Economy of Residential Photovoltaic and Battery Systems in Alberta

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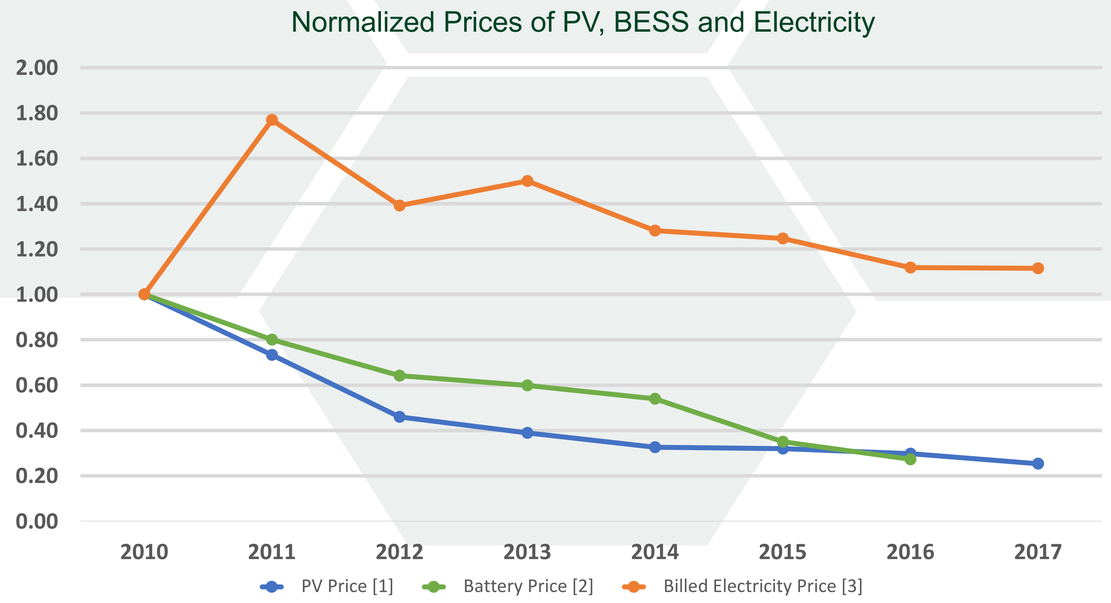
BACKGROUND

The objective of this study is to answer one question:
When would it be economical to install PV/BESS in Alberta?

Photovoltaic (PV) module and Battery Energy Storage System (BESS) prices are dropping at an incredible rate, while billed electricity prices are staying the same, or perhaps even increasing. Basic economics dictate that the install base of residential PV/BESS will increase exponentially when we cross the economic threshold, therefore it is imperative to find this crossing point so that solutions can be designed to prepare the grid for the huge influx of distributed generation.

Net present values (NPVs) of three configurations are calculated, both with current prices as well as projected future prices:

1) A house with no PV or BESS
2) A house with PV only
3) A house with both PV and BESS



[1] Data from pvXchange price index (July of each year), Accessed November 2017
[2] Data from Lithium-ion Battery Costs and Market, 2017. https://data.bloomberglp.com/bnef/sites/14/2017/07/BNEF-Lithium-ion-battery-costs-and-market.pdf
[3] Data from *Comparison of Electricity Prices in Major North American Cities* publications, Hydro-Québec, 2010 to 2017

