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Estimating the geothermal energy and the hydropower potential of a natural hot spring river in southern Iceland

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About 85% of the total primary energy consumption in Iceland originates from renewable sources, namely geothermal and hydropower resources. Hence, the small island in the North Atlantic is an ideal location to develop methods to estimate the geothermal and hydropower energy potential from natural sources. The Gulf Stream brings humid air masses to the steep slopes in the Icelandic highlands leading to over 10'000 mm a-1 precipitation in some areas and the numerous geothermal hotspots along the Mid-Atlantic Ridge generate geothermally heated water supply to natural streams. In this study we assess the water runoff and temperature variability of a natural hot spring in the Reykjadalur valley located in southwestern Iceland in order to estimate the geothermal energy and hydropower potential. A popular hiking trail leads into Reykjadalur, generating the need for energy supply for the recreational facilities. On 8 June to 2017 we installed two water level sensors and ten temperature sensors along the stream in Reykjadalur to continuously monitor discharge and water temperature. In combination with meteorological data from the national observation network and the stream flow data, we are continuously assessing the energy budget of the entire stream. The preliminary results suggest that the total geothermal energy potential is over 60 times greater than the hydropower potential. By extracting less than 10% of the surface water sufficient renewable energy could be generated for local summer houses and a visiting information center. We conclude that this extraction of geothermally heated water has a minimal ecological impact but could replace the fossil based energy production currently used for refreshment facilities in the vicinity of the hiking trail. While the results are only valid for the presented case study, the methodology can be applied to any geothermal stream worldwide, generating clean and renewable thermal energy and electricity.