Distributed Generation Interconnection Collaborative (DGIC)

“Innovation in the Interconnection Application Process”

Ken Parks, SDG&E and Bob Woerner, PG&E

April 2, 2014
Purpose of Today’s Meeting

• Learn about recent innovations in the distributed PV interconnection process
• Examine how certain challenges related to increased demand for distributed PV can be addressed through revised application processes and procedures
• Hear specific examples from electric utilities in mature solar markets (SDG&E and PG&E)
Speakers

Ken Parks
Customer Generation Manager for the Distribution System
SDG&E

Bob Woerner
Senior Director in Electric Operations
PG&E

Kristen Ardani
Solar Analyst, (today’s moderator)
NREL
DISTRIBUTION INTERCONNECTION INFORMATION SYSTEM

Net Energy Metering
Net Energy Metering 2013 Highlights

- 108% increase in authorizations from 2012
- Approximately 11,000 total projects installed
- On average, it took five (5) calendar days for SDG&E to authorize parallel operation
- 13,100 NEM Applications Processed
- 1,173 NEM “Fast Track” Applications Processed
- 10,710 successful remote meter changes
• 108% increase in authorizations in 2013 compared to 2012
• Total projects installed in 2013 – Approximately 11,000
• Time to authorize dropped to 5 calendar days
• Headcount pressure reduced
• Reduced contractor costs and time

GROWTH OF NEM INSTALLS

SDG&E Annual NEM Installs
GROWTH OF NEM INSTALLS


<table>
<thead>
<tr>
<th>Month</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>322</td>
<td>709</td>
<td>1218</td>
</tr>
<tr>
<td>February</td>
<td>363</td>
<td>629</td>
<td>1105</td>
</tr>
<tr>
<td>March</td>
<td>380</td>
<td>700</td>
<td>745</td>
</tr>
<tr>
<td>April</td>
<td>389</td>
<td>393</td>
<td>658</td>
</tr>
<tr>
<td>May</td>
<td>383</td>
<td>604</td>
<td>820</td>
</tr>
<tr>
<td>June</td>
<td>400</td>
<td>425</td>
<td>1043</td>
</tr>
<tr>
<td>July</td>
<td>460</td>
<td>460</td>
<td>1043</td>
</tr>
<tr>
<td>August</td>
<td>581</td>
<td>1221</td>
<td>1216</td>
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<tr>
<td>September</td>
<td>516</td>
<td></td>
<td></td>
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<tr>
<td>October</td>
<td>651</td>
<td></td>
<td></td>
</tr>
<tr>
<td>November</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>December</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NEM GROWTH CHALLENGES

• Strain on internal teams and processes
• Meter shop unable to meet demand
• Increase in authorization time
• Bottleneck at SDG&E
• Pressure to increase headcount
• Skyrocketing costs
• No off the shelf solution
DIIS Functionality Overview

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global database of all forms of customer generation for internal departments</td>
<td></td>
</tr>
<tr>
<td>Automated application tracking</td>
<td></td>
</tr>
<tr>
<td>Automated status update notifications for the customers (emails)</td>
<td></td>
</tr>
<tr>
<td>Integration with Customer System, Data Warehouse, and GIS</td>
<td></td>
</tr>
<tr>
<td>Empowers contractors to manage their own business through self-service tools and monitor every milestone within the utility’s control</td>
<td></td>
</tr>
</tbody>
</table>
DIIS FACTS

Capital project approval, funding and team kickoff on Jan 2012

Over 18,000 people hours invested to date

~ 12 FTEs dedicated to the project

Launched on February 19, 2013

~ 2.1 M invested in development

13 releases to date
## DIIS BUSINESS IMPACT AFTER ONE YEAR

<table>
<thead>
<tr>
<th>Component</th>
<th>Avoided Costs</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Energy Metering Application Process</td>
<td>$1,090,000</td>
<td>13,100 Applications Processed</td>
</tr>
<tr>
<td>Net Energy Metering FastTrack Process</td>
<td>$100,500</td>
<td>1,763 FastTrack Applications Processed</td>
</tr>
<tr>
<td>Remote Meter Configuration (RMC)</td>
<td>$1,145,970</td>
<td>10,710 Successful Meter Program Change-outs</td>
</tr>
<tr>
<td>Total</td>
<td>$2,336,470</td>
<td></td>
</tr>
</tbody>
</table>
ANNUALIZED SDG&E SAVINGS

