Solar PV System Operation & Integration

Solar for POTW Summit
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Joliet, IL

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Agenda

Utility Considerations | 10 min
Solar Lifecycle Management | 10 min
Q&A | as needed
Utility Considerations

Interconnection
Net metering
Utility bill savings
Interconnection Rules and Procedures

- 97%+ of all PV systems are grid-tie → must apply for interconnection
- Application goes to ComEd regardless of supplier
- IC process falls into 4 tiers depending on size, most POTWs will be in tier 2:
  - Relatively simple application
  - Application fee $100 + $1/kW
  - Timeline up to 30 business days
- Complications arise if near a network grid, on feeder with DG > 15% of max load, or if served by a municipal utility (check ComEd’s map online).
- If not eligible for tier 2, must pay for a study by ComEd, and potentially pay for any grid upgrades required
Physical Interconnection at the POTW

Photovoltaics: Sixteen Sharp NT-185U1, 185 W each at 36.21 Vmp, wired in two, eight-module series strings for 2,960 W total at 290 Vmp

KWH Meter: To utility grid

DC Disconnect: Square D HU361RB

Inverter: Sunny Boy SWR 2500U SBD, 2,500 Wp, 600 VDC maximum input, 240 VAC output

Utility AC Disconnect: Lockable switch

AC Service Entrance: To 120/240 VAC loads
Supply side connection:
- Solar comes in ahead of main breaker, in parallel with utility supply
- Most common for larger systems
- “Tap” (direct splice to incoming conductors)

Load side connection:
- Solar comes in on load side of main breaker
- Most common for residential
- Connection typically made via a breaker (backfeed)
- Comply with 120% rule (main breaker amps + PV amps < 120% busbar rating)
Amperage levels for a PV system:

<table>
<thead>
<tr>
<th>Inverter Size</th>
<th>AC Amperage at 480V</th>
<th>AC Amperage at 208V</th>
</tr>
</thead>
<tbody>
<tr>
<td>100kW</td>
<td>121A (150A breaker)</td>
<td>278A (350A breaker)</td>
</tr>
<tr>
<td>250kW</td>
<td>301A (400A breaker)</td>
<td>694A (900A breaker)</td>
</tr>
<tr>
<td>500kW</td>
<td>602A (800A breaker)</td>
<td>1388A (2000A breaker)</td>
</tr>
<tr>
<td>other sizes</td>
<td>scales linearly</td>
<td></td>
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</tbody>
</table>
Solar generally connects on the utility side of the transfer switch, doesn’t supply power during an outage.
Net Metering Policies in IL

- Utility provides credit for exported energy
  - Required to achieve a high offset %
- Eligible regardless of supplier. Must apply through supplier.
- Eligibility up to 2MW system size
- Credit for excess generation rolls over monthly. Credit value:
  - If electric load under 100kW, retail rate (probably no POTWs in this category)
  - If over 100kW and getting supply from ComEd, credit valued at a reduced rate
  - If over 100kW and getting supply from RES, compensation per terms of RES
- Credit is forfeit after 1 yr (in either April or October)
- Customer retains RECs

*If a system is sized not to overproduce, net metering is not necessary.*
Savings Profile

How much solar?
- Look at solar generation vs facility consumption on an annual basis (annual true-up)
- With net metering, can size for 100% offset
- Without net metering, size based on demand

Savings will be based on energy charges, little demand savings anticipated.
Important to consider time of day pricing
Utility Considerations
Interconnection >> Net metering >> Savings

Typical Monthly Generation
100kW-DC System*

Energy yield in Illinois: 1,250kWh/kW/yr
Heavily weighted to summer (July = 3x January)
Generation will decrease about 0.5%/yr

*Ground mounted system with 180 degree azimuth and 20 degree tilt
Peak generation is 80% of nameplate in summer, 60% of nameplate in winter. Savings on energy costs will depend on usage rates.

*Ground mounted system with 180 degree azimuth and 20 degree tilt
Utility Considerations

Interconnection >> Net metering >> Savings

Generation on Typical Days

100kW-DC System*

Energy savings are predictable (long term), but demand savings are not.

*Ground mounted system with 180 degree azimuth and 20 degree tilt
Lifecycle Management

*The process of going solar*
Solar Strategy

- Applying the best renewable energy solutions and financing methods to ensure the right issues and opportunities have been identified
- Identifying internal and external stakeholders to build support
- Considering innovative approaches such as collaborative procurement
Feasibility Assessment

- Evaluate the economic and technical potential of the solar project
- Create solar scenarios optimized for each location's unique energy profile, financing and incentive options, technical requirements, and long-term strategic objectives
- Reduce risk and increase returns
Procurement

- Requires an investment of time, technical expertise, and industry knowledge to secure the best deal.
- Should be transparent and efficient at every stage of the process from RFP creation to proposal evaluation to vendor selection.
Commissioning

- Complete an independent inspection post-installation to verify safety, compliance to design plans and codes, and performance
- Ensure a smooth transition from construction to operation
Operations and Maintenance

Three main aspects:

- Monitoring
- Preventative maintenance
- Reactive maintenance

Goals:

- Increase production
- Lower risk
Monitoring

- Alerts to major equipment failures
- Compare actual vs predicted output for more subtle problems (must have good performance estimate)
- Need a weather station on site to establish a baseline
Lifecycle Management
Strategy > Feasibility > Procurement > Commissioning > O&M
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Can also monitoring individual circuits on the DC side
Lifecycle Management
Strategy > Feasibility > Procurement > Commissioning > O&M

Preventative Maintenance

Three main tasks:
- Panel cleaning
- Inverter service
- BOS inspection
Preventative Maintenance

Cleaning:

- Water (+ vinegar optional)
- Typical cost: $0.0025/watt to $0.01/watt
- Cost depends on location, type of array, access to water

- Frequency depends on weather (peak sun season, rainy season, major soiling seasons)
- 2 times per year typical
Reactive Maintenance

- Goal: minimize downtime, <1% typical target
- Failure of inverter and/or meter are critical
- Carry insurance for natural disasters / theft
- Installation should come with warranty
THANK YOU!

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About Optony

Optony develops and deploys solar best practices across the entire solar project lifecycle for government agencies, schools and commercial organizations.

Working with clients across all phases of solar projects creates deep insight into true performance drivers which is used to reduce costs and improve performance at any stage in the process.

www.optony.com

“Optony's consulting service is a must-have for any organization considering an investment in solar. Based on Optony’s comprehensive analysis and recommendations, we now have a low-risk, high-return solar strategy.”
About Solar Roadmap

Initiative to **reduce the total installed costs** of solar systems
And **increase deployment** of solar power across the country

Focus Areas:
- Utility Interconnection
- Local Permitting Process
- Planning & Zoning Regulations
- Education and Outreach
- Financing Tools and Resources
- Innovative Deployment Programs

*200+ Cities/Counties Across the USA*