media should consider engaging with geothermal experts like Dr. Jacek Majorowicz and Dr. Stephen E. Grasby to get expert insights on this complex topic. Their recent publication is: “Deep geothermal energy in Canadian sedimentary basins VS. Fossils based energy we try to replace – Exergy [KJ/KG] compared”