Behind-the-Meter Projects: Overview

Karlynn Cory
2020 Tribal Energy Webinar
U.S. DOE Office of Indian Energy Policy and Programs
August 26, 2020
Today’s Goals

Behind-the Meter (BTM) Power Projects
  – What they are
  – Why they are desirable

Incentives, Net Metering, and other Policies
  – How they work

How to Scope Projects
  – Sizing of systems
  – Economics

Solar photovoltaics (PV) business structures
  – Solar PPA or lease
  – Direct ownership
What is Behind-the-Meter Power Generation?

1. Distributed generation (DG) is located on the distribution system
   a) “Behind-the-meter,” on the customer side of the meter
   b) Interconnected to the utility distribution system, on the utility side of the meter
2. Utility-scale generation is interconnected to the utility transmission system

Generating power closer to the load avoids transmission and distribution losses and can increase resiliency if designed right
Behind the Meter Projects Provide:

- Energy cost savings,
- Control over project operations and maintenance,
- Self-consumption of distributed generation (usually solar PV),
- Visible commitment to sustainability (with solar PV), and
- Resiliency (with battery storage).
BTM Project Screening Best Practices

• Identify the relevant load
• Identify the project site
  • Rooftop or ground mount
• Characterize the solar resource
• Evaluate technology options
• Estimate the economics
• Identify financing alternatives
• Engage your utility early

NREL Technical Assistance is Available:
https://www.energy.gov/indianenergy/technical-assistance
Incentives, Net Energy Metering (NEM), and Other Policies

State and utility policies can provide support to all tribal projects.
Incentive Provider
• Utility
• State
• Federal (tax credits only)

Type of Financial Incentive
• Upfront amount ($ or %)
• Performance-based (per kWh)
• Cash or tax credit

https://www.dsireusa.org/
State-developed mandatory rules for certain utilities (35 states + DC+ 4 territories)

In transition to statewide distributed generation compensation rules other than net metering (5 states)

Statewide distributed generation compensation rules other than net metering (5 states)

No statewide mandatory rules, but some utilities allow net metering (2 states)

40 States + DC, AS, GU, PR, & USVI currently have mandatory Net Metering rules

5 of these states are in transition to policies other than net metering
NET ENERGY METERING

Source: NREL
https://www.nrel.gov/docs/fy18osti/68469.pdf

1 Measures net consumption over one billing cycle.
NEM
Excess Generation

BTM PV systems generally meet the average annual load. Some months it will generate more than demand and some months less. Treatment of excess generation is an important NEM design element.

Excess generation rolls over
- Usually within one entire year
- Sometimes within each month/billing period

At end of year/month excess generation is either
- Lost,
- Credited/paid at avoided cost, or
- Credited/paid at the retail rate.
BUY ALL, SELL ALL

DG System → DG Production Meter → Utility Grid

Netting Frequency
Not Applicable

Consumption Meter

Usage
Load → Consumption
DG

Metering
Retail Rate → Sell Rate

Billing
Bill
Cons. +
Prod. −

Grid electricity
Gross DG production

1 Measures gross DG production over one billing cycle.
2 Measures gross electricity consumption over one billing cycle.

Source: NREL
https://www.nrel.gov/docs/fy18osti/68469.pdf
How to Scope Solar PV BTM Projects
Project Size Considerations

Need to work within the NEM law
- Available roof space or ground space (slope, geotech) → How big the system could be
- Site conditions (roof orientation, azimuth, and shading) → How much power it can generate monthly, annually
- Size project at or below total on-site average annual load → How much you can use
  - Typically at or below 100% average load (NEM laws)
  - Excess generation is
    - Lost (Aim for project size smaller than 100% load),
    - Paid/credited at avoided cost rate, or sometimes at retail rate (~100% load)
System Economics

- Cost decreasing over time
- Cost varies by state
  - CA buildings more energy efficient
- Residential systems are generally most expensive
  - Not much economies of scale
  - Bulk purchasing can help
- Community systems are a bit cheaper

Solar PV

Business Structures
Direct Ownership

- Immediate ownership and control
- Clear, visible commitment to sustainability
- Can use state/utility incentives
- All operations and maintenance (O&M) responsibilities
- Requires upfront cash/financing
- Higher financing rates than 3rd parties, but don’t pay 3rd parties
- No tax incentives
- Must own the roof/land
Solar PPA

Customer (consumer) buys electricity from system owner, as it is generated (¢/kWh)

System owner installs, owns, maintains PV system on consumer facility

Consumer buys traditional electricity

Utility buys renewable energy credits from system owner

Utility buys unused solar electricity; net-metering interconnection agreement

Renewable Energy Certificates (RECs) provided to utility

Adapted from: https://www.nrel.gov/docs/fy10osti/46668.pdf
Solar Lease

Customer (consumer) pays fixed, scheduled payments to lease the PV system ($/month)

