

Solar Swap Market Analysis

By Philip Hempstead, ECE '23

The Problem

Massachusetts residents are consuming dirty electricity generated by fossil fuels and are struggling to pay for it. With electricity rates estimated to increase 64% this winter and climate change a looming threat, these problems are only getting worse. Solar Swap aims to provide a cheaper and cleaner alternative by allowing residents to produce more solar electricity than they consume and sell the excess to residents who cannot produce their own solar electricity.

Context

The Current Process

When MA residents generate more solar electricity than they consume, they send the excess energy into the grid and amass a credit from utility companies. In the moments that MA residents consume more energy than they produce, they accrue a bill from utility companies. This process is called net metering. [1] Solar PV installation companies typically design PV systems such that the credits and bills amassed by households balance out to net zero over the course of the year. In certain instances, this means only installing solar on a portion of a customer's roof and leaving the rest empty.

It is uncommon for residents with optimal solar roofs to buy an oversized system because it is inconvenient to convert utility credits into money. To do this, residents would need to find another resident, typically a neighbor, who could use utility credits in their account. Next, both parties would need to fill out the paperwork required by 'schedule

Z', MA's system for the transfer of utility credits. Finally, the two parties would need to negotiate a price for the utility credits and draw up a contract detailing the agreement. As a result, it is extremely uncommon for people to install an oversized PV system. [2]

Solar Swap's Goal

We aim to create a platform to make the sale of utility credit seamless and convenient. With Solar swap, residents with favorable roofs for solar will save additional money by converting the extra space on their roof into a source of revenue. They can feel good about having a bigger environmental impact. At the same time, residents who cannot produce solar will be able to save money on their electricity bill and power their life with clean energy. We will provide installation companies with the opportunity to do more business by installing larger, more profitable systems. These three stakeholders will be referred to as Credit Sellers, Credit Buyers, and Installation Companies, respectively, throughout this report.

Laws and Regulations

Net Metering

Net metering is the concept of using the grid as an energy bank. Residents are only billed/credited for their net consumption or net production of electricity at the end of every billing period, which occurs every month.

- Utility credits appear as a dollar amount (not kWh) on customers' electricity bill.
- Utility credits never expire and are rolled over to the next billing period. [1]
- Typically, systems are designed to meet a resident's net energy needs over the course of a year. These systems amass a net excess credit over the summer due to extended hours of sun and lower energy needs. Over the winter, residents consume more than they produce and eat away at the amassed credit to arrive at an annual net zero bill. [3]

Schedule Z

Schedule Z is MA's system for 'virtual net metering', the transfer of credits between utility accounts.

- Schedule Z can only be used to assign credits from one utility account to another and does not facilitate payment contracts between account owners.
- Contracts contain the proportion of overage yet to be generated that the credit seller wishes to allocate to the credit buyer. This means that the amount of credit received by the buyer is unknown before the transaction occurs. For example: account A can send 50% of their 'overage' (excess energy) to account B for the following 6 months. However, depending on the weather and energy consumption of the owner of account A, the credit received by account B could vary greatly.
- Credit sellers can assign net metering credits to any account that is...
 1. a customer of the same utility company AND
 2. located within geographic proximity to the seller's account (within the same ISO-NE load zone)
- Credit sellers can assign excess energy to as many accounts as they wish.
- Credit sellers can make changes to their schedule Z contract no more than twice a year. [4]

Net Metering Cap

On August 11th, 2022, Governor Baker signed H5060, climate legislation which, among other things, increased the residential solar net metering cap from 10kW to 25kW solar systems. [2] Put simply, this allows for MA residents to install larger solar PV systems. For example, a resident who consumes the power equivalent to that produced by a 10kW system was previously unable to oversize. With H5060 in place, this resident could now install 15kW of excess solar that generates clean utility credits.

Stake Holders

Installation Companies

Oversizing a solar PV system is an economy of scale because most of the system installation labor cost is fixed. This means that installing an oversized system is far more profitable than traditionally sized systems for installation companies.

