An Empirical Analysis of Net Metering

by
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Panel on Distributed Generation

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Overview

- The economic value customers derive from distributed generation (DG), combined with net metering, is largely driven by retail tariffs that are not cost-reflective.
- Excessively high energy prices in these tariffs artificially inflate the value of DG projects, most of which are rooftop solar PV facilities in the US today.
- One unintended consequence is that DG customers avoid fully paying for the grid services they utilize.
- Most of these avoided costs then get shifted to non-DG customers.
Cost shifting is particularly disconcerting because the non-DG customers bearing these costs are lower energy consumers and typically less affluent than the DG customers who avoid the costs.

Because of the punitive, multi-tiered retail rate designs of its investor-owned utilities, California is the poster child for cost shifting abuse.

This presentation will (hopefully) provide insights into the DG/net metering problem based on a quantitative analysis of a typical rooftop solar PV project.
DG Project Valuation

The DG project examined here is a typical residential rooftop solar PV facility located in Southern California Edison’s (SCE’s) Zone 9 service area near Los Angeles.

The project has the following characteristics:

- Size: 4 KW-dc
- Annual solar energy output: 6203 KWh/Yr.
- Initial Investment: $14,586 ($3.74/watt-dc)
- Annual O&M cost: $180/Yr.
- Economic life: 20 years.

The customer/owner consumes 15,000 KWh/Yr.

Average SCE residential consumption is 7,000 KWh/Yr.
Almost all of SCE’s net metered customers are served under its Residential Domestic Tariff, described below.

<table>
<thead>
<tr>
<th>Southern California Edison Residential (Domestic) Retail Rate Structure¹</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tiered Rate ($/kWh)</strong></td>
</tr>
<tr>
<td><strong>Usage Subject to Rate</strong></td>
</tr>
</tbody>
</table>

1. New rate design filed with the CPUC on November, 21, 2013; awaiting approval.
The analysis ran discounted cash flow (DCF) calculations for the project to determine its net present value (NPV) to the customer/owner under three financing options:

- Customer finances project with his own cash (equity-financed)
- Customer finances project with a 10-year home equity loan (debt-financed)
- Customer signs a power purchase agreement (PPA) with a solar leasing company, e.g., SolarCity (third-party financed).

For the third-party financed option the first-year energy price in the PPA is set equal to 85 percent of the average of SCE’s two highest tiered prices and escalated thereafter at 2.9 percent per annum.
Results of Analysis

The equity-financed option produced the following:*

| DCF Analysis for an All-Equity Financed 4 kW Solar Project Near Los Angeles |
|-------------------------------------------------|----------------|----------------|
|                                                   | 1-Jan-14       | 2014           |
|                                                   | 2015 - 2023    |                |
| Gross Consumption (kWh)                          | 15,000         | 285,000        |
| Solar Generation (kWh)                           | 6,203          | 117,865        |
| Net Consumption (kWh)                            | 8,797          | 167,135        |
| Initial Investment ($ Nominal)                   | $14,586        |                |
| Investment Tax Credit ($ Nominal)                | $4,376         |                |
| Bill Reductions ($ Nominal)                      | $1,911         | $47,761        |
| O&M Costs ($ Nominal)                            | $178           | $4,449         |
| Cash Flows ($ Nominal)                           | $6,109         | $43,312        |
| Present Values ($ SOY-2014)                      | $6,042         | $26,317        |

**Project NPV ($ SOY-2014): $17,773**  **Breakeven Year: 7**

Note: Present values are expressed in Start-of-Year (i.e., January 1) 2014 dollars.

*These are preliminary results and subject to revision.
Results of Analysis

- As the table shows, this project is VERY PROFITABLE!
  - For each dollar invested the owner gets back $2.22 in value (including the initial investment)
  - The customer fully recovers the investment, plus carrying costs, plus the present value of the O&M costs, in just 7 years; thereafter, the electricity is free for at least the next 13 years
  - The project’s after-tax internal rate of return is 18 percent.

- The debt-financed option (not shown) looks even better:
  - It adds an additional $1,000 in present value due to the tax-deductibility of the interest payments on the home equity loan
  - It requires no money down and produces all positive cash flows.