OTHER BENEFITS

- Doubled processed applications in 2013
- Time to authorize dropped to 5 calendar days
- Headcount pressure reduced
- Reduced contractor costs and time

* Does not include contractor savings or other soft benefits
DIIS OBJECTIVES

- Be connected with our customers
- Be transparent within every milestone under SDG&E control
- Reduced timeframe for authorization
- Authority having jurisdiction inspections will automatically update DIIS database
- DIIS Remote Meter Configuration
- Future Business Opportunities
DIIS OVERVIEW

- Automated application process and online tool for contractors and customers to manage interconnections
- Real time status updates and notifications
- Self Service management portal for contractors
- Rich reporting and analytics
- Tools to manage internal workflow of inspectors, distribution analysts and GIS
- Remote Meter Configuration, RPF management, and FastTrack
- Accessible from web, tablet and smart phones
- Extensible and scalable architecture
DIIS CAPABILITIES OVERVIEW

Customer at a Glance

Account Verification

Advanced Search

Go Solar Connectivity
DIIS CAPABILITIES OVERVIEW

- Automated notifications
- Auto save
- Reverse Power Flow
- History tracking
FUTURE PRODUCT ROADMAP

- Advanced search functionality
- Automated email enhancements
- System sizing
- Authority having jurisdiction integration
- Solar statistics capture
- Advanced energy storage, electric vehicles and other Rule 21
- Future applications for FERC process
THANK YOU

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Customer Generation Manager
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San Diego, CA 92123
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www.sdge.com/nem
KParks@semprautilities.com
THEN, INSERT PG&E SLIDES HERE
• California Drivers

• PG&E Volumes

• Standard NEM Process Improvements
PG&E Overview

• Pacific Gas and Electric Company (PG&E) is one of the largest combination natural gas and electric utility in the U.S.

• Serving 15 million people in a 70,000 square-mile service area in Northern and Central California

• Customer Accounts:
  – 5.1 million electric
  – 4.3 million natural gas
California Demand

- Encouraging regulatory environment
  - De-coupling 1982
  - Deregulation 1986
  - High tier rates
  - Renewable goals 2002
  - Incentives

- Favorable natural conditions
  - Sun, wind, water, land
  - Resource extraction operations

- Willing market participants
  - Environmentalists
  - Early adopters
  - Inventors
  - Entrepreneurs
Government Drivers

Incentives
- California Solar Initiative
- Solar Water Heating (CSI Thermal)
- Self Generation Incentive Program

Rates
- Net Energy Metering
- G-EG (natural gas rate)

Recovery Rates
- Otherwise Applicable Rate (OAS)
- Standby Rates
- E-DCG (departing load rates)

Tax Credit
- 30% Investment Tax Credit

Power Scale
- 1 kW
- 10 kW
- 100 kW
- 1 MW
- 10 MW
- 100 MW
- 1000 MW
Renewable Portfolio: Past, Present and Future

California has the most aggressive RPS goal in the U.S.

Note: Generic means PG&E will procure from to be determined resources. Some of these resources will be procured through mandated programs such as: RAM, AB 1969, and ReMAT.

