SAM International Case Studies: DPV Analysis in Mexico

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Agenda

• SAM Mexico Case Studies
  o Customer impacts from changes to net metering and billing agreements
  o Potential benefits of PV for a) customers b) the Mexican Treasury and c) the environment
• Overview of International Utility Rate Database (I-URDB)
• International SAM next steps
Mexico Background

- In 2015, Mexico passed the Energy Transition Law (LTE) that required the energy regulator, CRE, to develop a fair compensation mechanism for distributed generation (DG)
- The LTE also required SENER, the Ministry of Energy, to examine the customer benefits of DG
- CRE reached out to NREL to look at impact of different compensation mechanisms on DPV customers
- In Mexico, there are different electricity tariff classes (1-1F) with tiered rates for electricity use
- There is a limit to electricity usage and if a customer goes over that usage in a 12 month rolling average, the customer is bumped into a high rate tariff class (DAC)
- The Mexican Treasury (Hacienda) subsidizes tariffs 1-1F to keep electricity rates low
Compensation Mechanism Analysis

- Based on three compensation schemes, determine the payback period for PV systems in 5 different locations
- Locations: Tijuana, Monterrey, Guadalajara, Merida, and Mexico City
- Mexico currently has Net Energy Metering (CM #1)

Source: NREL, forthcoming
SAM Modelling

- **SAM Inputs**
  - Mexico electricity tariffs
  - PV system costs
  - Customer consumption data
  - System size (sized to displace 100% of customer’s load)

**Compensation Mechanisms in SAM – ‘Electricity Rates’**

### Monthly Accounting of Excess Generation

<table>
<thead>
<tr>
<th>Monthly Accounting of Excess Generation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Monthly total excess rolled over to next month bill in kWh</td>
<td></td>
</tr>
<tr>
<td>☐ Monthly total excess credited to next month bill in $ at sell rate(s)</td>
<td></td>
</tr>
<tr>
<td>☐ Cumulative hourly (subhourly) excess credited to current month bill in $ at sell rate(s)</td>
<td></td>
</tr>
<tr>
<td>☐ Cumulative hourly (subhourly) excess credited to next month bill in $ at sell rate(s)</td>
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</tr>
<tr>
<td>☐ All generation sold at sell rate(s) and all load purchased at buy rate(s)</td>
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</table>

### Results – Payback Period (years)

<table>
<thead>
<tr>
<th>Tariff 1/1C</th>
<th>DAC</th>
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<tbody>
<tr>
<td>#1 NEM</td>
<td>#2 NB</td>
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<tr>
<td>TIJ</td>
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</tr>
<tr>
<td>MON</td>
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<tr>
<td>MEX</td>
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</table>

Source: NREL, forthcoming
Multi-Perspective DPV Benefits Analysis

- SENER reached out to NREL to examine DG benefit’s to:
  - Solar customers – annual customer bill savings and payback period
  - Mexican Government (Treasury) – avoided subsidy payments and decreased tax collection per kW DG
  - Environment – avoided CO$_2$, NOx, and SO$_2$ emissions per kW and avoided water withdrawal
- Analysis looked at 8 tariff classes (1-1F and DAC) for each of the 16 tariff divisions in Mexico
SAM Modelling

• SAM Inputs
  o Entered electricity tariffs (1-1F) and all 16 DAC regional tariffs into I-URDB
  o Confidential Treasury subsidization rates
  o Customer load data, by tariff class
  o PV system costs ($35 MXN/W)
  o Average Mexican generation fleet (for environmental)
    – Assumed a 1:1 ratio for DG offset average generation
  o System size (sized to displace 100% of customer’s load)

• Calculated generation in each tariff division’s three largest cities and averaged for yearly PV generation
Benefits Analysis Results

- Analysis found that subsidized customers were unlikely to install PV (~20 year payback period)
- However, these customers would have the highest benefit to Treasury
- Policy intervention is likely needed to address these benefit differences

International Utility Rate Database (I-URDB)

- Developed by NREL for compiling different utility rates
- SAM can pull in rates automatically from website
- All relevant rate information (fixed charge, demand charge, electricity prices, tiers, etc.) is uploaded to the database and organized by utility
- Currently, rates for Mexico, Belize and a few Canadian utilities are available
- Rates can be added as needed and can occur for countries where NREL performs analyses
- Found at https://openei.org/apps/IURDB/
I-URDB: Tariff 1C

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<th>Max Usage Units</th>
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<th>Adjustments $/kWh</th>
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</table>

Fuel Adjustments Monthly ($/kWh)

Weekday Schedule

- Allows for tiered electricity rates
- No fuel adjustments used in Mexico analysis
- Seasonality and weekend/weekday rate entry available
Next Steps – International SAM

- Creation of a SAM International website to provide information on past analyses
- Creation of SAM Mexico Example file with standard data values in SAM
- DPV Analysis in Peru
  - Customer benefit analysis
  - Displaced diesel generation analysis
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• https://sam.nrel.gov/
• https://openei.org/apps/IURDB/
• https://www.gob.mx/tramites/ficha/interconexion-de-centrales-electricas-con-capacidad-menor-a-0-5-mw/CFE3143
• https://www.gob.mx/sener/documentos/beneficios-de-la-generacion-limpia-distribuida-y-la-eficiencia-energetica-en-mexico