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Northwest BC Geothermal & CCUS Assessment Project – Phase 1

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Summary

Geoscience BC (GSBC) is funding a review of the geothermal and carbon sequestration potential of a highly prospective area of northwestern British Columbia. The project area is broadly focused on the Golden Triangle of British Columbia, where some of the world's largest and richest mineral deposits have been discovered. To unlock these mineral riches, significant electrical energy requirements are needed. Currently, the BC Hydro electrical grid provides limited service to this region, through run of river hydro projects and diesel generation. Most mining and exploration fascilities relay on diesel generation to meet their electrical needs but also have requirements for thermal energy for space heating and mineral processing. In order to decarbonize this heavy industrial activity low carbon generation sources are needed along with thermal energy and options for carbon sequestration.

Theory / Method / Workflow

The project team is using a "Play Fairway Analysis " (PFA) exploration philosophy to identify and characterize key play elements required for the existence of geothermal resource systems. PFA is an established approach used in both the hydrocarbon and geothermal industries and is suitable for the carbon sequestration aspect of this report. PFA has been recently applied in the geothermal industry and utilized on projects conducted by academia and government agencies with funding support by the US Department of Energy through various funding mechanisms. This type of analysis was specifically developed for evaluating "blind" geothermal systems. Blind systems are those that do not show surface manifestations. For example, the Great Basin area of the USA hosts ~24 geothermal power plants with more than 600 MW of capacity. By carrying out a PFA on this basin, the results suggest that the region is capable of producing much greater amounts of geothermal energy. Some of this increase in generation capacity is anticipated to be through the adoption of new technology (for example Engineered Geothermal Systems (EGS)), but other capacity is through development of blind resources not previously identified.

PFA combines geological, geochemical, and geophysical features that characterize known geothermal systems and carbon sequestration attributes. In a region that is "blind", due to remoteness, topography and/or vegetation cover, remote sensing and advanced geoanalytics are imperative tools for the discovery of previously unknown geothermal systems and areas favourable for carbon sequestration. In the USA, using multidisciplinary teams of specialists, to carry out geothermal PFA, researchers integrated the following information: 1) structural settings (i.e., patterns of faulting), 2) age of recent faulting, 3) slip rates on recent faults, 4) regional-scale strain rates, 5) the tendency of faults to slip or dilate based on their orientation in the regional stress field, 6) earthquake density, 7) gravity data, 8) temperature at 3 km depth, and 9) geochemistry from springs and wells. These parameters were grouped into subsets to delineate rankings for local permeability, regional permeability, and heat, which collectively defined the geothermal play fairways (i.e., most likely locations for significant geothermal fluid flow). Due to the

richness of the data set in the Great Basin the team was able to develop weightings of individual data types to best predict permeability and overall geothermal potential. They employed rigorous statistical methods, utilizing 34 benchmarks of known relatively high-temperature (>130°C) geothermal systems in the region, to determine the hierarchal weights of each parameter to produce a geothermal favourability map.

The first objective of this study has been to compile and review the geological, geophysical, geochemistry, heat flow and all other data providing valuable information on the geothermal and carbon sequestration potential of the project area (Task 1). From this point, based primarily on publicly available data, geoanalytics have been undertaken to identify the fairways of critical geothermal play elements, from which more favorable site(s) for potential geothermal energy extraction and carbon sequestration can be high graded (Task 2). Providing a very high-level overview favourability map will be Task 4. Documenting and reporting will be completed in Task 4. Carbon Sequestration reporting deliverables will be specifically addressed in Task 5. A key feature of the final report will be to provide recommendations regarding further data requirements or possible exploration work to investigate the selected sites.

Results, Observations, Conclusions

The research team has completed compilation of 21 different data sets, but have found significant gaps for NW British Columbia. In addition, much of the data is at too course a scale to provide much guidance for favourability mapping. However, the work is providing an opportunity to evaluate what data does exist and specifically the data gaps that need to be filled in order to provide an evaluation with a higher confidence level. With the current data available and the time constraints of the project, only a very high level evaluation of the area will be possible.

This is the first time a PFA type of analysis has been applied to a region in Canada in a rigorous manner. Data limitations are prevalent and will impact the final analysis.

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