Solar Development 201
From Construction to Commissioning
January, 28th at 10:00 am PST
Meet Your Speakers

Nate Roberts
Sr. Director, Development

14+ years experience working in general construction and renewable energy development and construction. Oversees development and construction for all Distributed Generation assets in North America.

David Granlund
Sr. Project Manager, Development

4+ years experience developing solar for CA school districts, resulting in close to 50 MW of capacity across dozens of districts.

Casey Miller
Director, Development

14+ years experience working in renewable energy. Oversees development and construction for behind-the-meter projects in California.

Madeline Milani
Marketing Manager

Focus on expanding renewable energy beyond energy savings by impacting the classroom and indirect stakeholders.
Our goals for the webinar:

- Know the steps that a solar developer takes once construction begins.
- Understand information a solar developer might need to complete tasks.
- Learn how solar and storage integrate into your campus environment.
Webinar Outline

Introductions

Case Study: Sample Project Schedule

1. Pre-Construction Planning
2. Construction
3. Start-up, Operation and Commissioning
4. Closeout
Project Schedule

Let’s look at a sample project schedule to orient ourselves to the development process.
Recapping from Part I

• Kick-Off Meeting
• Introduce Project Team
• Gather Stakeholder Needs
• Review Project Schedule

SITE DILIGENCE
UTILITY INTERCONNECTION
PV + STORAGE DESIGN
EQUIPMENT PROCUREMENT
CONSTRUCTION
OPERATION
1. Pre-Construction

What goes down before we dig holes in the ground.
Schedule: 2.8 MW Solar Parking Canopy

Jan-20  Feb-20  Mar-20  Apr-20  May-20  Jun-20  Jul-20  Aug-20  Sep-20  Oct-20  Nov-20  Dec-20  Jan-21

(4) PV Design

(5) Procurement

(6) Construction

(7) PTO and Commissioning

(8) Closeout
Pre-Construction Meeting

Once near permit submission, the agenda switches to construction topics. These include:

- Phasing and sequencing
- Temporary constructs
- Schedule adjustments
- Other checklist items

MATERIAL AND EQUIPMENT SUBMITTALS
PERMIT DRAWINGS
DSA FORMS
2. Construction

Lights, Panels, Action!
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Site Modification and Material Staging

- **Site Modification**: At certain projects sites and locations, trees and/or light poles may need to be removed to facilitate array placement or to address shading concerns. Temporary construction fencing, traffic patterns, and fire lane access may be required as well.
- **Material Staging**: Equipment and material staged only in approved areas.
Coordination, Assembly, and Inspections

- **Coordination:** Weekly construction update and coordination meetings are held with facility personnel, design and construction partners, Inspector of Record, and testing and special inspection laboratory.
- **Array Assembly:** Includes foundations, structure, panels, DC/AC electrical work, and directional boring/trenching.
- **Inspections:** Facilitated concurrently with construction.
LED Lighting, Energy Storage, and Data Acquisition

- **LED Lighting**: Light poles that are removed due to array placement will be replaced with under canopy LED lights. We look to utilize a customer’s existing lighting circuit in order to maintain consistent lighting operations to a given campus or facility.

- **Battery Energy Storage System (BESS)**: May be installed in parallel with the balance of the PV system; all in effort to maintain projected Commercial Operation Dates.

- **Installation of data acquisition system (DAS) equipment**: May include a kiosk/dashboard, metering, weather instrumentation and power controllers.
Finishing Touches

- **Shutdown/Tie-in**: A Method of Procedure (MOP) is developed to safely shut down power and connect the system to the grid. Shutdowns typically occur during off hours (nights and/or weekends).

- **Installation of Utility Upgrades (where applicable)**: Including substation/transmission upgrades, as well as SCADA recloser or telemetry unit installations, if applicable.

- **Full Site Cleanup**: Restoring construction areas back to our documented pre-construction conditions.
3. Start-up, Operation, and Commissioning

It's time to start generating solar power!
Schedule: 2.8 MW Solar Parking Canopy

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(8) Closeout
Following Mechanical Completion

- **Start-up**: Confirmation that all operating equipment is checked-out and ready to be commissioned once the system is started up.
- **Request for and declaration of Permission to Operate**: Also known as PTO, which is submitted to the utility.
- **System Commissioning and Performance Testing**: Acceptance Testing will take place after the system receives Permission to Operate.
- **Notice of Commercial Operation**: Issued after the determined performance acceptance period; and upon the system passing all required performance metrics.
4. Closeout

Checking off the final boxes
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(4) PV Design

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(6) Construction

(7) PTO and Commissioning

(8) Closeout
Project Closeout

- **Closeout Documentation:** Includes Record Drawings, Product Documentation, and miscellaneous documents to support the project financial transaction.
- **Site Safety Walk:** Ensure all key facility personnel are trained on how to shut the system down in the event of an emergency.
- **Live Demonstration of Data Acquisition System (DAS):** View real-time system production and a variety of pre-formatted or customizable reports.
- **Punchlist and Final Site Clean-Up:** The goal is to have a given site restored as construction progresses and as soon as possible upon the notice of Commercial operation.
- **Hand off to Asset Management:** Introductions are made to the internal asset management and operations and maintenance team.
### Sample Punchlist

<table>
<thead>
<tr>
<th>PUNCH ID</th>
<th>SITE</th>
<th>TASK NAME</th>
<th>ENTITY RESPONSIBLE</th>
<th>STATUS (OPEN/CLOSED)</th>
<th>DATE COMPLETED</th>
<th>APPROVED BY</th>
<th>COMMENTS</th>
<th>BEFORE PHOTO</th>
<th>AFTER PHOTO</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.14.2019_01</td>
<td>School 1</td>
<td>Padlock all disconnects.</td>
<td>ForeFront</td>
<td>CLOSED</td>
<td>8.28.2019</td>
<td>ForeFront, School 1</td>
<td>None.</td>
<td><img src="image1.png" alt="Before Photo" /></td>
<td><img src="image2.png" alt="After Photo" /></td>
</tr>
<tr>
<td>8.14.2019_02</td>
<td>School 2</td>
<td>Fill in holes/trenches and grade fill along west edge of system.</td>
<td>ForeFront</td>
<td>CLOSED</td>
<td>8.28.2019</td>
<td>ForeFront, School 2</td>
<td>None.</td>
<td><img src="image3.png" alt="Before Photo" /></td>
<td><img src="image4.png" alt="After Photo" /></td>
</tr>
<tr>
<td>8.14.2019_03</td>
<td>School 3</td>
<td>Remove spare modules.</td>
<td>ForeFront</td>
<td>CLOSED</td>
<td>8.28.2019</td>
<td>ForeFront, School 3</td>
<td>None.</td>
<td><img src="image5.png" alt="Before Photo" /></td>
<td><img src="image6.png" alt="After Photo" /></td>
</tr>
</tbody>
</table>
Let’s revisit our goals for the webinar.

- Know the steps that a solar developer takes before beginning construction.
- Understand information a solar developer might need to complete tasks.
- Learn how solar and storage integrate into your campus environment.
Questions?

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Thank you