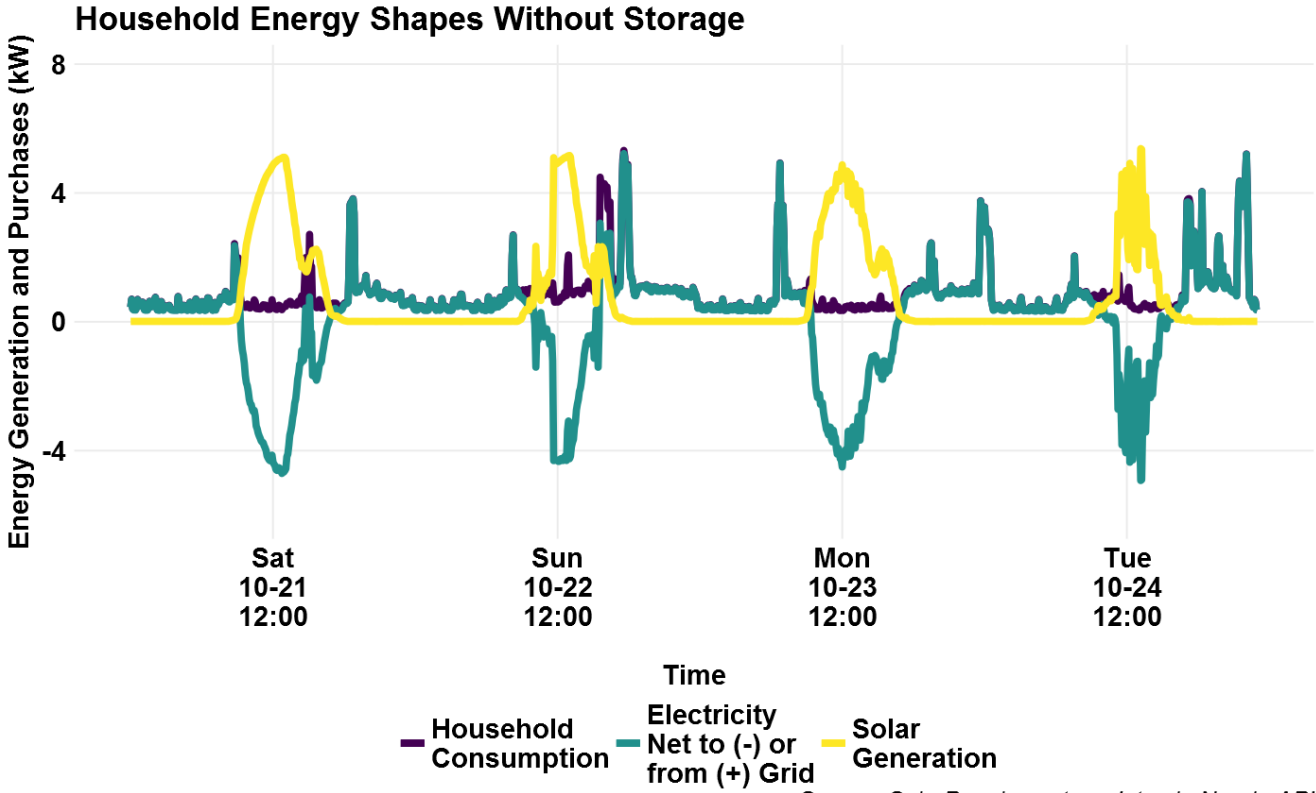
BUEC 563: Energy Industries and Markets

Mini-case #4 – Renewable energy investments

For this case, you are to provide a recommendation to my family with respect to the installation of battery storage to complement my newly-installed solar power system. Here is the relevant information.

The investment in question is a Tesla Powerwall, a 13kW battery system, with a total installed cost of $8500 for the battery and supporting equipment plus $1500 labour.

My household solar power system is a 7.6kW DC, south-facing array, and our annual power usage is approximately 750kWh per month.. While we expect that our solar generation will more-than-offset our electricity usage through the year, we will not be *off-the-grid* as there will be many points through the year when we rely on the grid for our electricity. AS you can see from the image below, in a typical week, we have periods where we are both net purchasers and sellers of electricity.