System owner installs, owns, maintains PV system on consumer facility

Consumer buys traditional electricity

Utility buys renewable energy credits from system owner

Utility buys unused solar electricity; net-metering interconnection agreement

RECs provided to utility

Money

Electricity/RECs

Adapted from:
https://www.nrel.gov/docs/fy10osti/46668.pdf and
Comparing the Financing Options

<table>
<thead>
<tr>
<th>Financing Mechanisms</th>
<th>Self-Financing</th>
<th>Third-Party Ownership PPA</th>
<th>Solar Lease</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Incentives</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State Cash Incentive</td>
<td>Yes, if eligible</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>(production-based or upfront)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of Federal ITC</td>
<td>No</td>
<td>Yes</td>
<td>Yes, except on government or non-profit property</td>
</tr>
<tr>
<td>Accelerated Depreciation</td>
<td>No</td>
<td>Yes</td>
<td>Yes, except on government or non-profit property</td>
</tr>
<tr>
<td>State Tax Credits</td>
<td>No</td>
<td>Yes**</td>
<td>Yes**</td>
</tr>
<tr>
<td><strong>Responsibilities</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upfront Costs</td>
<td>Yes</td>
<td>No*</td>
<td>No</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>Yes</td>
<td>No</td>
<td>Yes, unless contracted to the developer</td>
</tr>
</tbody>
</table>

* The lower the up-front costs, the higher the price of electricity, therefore up-front costs depend on the contract arrangement between the third-party owner and the customer to meet the goals of both parties.
** Requires a larger tax liability within the state the system is located.
U.S. DOE Technical Assistance is Available

1. Strategic Energy Planning
2. Technical Analysis
3. Financial Analysis

More info: https://www.energy.gov/indianenergy/technical-assistance

Apply for technical assistance.
Free NREL Technoeconomic Tools

**REopt Lite**: RE model that examines economic viability, critical load outages, integration, and optimization

- Includes solar PV, wind, and battery energy systems and will soon include CHP
- The user can enter your own input data

**System Advisor Model (SAM)**: software model that facilitates project-level decision-making.

- Includes solar PV, solar thermal/process heat, high concentration PV, wind, geothermal, biomass power generation, marine energy wave and tidal systems, solar water heating, and battery energy storage
- The user can enter your own input data

[https://reopt.nrel.gov/tool](https://reopt.nrel.gov/tool)
[https://sam.nrel.gov/](https://sam.nrel.gov/)
Thank you!

www.nrel.gov

Karlynn Cory
Karlynn.cory@nrel.gov

Photo sources available upon request

This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by The U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Indian Energy Policy and Program Office. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.
| Source: NREL | https://www.nrel.gov/docs/fy18osti/68469.pdf |

<table>
<thead>
<tr>
<th>Feature</th>
<th>Net Energy Metering</th>
<th>Buy All, Sell All</th>
<th>Net Billing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Consumption Allowed</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Netting Frequency</td>
<td>Billing Cycle</td>
<td>Billing Cycle</td>
<td>Instantaneous</td>
</tr>
<tr>
<td>Quantities Measured and Billed</td>
<td>1) <em>Net consumption over the billing cycle</em></td>
<td>1) <em>Gross consumption over the billing cycle</em></td>
<td>1) <em>Instantaneous net consumption throughout the billing cycle</em></td>
</tr>
<tr>
<td></td>
<td>2) <em>Net excess kWh credits to be compensated or banked</em></td>
<td>2) <em>Gross DG production over the billing cycle</em></td>
<td>2) <em>Instantaneous net exports throughout the billing cycle</em></td>
</tr>
<tr>
<td>Sell Rate Applicability</td>
<td>Accrued net excess generation credits that have expired after credit reconciliation period</td>
<td>Gross DG production</td>
<td>Instantaneous DG exports</td>
</tr>
<tr>
<td>Value of DG to Customer</td>
<td>• Retail rate for self-consumption and exported generation</td>
<td>• Sell rate for gross DG production</td>
<td>• Retail rate for instantaneous self-consumption</td>
</tr>
<tr>
<td></td>
<td>• Sell rate for expired net excess generation credits</td>
<td></td>
<td>• Sell rate for instantaneous net DG exports</td>
</tr>
<tr>
<td>Intra-Billing Cycle Banking of Kilowatt-Hours</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
Community and Shared Solar

Like NEM, but expands the market

- Renters
- Multi-family housing
- Homeowners with unsuitable rooftops

Energy Storage Financial Incentives

www.dsireusa.org / April 2020

Note: NJ has a statewide rebate program but the rules are currently being revised.

Seven states have statewide incentives for energy storage. An additional three have utilities offering direct incentives.

KEY
- State Tax Credit
- State Property or Sales Tax Incentive
- State Grant, Rebate, or Performance-Based Incentive Program
- Utility Rebate Program(s)

U.S. Territories:
- AS
- PR
- VI
- GU