Considering the following labor information, imagine having to sell and install 30 one panel systems, or one 30 panel system as an installation company.

Fixed Labor Cost: Every system sold requires...

- Sales presentations, calls and answering customer questions
- System Design
- System permitting
- Inspections (rough and final)
- Crew mobilization
 - Packing up equipment
 - Transportation
 - Site layout and measurements
 - Confirming and counting shipped job supplies

Variable Labor Cost:

- Once everything is set up, installing 2 panels will take longer than one

Credit Sellers

We modeled the investment opportunity of oversizing a system and selling the excess credits.

Our model assumes...

- Credits are sold at 80% of their value to buyers.

- Credit Seller consumes equivalent energy of that produced by a 10kW system.
- Credit Seller's roof can accommodate a 15kW oversized system.
- Credit seller has an average roof orientation and standard depreciation of panel performance – every kW installed produces 1100 kWh of electricity per year and depreciates at 0.1% per year.
- Competitive installation pricing and no discount for oversizing the system.
- Annual increase in utility rate of 3.95% per year.

Our model does not include...

- The 30% tax rebate on solar PV system purchases. In our model the solar system is full price.
- Revenue from solar credit sales is taxable. In the model the revenue is not taxed.
- Our model doesn't account for the additional earnings from selling RECs.

The investment in an oversized system would pay for itself even faster considering the above information. The model we put together is an underestimate of savings.

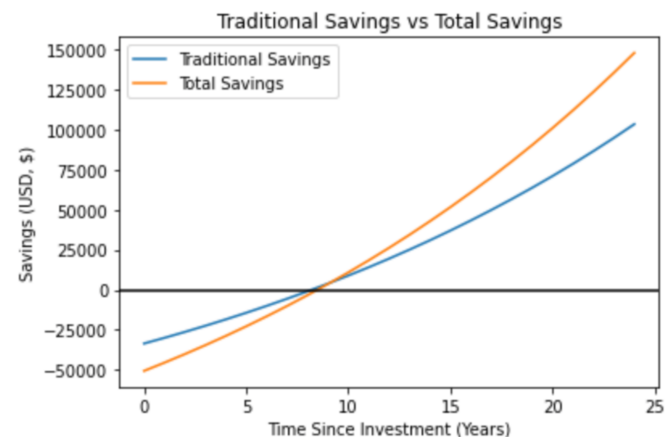


Figure 1. Our model shows that the oversized system pays for itself as quickly as a traditionally sized system.

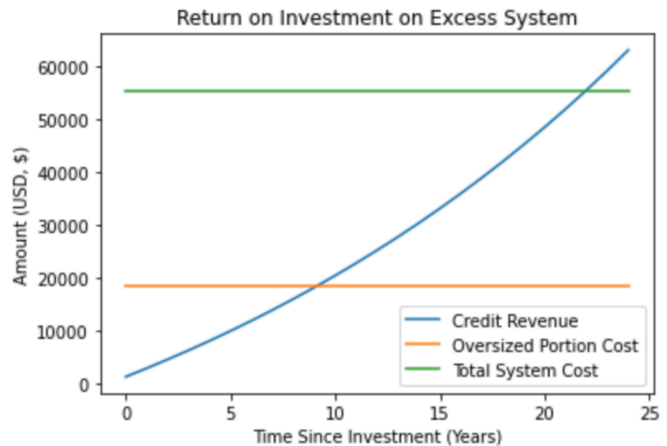


Figure 2. The revenue from selling excess credit amasses to \$63,000 over 25 years and pays for the system in its entirety and then some. The exact numbers are detailed below.

Cost of traditionally sized system: \$36,900
 Cost of excess system: \$18,450.00
 Total cost of system: \$55,350.00
 Revenue from Excess Credits: \$62,962.00
 Excess Credit profit: \$44,512.00
 Yearly avg of Oversized Profit: \$1,780.00
 Real profit: \$7,612.00
 Savings from traditionally sized system: \$103,395.00
 Total savings: \$147,908.00

Credit Buyers

Solar Swap offers credit buyers a cheaper alternative to electricity sold by utility companies.