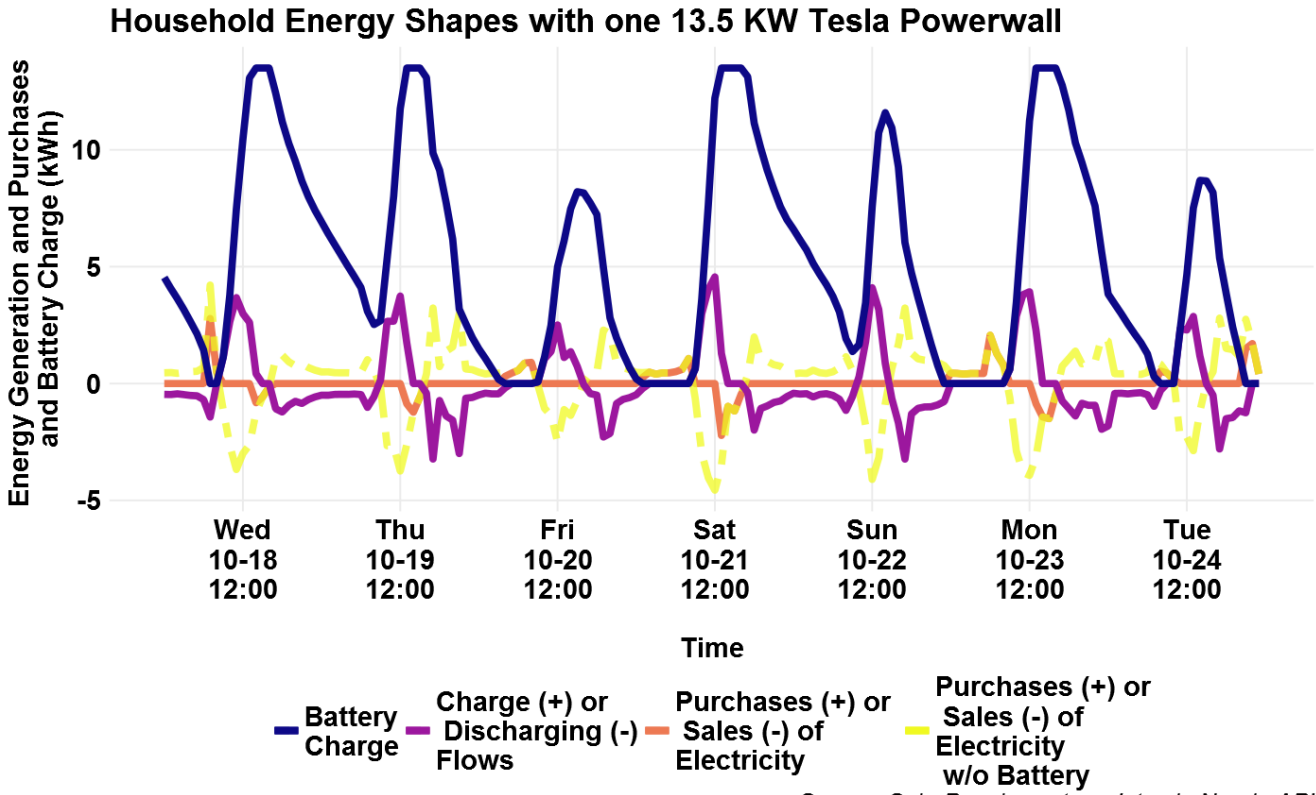


Source: SolarPeople system data via Neurio API
Graph by Andrew Leach

The case for a battery storage system in Alberta comes from the way in which power is priced in Alberta for microgenerators. For power sold back to the grid, we receive a credit at the monthly retail price while electricity purchased from the grid is billed at the power price plus applicable transmission and distribution charges. As such, a battery would allow us to shift the power we generate to serve more of our own use through the year, thereby saving transmission and generation costs.

In the Excel file provided along with this mini-case, I've provided you with data at hourly frequencies

for both our expected solar generation and our expected hourly load. Using this information, and information on Alberta power prices and transmission and distribution rates, your role is to assess the value of the battery installation. To get you off on the right foot, here's some modelled output for this past week, with a hypothetical Powerwall installed.



Source: SolarPeople system data via Neurio API
Graph by Andrew Leach

As you can see, during this past week, the battery would not have been sufficient to keep us fully off-grid, so to use all the power we generated - the battery hit both full capacity and fully-discharged states. However, the battery does dramatically reduce purchases from the grid, and almost eliminates sales as well - it would have allowed us to use our solar power to power our house for most of the week. The question is, would it be worth it?

To further aid in your analysis, I have provided you with a reference copy of our electricity bill (before solar was installed). I am happy to answer any other questions you have.

ELECTRICITY Provided by ENMAX

			PREVIOUS		PRESENT			SITE ID: 0030110925190	
DAYS BILLED:	28	RATE	READING	DATE	READING	DATE	BC	MULT	USE(kWh)
METER #:	43885	ERVAR	7542.000	JAN 13	8399.000	FEB 09	A	1.00000	857.000

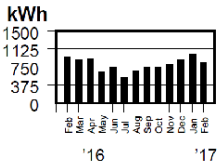
New Charges

Electric Energy Charges - ENMAX Energy Corporation (EasyMax Floating Rate)

Energy Charge (Feb 1 to Feb 9)	275.000 kWh	@ $ 0.0387300 / kWh	$ 10.65 *
Energy Charge (Jan 13 to Jan 31)	582.000 kWh	@ $ 0.0411100 / kWh	$ 23.93 *
Administration Charge (Jan 13 to Feb 9)			$ 5.51 *

Delivery Charges - EPCOR (Jan 13 to Feb 9)

Distribution Charge	$ 23.92 *
Transmission Charge	$ 26.40 *
Balancing Pool Allocation	$ 0.98 *
Rate Riders	$ 5.12 * CR
Local access fee paid to EDMONTON	$ 7.20 *
Summary	**$ 93.47**



AV COST / DAY $3.34

Deliverables: Provide a 4 page briefing note directed to our family. Your report should not exceed 4 pages, excluding title page. I would like you to make a recommendation as to whether we should install a Powerwall. Bonus question: For an extra grade, how many Telsa Powerwall batteries would I need to expect to be fully off-grid through the year? What would be the rate of return on that investment?

For your work, assume that our solar power system will last 25 years with 1% per year degradation, and that the battery lasts 10 years. Assume that the maximum charge and discharge rates are 5kWh in any given hour and the capacity of the battery is 13.5kWh. Assume a 90% efficiency rating and that the full capacity of the battery is available for all 10 years. For an opportunity cost of capital, use our mortgage,a variable-rate mortgage at prime minus 0.75%, which sets our current opportunity cost of capital for this project to about 2%.