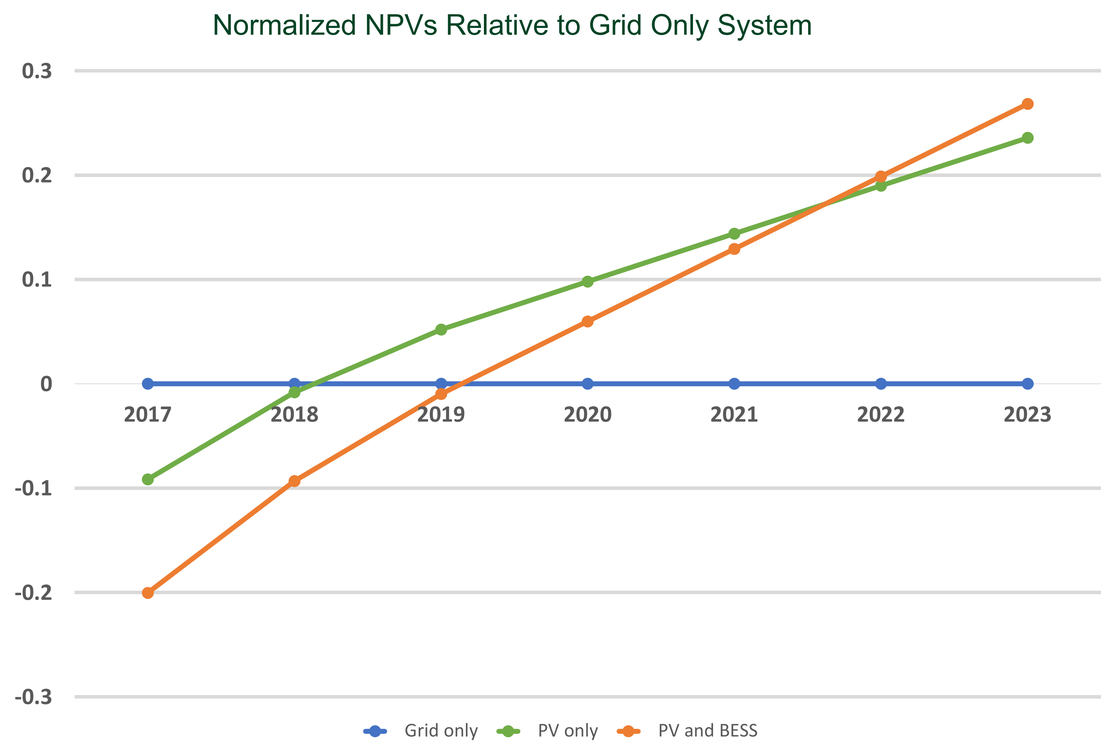
RESULTS

System costs were obtained from NREL [4]. The costs, adjusted for Canada, are show in the table below.

Energy transactions were based on electricity prices of $0.05/kWh with a 2.1x T&D fee multiplier using non-fee offsetting net-metering. NPVs were calculated at a discount rate of 2% for a 10 year equipment lifetime. The Alberta Solar Rebate [5] was applied to the capital investment of the systems. The PV was designed to satisfy an annual load of 6MWh, and the BESS chosen has a capacity of 4kWh with a 2kW inverter. Projected PV and BESS prices were derived using a 15% YoY price decrease.

The results show that, even without full bill offset, we should expect to see the tipping point within 1 to 2 years.

System Costs	
Module cost	$1050/kWp
Inverter cost	$315/kWp
Battery cost	$450/kWh
Balance of system equipment	$1050/kWp
Labour, margins and overhead	$1312.5/kWp



[4] Data from NREL, Installed Cost Benchmarks and Deployment Barriers for Residential Solar with Energy Storage
[5] https://www.efficiencyalberta.ca/solar/

FUTURE DIRECTIONS

The findings of this study are both encouraging and disturbing. While the economic incentive for residential customers to install PV/BESS systems becomes stronger every day, utility companies are less equipped to handle the huge influx of DERs under the present regulatory and market frameworks. It is imperative for academic researchers, utility companies, and regulators to work together on creating fast, robust, and scalable solutions today to prevent infrastructure and market disasters in the future.

PARTNERS

Sample data for simulation studies presented in this poster were provided by Landmark Group

Guidance on the economic aspects of this study were provided by FES project T06-P05: Economic Policy and the Future Electricity Grid

FES PROJECT OVERVIEW

Project T06-P02
Modern energy systems provide plethora of data (including data on generation, loads, weather and market conditions) that can be harnessed for the design, monitoring, and control of electric power grids. Under the smart grid framework, this data and information is gathered and processed using information and communication technologies (ICT) and can be used to enhance the reliability, efficiency, flexibility, and resilience of power systems. In future energy systems, an additional degree of complexity will be brought by mass introduction of renewable energy sources (RES) and storage devices. This integrated research program will address the major challenges expected within the future grids through data-driven methods, and develop principles for building grids capable of adaptation to changes not yet anticipated in the future.

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