Design Considerations

It is clear Solar Swap provides significant financial benefits to Credit Sellers, Credit Buyers, and Installation Companies. However, there are several considerations our design must address for Solar Swap to be adopted. The following section addresses these design considerations and how they affect the stakeholders.

How would credit sellers find out about the opportunity to oversize a solar PV system?

Currently, installers play the role of 'educators' by simplifying the process of installing solar for customers. We could partner with Installation Companies by compensating them for promoting solar swap to customers. Additionally, installation

companies would benefit by selling more profitable oversized systems. Alternatively, we could advertise Solar Swap to Credit Sellers directly.

How do we minimize the risk?

The risk is that Credit Sellers install an oversized system and are unable to sell their excess credits. To minimize risk, we must ensure there are enough buyers. The first solution would be to Sign up buyers before there are any credit sellers because they take on no risk. Worst case scenario for the buyer is that the supply does not match their demand. Another solution would be to sign up energy ‘hogs’ that consume the equivalent to many smaller energy accounts. Once we’ve locked a ‘hog’ into a contract it is much easier to ensure potential credit sellers that there is plenty of demand for their energy. An example of a ‘hog’ is Non-profits because they can’t get a government rebate for solar and often have a very high energy bill.

How do we redistribute risk?

Stake holders will be unwilling to participate in the Solar Swap marketplace if they are taking on too much risk. To incentivize all stakeholders, we must consider strategies for balancing risk. One option is for installation companies take on the financial risk and guarantee that credit sellers will be compensated for their excess production. Another option is for banks to take on the financial risk and guarantee that credit sellers will be compensated at a base rate and resell their excess at a higher rate. In both cases, installation companies/banks would be responsible for finding enough buyers to satisfy the credit sellers. A third option would be for Credit Sellers to have the option to adjust their price to encourage credit buyers to buy.

How do we streamline the process of selling credits?

Solar Swap would not be worthwhile to potential Credit Sellers if selling credits were a time-consuming commitment over the lifespan of an oversized system. An option would be to include an automatic mode: Solar Swap would automatically attempt to *sell 100% of your excess energy on a yearly basis*. Users may opt for a more conservative approach that only sells a percentage of their energy

if they believe they will consume more energy than is predicted that year.

Solar Swap’s Solution

Because Solar Swap is a Capstone project and not a real business, we’ve designed a solution that greatly minimizes risk and is simple enough to implement before graduation. We will not encourage Credit Sellers to buy oversized systems, guarantee transactions, or partner with Installation Companies to promote our service. Instead, our service is intended to streamline the credit to cash conversion process for people who already own an oversized system. Rather than handling the schedule Z paperwork or the financial transaction ourselves, our platform is intended to simply connect buyers and sellers. Like Craig’s List, our platform allows credit sellers to list the amount of credit they’d like to sell and their initial offer. If a Credit Buyers is interested in an offer, they can send a counteroffer along with a note and their email address. From this point, the seller can either reject the counteroffer or email the buyer to finalize the transaction on their own. Although this solution doesn’t fully streamline the process for Credit Sellers and Buyers, it’s an easy alternative to the awkward negotiation process that takes place with neighbors. Furthermore, it spares us, the creators, the risk of handling transactions.

References

1. “220 CMR: DEPARTMENT OF PUBLIC UTILITIES.” *Mass.gov*, https://www.mass.gov/files/220_cmr_18.00_final_12-1-17_1.pdf
2. *Bill H.5060 192nd (Current) - Malegislature.gov*. <https://malegislature.gov/Bills/192/H5060>.
3. I worked as a solar design intern at Sun Bug Solar and ACE solar.
4. “Section 139.” *General Law - Part I, Title XXII, Chapter 164, Section 139*, <https://malegislature.gov/Laws/GeneralLaws/PartI/TitleXXII/Chapter164/Section139>
