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MEDIA RELEASE
Nov. 23, 2017

‘Off-grid’ homes need dozens, 131 Tesla batteries, BC researchers say

Powering your home with solar panels to go off the grid may seem like an ideal way to save money and combat climate change. But just how feasible is it?

Researchers at the 2060 Project, based at the Institute for Integrated Energy Systems at the University of Victoria and supported by UVic-led Pacific Institute for Climate Solutions, sought to find out. The modelling results show that in order to achieve energy self-sufficiency—never drawing power from the grid, but able to send excess power into the grid—a typical Victoria homeowner would need to buy a 12-kilowatt solar photovoltaic (PV) system requiring battery storage that equal 131 Tesla Powerwalls. The current cost of such a PV system is about C$25,560 and the Powerwalls approximately C$8,800 each, according to industry cost benchmarks.

The fewer solar panels a home has, the more batteries needed, and vice versa. As an alternative, a homeowner could purchase a larger 30 kW PV system, which would then require roughly 21 Powerwalls. However, this option would require an area of roughly 3,200 ft² to accommodate the solar panels or about the size of a tennis court.

“Solar panels can certainly be used to some benefit to our electricity system, but our case study explores how feasible it is to be self-sufficient,” said Bryson Robertson, program manager for the 2060 Project. “Our modelling shows that being energy self-sufficient is not easy or cheap, and likely won’t achieve deep decarbonization in a northern country like Canada. Solar panels can provide value to the system, but don’t provide significant energy resources during winter. A time when provinvial demand for electricity is highest.”

Infographic: Going off-grid: How feasible is household energy self-sufficiency?

PhD researcher Cameron Wade used 2016 energy consumption data from a three-bedroom household in Victoria with an annual load of 9,600 kWh, with no electric heating or electric vehicle. He then compared Victoria to Vancouver, Kelowna and Calgary. Calgary showed the smallest battery capacity requirements of the four cities due to its sunnier winters. But in these clear, cold places, the electricity demand of the household rises due to the electrification of heating and transport, said Wade. He also highlighted that consumers should factor the carbon footprint of energy sources. For example, if the goal for self-sufficiency revolves around introducing low-carbon energy to the system, the switch to solar from low greenhouse gas (GHG) emitting hydropower results in little to no reduction in GHGs, compared to switching from GHG-intensive, coal-fired electric.

The findings are featured in the 2060 Project’s blog. The work, which has not been peer-reviewed, is part of broader 2060 Project initiative to better understand the feasibility of potential energy futures, residential demand and the impact on the climate and energy system as a whole. Researchers are expected to release three other blogs over the next several months on residential solar PV systems, electrification of heating/cooling, and residential energy storage.

PICS, an independent, policy- and technology-neutral, knowledge network focused on climate change mitigation and adaptation solutions, was created by a BC government endowment in 2008. It is hosted and led by UVic in collaboration with BC’s three other research-intensive universities.

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