Zeitschrift: Swiss review : the magazine for the Swiss abroad
Herausgeber: Organisation of the Swiss Abroad
Band: 49 (2022)
Heft: 3

Artikel: Lakes set to cool and heat an increasing proportion of our buildings
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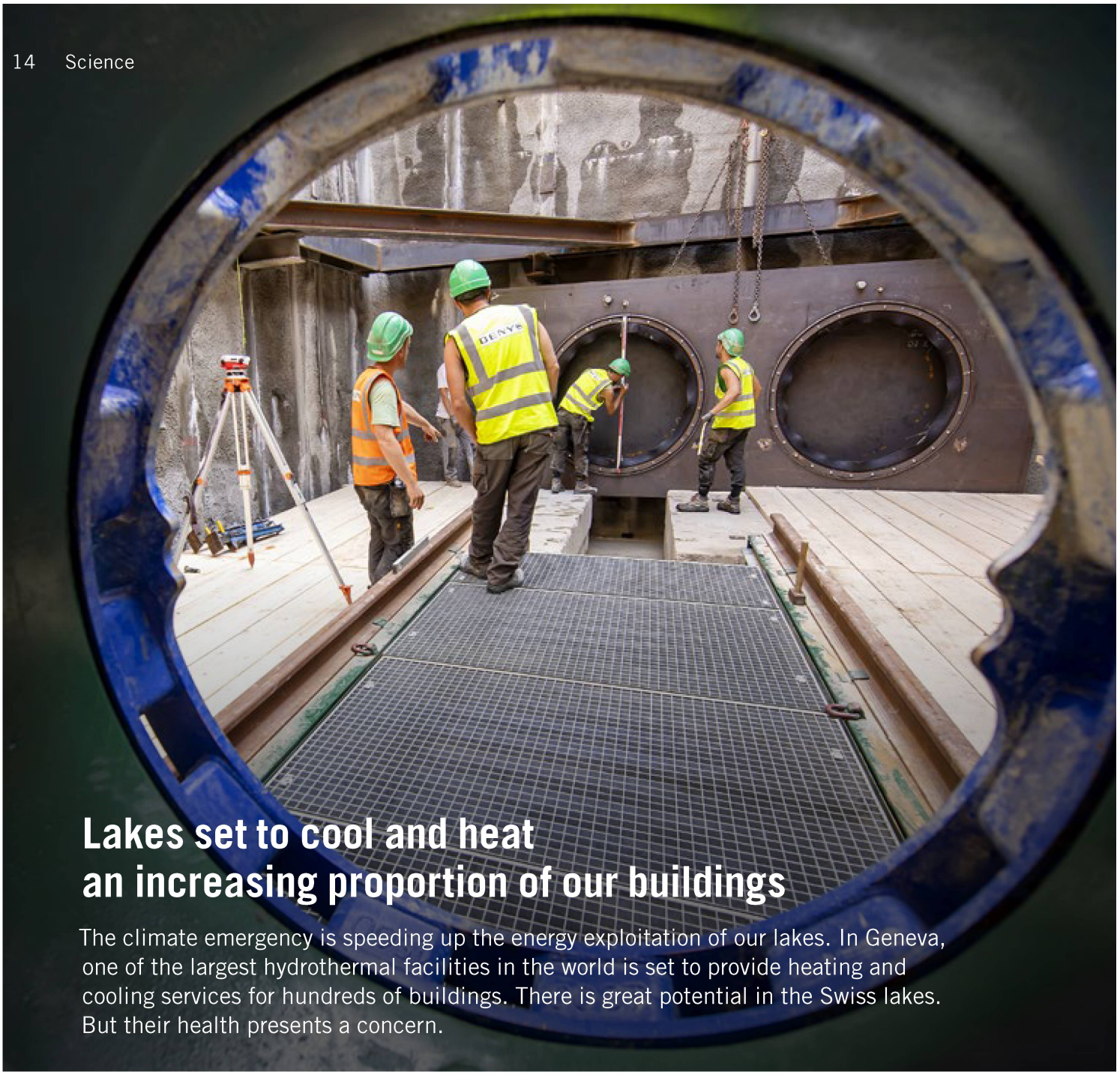
DOI: https://doi.org/10.5169/seals-1051861



Lakes set to cool and heat an increasing proportion of our buildings

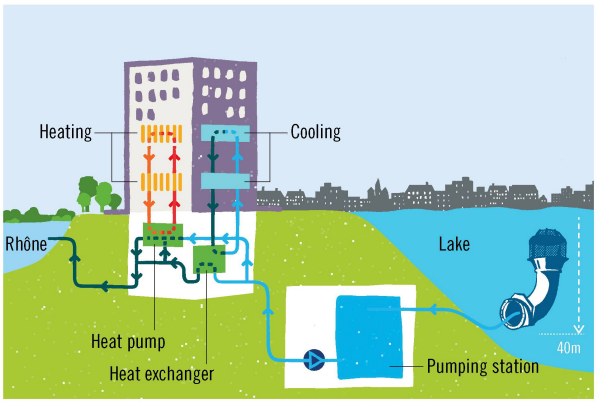
The climate emergency is speeding up the energy exploitation of our lakes. In Geneva, one of the largest hydrothermal facilities in the world is set to provide heating and cooling services for hundreds of buildings. There is great potential in the Swiss lakes. But their health presents a concern.