- What’s not to like???
The third-party financed option produced the following:

*These are preliminary results and subject to revision.*

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<tr>
<th>DCF Analysis for a Third-Party Financed 4 kW Solar Project Near Los Angeles</th>
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<td>Initial Investment ($ Nominal)</td>
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<td></td>
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<td>Investment Tax Credit ($ Nominal)</td>
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<td>O&amp;M Costs ($ Nominal)</td>
<td>LeaseCo Pays</td>
<td></td>
<td>$4,449</td>
</tr>
<tr>
<td>PPA Payments ($ Nominal)</td>
<td>$1,573</td>
<td>$40,278</td>
<td></td>
</tr>
<tr>
<td>Cash Flows ($ Nominal)</td>
<td>$337</td>
<td>$7,483</td>
<td></td>
</tr>
<tr>
<td>Present Values ($ SOY-2014)</td>
<td>$326</td>
<td>$3,434</td>
<td></td>
</tr>
</tbody>
</table>

*Project NPV ($ SOY-2014): $3,760 Break even Year: 20*

Note: Present values are expressed in Start-of-Year (i.e., January 1) 2014 dollars.
The most striking result shown here is how much value the customer loses by signing a PPA with a solar leasing company - **80 percent** of the project’s intrinsic value!

Not all of the lost value is profit for the leasing company, which has significant marketing and customer acquisition costs, (which a customer/owner does not); moreover, it must share its profits with a “tax equity” investor group.

To its credit, the leasing company delivers a turnkey project, thereby relieving the customer of the hassle of planning, installing and maintaining the system.

Still, is that worth 80 percent of the project’s value?
Results of Analysis

- So far the analysis reveals that DG/net metering produces at least two undesirable results:
  - It shifts costs from relatively affluent, high energy-consuming DG customers to less affluent, lower energy-consuming non-DG customers
  - Most of the subsidies go to solar leasing companies, at least in California, where they provide 75 to 80 percent of new systems.

- One other undesirable result is that DG/net metering inefficiently promotes solar energy projects that do not produce renewable energy at lowest cost to society.

- Utility scale projects produce solar energy for about half the cost of rooftop solar PV.
So how can we fix the DG/net metering problem?

Two regulatory solutions exist:

- Redesign retail tariffs to be more cost-reflective
- Separately meter all DG energy and compensate it at “avoided cost” (The City of Austin, TX currently does this).

To explore these two general fixes, the impacts of the following alternatives on our solar PV project’s NPVs were examined:

- Replace SCE’s multi-tiered rates with a monthly fixed charge ($10, or $30) and one energy price designed to be revenue-neutral
- Compensate all DG energy at SCE’s avoided cost (energy, T&D losses, generating capacity) plus add a CO2 credit.
Here is a summary of the results:

*These are preliminary results and subject to revision.*

### Impact of Regulatory Changes on a 4 KW Solar Project Near Los Angeles

<table>
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<th>Regulatory Alternative</th>
<th>Project Financing Option</th>
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<tr>
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<td>All-Equity Financed</td>
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<tr>
<td>Existing Tariff with Four-Tiered Energy Prices</td>
<td>$17,773</td>
</tr>
<tr>
<td>Two-Part Tariff with $10 Customer Charge</td>
<td>$4,161</td>
</tr>
<tr>
<td>Two-Part Tariff with $30 Customer Charge</td>
<td>$640</td>
</tr>
<tr>
<td>Sell all Solar Energy at Societal Avoided Cost²</td>
<td>$32</td>
</tr>
</tbody>
</table>

1. Initial PPA price set at 85 percent of highest energy price in retail tariff.
2. Customer buys all consumed energy at retail tariff prices and sells all locally generated energy at the utility's avoided cost plus a CO2 credit. With this option the average price paid for energy.
3. Indeterminate because the project payoff depends on the the customer's retail tariff.

Note: Present values are expressed in Start-of-Year (i.e., January 1) 2014 dollars.
Conclusions

- All of the regulatory fixes substantially reduce the value of the project to the customer - but they also reduce, or eliminate, cost shifting and uneconomic incentives.
  - The $10 per month fixed charge is about what is needed to just cover metering, billing and that portion of the distribution system exclusively dedicated to serve a residential customer
  - The $30 per month fixed charge is about what is needed to fully recover the distribution system costs allocated to the customer.

- The ideal fix is the Austin Energy model, because it:
  - Eliminates all cross-subsidies
  - Eliminates discrimination between large and small consumers
  - Provides a transparency that is lacking in net metering.
That’s all Folks!
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