

BRINGING SOLAR POWER TO THE PEOPLE: MULTI-YEAR CASE STUDY OF A FIRST-IN-TIME COMMUNITY SOLAR GARDEN

Lori Smith Schell, Ph.D., ERP
Empowered Energy
+1 (970) 247-8181
LSchell@EmpoweredEnergy.com

Overview

A Community Solar Garden (“CSG”) is a solar photovoltaic (“PV”) installation designed to provide renewable electricity by subscription to multiple utility customers (“Subscribers”). The CSG may be owned by the utility or by a third party, and the owner sells or leases a share of the CSG’s solar electricity generation to utility customers. Subscribers to a CSG are typically residential electricity customers who are unwilling or unable to install rooftop solar PV on their own (e.g., due to inability to afford the up-front installation cost, rooftop shading, or lack of home ownership). CSG Subscribers may contract for CSG generating capacity to cover any percentage of their electricity usage, depending on their budget constraint. The percent of CSG generation paid for above 100 percent of a utility customer’s expected usage is utility-specific and takes into account uncertainties in both electricity usage and solar electricity output. CSG Subscribers are credited with the amount of monthly CSG solar electricity output corresponding to their subscribed share of CSG capacity through “virtual” net energy metering (“NEM”). Excess generation may be “banked” and credited against the Subscriber’s future consumption, with an annual cash-out of end-of-year banked generation up to the allowed excess.

This case study will present financial and operating results for the first three years of actual operations of the first-in-time CSG installed on an rural electric co-operative’s distribution system in rural southwest Colorado, U.S.A. The case study will provide insights into the impact of CSG installations on utilities and CSG Subscribers that may be applied to any electricity distribution system. The CSG program and its financial results for the individual CSG subscriber are compared to incentives that would have been paid under solar PV incentive programs in California and Germany.

Methods

The financial results for the individual Subscriber are based on a comparison of the Subscriber’s historical electricity usage with the Subscriber’s share of the CSG’s annual solar electricity output. Historical electricity usage patterns for the Subscriber are compared to the Subscriber’s share of CSG solar electricity output on both a volumetric and avoided cost basis. The avoided costs are based on actual tabulation of the Subscriber’s credited amounts based on virtual NEM, which credits the Subscriber the full retail value for its share of CSG solar electricity output.

The financial results for the electric co-operative are based on the charges that the co-operative avoids paying to its electricity provider because of the existence of the CSG. The CSG’s actual annual hourly solar electricity output is tracked to determine how much solar electricity generation occurs during the co-operative’s monthly peak. Peak CSG generation reduces the peak demand charges paid by the co-operative and overall CSG generation reduces the energy charges paid by the co-operative to its electricity provider. Only observable monetary values are included in the financial results. No attempt is made to quantify any non-monetary externalities (positive or negative) resulting from the existence of the CSG on the co-operative’s distribution system.

Results

In the case study presented, the third-party owner of the CSG offered 20-year leases to its CSG subscribers at a flat rate per kilowatt-hour over the 20-year term. This rate structure was designed to be more costly for the Subscriber than buying electricity from the electricity co-operative during the first half of the lease and less costly during the

second half of the lease provided that the co-operative's rates increased as forecasted over time by the third-party owner of the CSG.

The CSG's first-year solar electricity generation was 15 percent greater than predicted by the third-party owner of the CSG. The Subscriber had contracted for a share of the CSG's solar electricity generation that the Subscriber believed would approximate its anticipated annual electricity usage. The resulting excess generation was sold back to the co-operative at a rate just over half of the retail rate available under the NEM. The Subscriber's first-year financial results confirmed that, as expected, the Subscriber paid a significant premium as a CSG Subscriber compared to what it would have paid to the electricity co-operative. The Subscriber reduced its CSG capacity commitment in year two of the CSG's operations but the CSG's solar electricity generation still resulted in the Subscriber selling back the excess generation to the co-operative. The Subscriber again reduced its CSG capacity commitment for year three of the CSG's operations in hopes of not have excess generation to sell back to the co-operative at the end of the fiscal year.

The co-operative's first-year financial results showed that a relatively small proportion of the CSG's solar electricity output occurred during the co-operative's peak period of demand (which tends to occur in the early evening rather than close to the solar peak). The co-operative's calculations showed that it avoided only about 30 percent of the actual expenses incurred for residential CSG Subscribers versus what it otherwise would have incurred had the Subscriber continued to buy its electricity supply from the co-operative rather than from the CSG. Second-year impact on the co-operative were further impacted by the increasing amount of virtual NEM solar PV capacity installed on its system, resulting in necessary changes to the co-operative's time-of-use pricing structure.

Conclusions

The conclusions of the multi-year analysis supported the financial results expected by the CSG Subscriber and went beyond the CSG solar generation performance expectations of the third-party owner of the CSG. The CSG Subscriber had initially contracted for the share of the CSG's capacity anticipated to generate electricity approximately equal to 100 percent of its annual electricity usage. Therefore, the higher-than-expected CSG solar generation led the CSG Subscriber to reduce its contractual share of the CSG going into year two, and again into year three. The electricity co-operative's peak summer and winter (heating) load typically occurs during the evening hours, so the fact that the CSG's solar generation did not make a significant contribution to reducing the co-operative's peak demand was not unexpected. A fruitful line of future research would be to quantify the (in)direct benefits of the CSG on the co-operative's system, to determine the extent to which such benefits would offset the more-easily measured direct cost impacts of the CSG's solar generation.