STÉPHANE HERZOG

Heating engineer Fabrice Malla guides us 17 metres below the surface of Lake Geneva, in the area known as Vengeron. Here we are in a concrete cathedral, 70 metres long. In 2024, this sump will receive the equivalent of three Olympic swimming pools of cold water, collected two kilometres offshore, at a depth of 45 metres. From 2024, electric pumps will push this liquid towards two networks. The first, built in a closed loop, will serve the buildings spread around the airport. The second network will feed cold water directly into the buildings of the city centre. Heat pumps installed by Services industriels de Genève (SIG) in a planned total of 300 buildings will enable the extraction and amplification of heat from the water.

Welcome to the world of hydrothermal energy, a universe in which cold water can generate heat. Fabrice Malla cites other similar large-scale projects, notably in Toronto and Honolulu. The facility in Vengeron, budgeted at 100 million Swiss francs, will be the starting point of one of the biggest hydrothermal networks in the world. “We are going to irrigate half the canton with hot and cold water,” says the SIG engineer. The operation will drastically reduce the amount of greenhouse gases generated. The electric energy used for running the network will be of hydraulic origin, according to spokesperson Véronique Tanerg Henneberg. But this is not necessarily the rule. “Heat pumps require electricity, but we don’t have enough. The progressive move away from nuclear energy will involve the development of solar and wind energy,” in the view of Martin Schmid, a researcher at the Swiss Federal Institute of Aquatic Science and Technology (Eawag). Due to global warming, summer demand for cooling is inevi-

The huge pipes are indicative of how much water will be taken from Lake Geneva: 10,000 litres per second.
Photo: Keystone



The Geneva hydrothermal project aims to provide a double benefit. In winter, energy is taken from the water by means of a heat pump in order to heat a building. In summer, a building can be cooled using cool water taken from the depths.

tably set to increase. But demand for heating will drop, thanks to improved housing insulation.

A multitude of small stations

In Switzerland, the development of hydrothermal energy dates back to the 1930s, when small stations were built to heat a few buildings. There are hundreds of them. Now, large-scale projects in urban areas bordering the lakes, notably in Zug and Zurich, are coming to the fore. Thanks to water collected at a depth of 45 metres in two stations, Lake Lucerne provides lake-based energy to 3,700 homes in the centre of Lucerne. In Horw, 6,800 homes will receive energy from the lake. In Biel, hydrothermal energy is set to be provided from autumn 2022. The town is planning for 185 connection points, leading to an 80 per cent drop in CO2 emissions.

The energy resources of the Swiss lakes seem to be a sort of blue gold. The figures are simply mind-boggling. According to an article written in 2018 by the Eawag institute, total energy consumption in Switzerland equates to 850 petajoules per year, or 236 terawatt-hours (with the nuclear plant in Gösgen producing 7.9 terawatt-hours of electricity in 2021). Half of this energy is used to heat buildings and in industrial processes and is derived from gas and heating oil. But Lake Geneva alone, used in accordance with legal standards regarding hydrothermal energy, could theoretically generate almost a third of all of the energy consumed in Switzerland each year! “The energy from our lakes will cover 30 per cent of our heating needs. Approximately one building in three located in a dense area, near to a lake, will benefit from urban heating connected to a sustainable resource, including hydrothermal energy,” estimates François Maréchal, professor at EPFL specialising in energy systems. The researcher describes hydrothermal energy as “a super-resource, but one that no one talks about”. But Switzerland is leading the field, comments Martin Schmid.

The question of water discharge into rivers

There remains the question of the impact of these procedures, as the water drawn is partially discharged back into water currents at a different temperature. During this cycle, water drawn at 6 °C in Lake Geneva, for example, will later be discharged at 3 °C in the Rhone, which itself is at 1.5 °C. In summer, water at 8 °C will be drawn from the bottom of the lake and discharged at 13 °C in river surface water reaching 20 °C. All of the studies point to the same conclusion: even if all of the Swiss energy demands for heating and cooling were covered by the lakes, the discharge would have a low to non-existent impact, given the small differences in temperature between the pumped water and the discharged water. “To modify the temperature of Lake Geneva by one degree, there would need to be 100 stations like that in Vengeron,” explains Malla.

Switzerland does have rules that it follows. For example, the temperature of a water current cannot vary by more than 1.5 °C in an area with trout. “If the legal provisions are correctly taken into account, the exploitation of hydrothermal energy could really happen,” believes Nicolas Wüthrich from Pro Natura. There is also another problem: rising temperatures in the lakes. In Lake Geneva, mild winters have prevented the deep beds of the lake stirring for ten years; without oxygen, these areas risk biological death. This phenomenon hinders the production of cold energy via hydrothermal exploitation. Heating also tends to provoke the development of invasive species. One such species is the quagga mussel, the larvae of which penetrate the supply networks for drinking water and water destined for hydrothermal energy production, requiring the water to be treated with chlorine. Another subject of concern: if the water is discharged far from the point of extraction, there is a risk of displacement of nutrients and pollutants, notes Eawag.

Pro Natura worries that, in rivers and streams in particular, the raised temperature could be a threat to certain species. For example, the effects of shade virtually disappear at temperatures above 25 °C. “This makes the reintroduction of large quantities of heated cooling water over the year a delicate process.” Nevertheless, water currents with well-shaded riverbanks will help to keep temperatures lower, suggests Pro Natura. In winter, the discharge of colder water produced through hydrothermal heating systems could even theoretically have a positive effect. “But interfering with the natural balance is always a risky business” warns Nicolas Wüthrich.