Applications submitted exceed PG&E’s peak load
Extensive compliance

- ~2000 requirements across 4 work streams
- ~135 milestones for Wholesale Distribution process alone
- Must retain 40+ documents for each interconnection project
2013

- New solar generation concentrated in Central Valley
  - Lower land cost and higher solar intensity
  - The T&D infrastructure undersized
  - Long lead times for upgrades
- New generation is located far from load center
  - Reverses the typical power flow
  - Need upgrades to the 230 kV and 500 kV backbone systems
- Biofuel distribution generation typically remotely located
  - Unable to see end-of-line faults
  - Direct Transfer Trip protection required
Standard NEM in PG&E’s Service Area

**Statistics**
- ~107,680 systems installed to date
- ~25% of nationwide rooftop systems
- ~2,790 applications per month in 2014
- ~557 MW of customer installed
Standard NEM Cycle Time

![Graph showing the cycle time for NEM applications received per month with key timestamps and labels indicating increased volume impact, initial process simplification, staffing & processing adjustments, and daily metrics.](image)
Initial Process Changes
- Removed 24/7 access requirement
- Removed insurance question review
- Less restrictive meter number match
- Stopped using paper
- Staff adjustments

Eliminating the Paper

Hallways full of file cabinets

Cabinets gone, paper on its way

All gone!
**Daily NEM Process Flow Metrics**

As of Midnight  
Monday 3/24/14

<table>
<thead>
<tr>
<th>Process</th>
<th>Inbox</th>
<th>Drive</th>
<th>Enos</th>
<th>Review</th>
<th>Ready</th>
<th>FMS</th>
<th>Pending</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gen</td>
<td>114</td>
<td>114</td>
<td>102</td>
<td>96</td>
<td>2</td>
<td>116</td>
<td>122</td>
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<tr>
<td>S</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>E&amp;P</td>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td>76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow-up</td>
<td>49</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage</th>
<th>Customers</th>
<th>Status</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gen</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enos</td>
<td>102</td>
<td>V</td>
<td>Final BP = 143, Defect = 113, Final BP &amp; Defect = 415</td>
</tr>
<tr>
<td>Review</td>
<td>96</td>
<td>V</td>
<td>E&amp;P Follow-up = 35</td>
</tr>
<tr>
<td>Ready</td>
<td>2</td>
<td>V</td>
<td>Pending = 134</td>
</tr>
<tr>
<td>FMS</td>
<td>41</td>
<td>V</td>
<td>FMS Follow-up = 10</td>
</tr>
<tr>
<td>Pending</td>
<td>122</td>
<td>V</td>
<td>PGE EGI = 216, PGE Other = 228, Customer = 801</td>
</tr>
</tbody>
</table>

Monitoring both flows and ending balances for each stage of the processing.
Standard NEM Processing Volumes

Baselines set to match daily input volumes to avoid building backlogs
Average PTO Timelines (Business Days)
1) System Built and Passed Final Inspection

- Fill out Agreement & Customer Auth (fillable PDF)
  - Obtain from PG&E website
  - Fill out using a computer
- Sign A&A
  - Electronic and wet signature options for Customer
  - If electronic signature is obtained, need to be verifiable by qualified 3rd party vendor
- Fill out Application (fillable PDF)
- Submit to PG&E (via email)
  - A&A (completed, machine readable PDF - not signed)
  - A&A (signed copy - wet or electronic)
  - Application (completed, machine readable PDF)
  - Final inspection certificate
  - Any additional documentation required

2) System Not Yet Built

- Fill out Agreement & Customer Auth (fillable PDF)
  - Obtain from PG&E website
  - Fill out using a computer
- Sign A&A
  - Electronic and wet signature options for Customer
  - If electronic signature is obtained, need to be verifiable by qualified 3rd party vendor
- Submit A&A to PG&E (via email)
  - A&A (completed, machine readable PDF - not signed)
  - A&A (signed copy - wet or electronic)
- Build system
  - Obtain final local jurisdiction inspection certificate
- Fill out Application (fillable PDF)
- Submit to PG&E (via email)
  - Application (completed, machine readable PDF)
  - Final inspection certificate
  - Any additional documentation required
Two Forms

Fillable PDF forms are located on the PG&E website: [http://www.pge.com/standardnem/](http://www.pge.com/standardnem/)

**Agreement & Customer Authorization (79-1151A)**

**Application (79-1151B)**
Two new forms replace the previous version (79-1101)

- Agreement and Customer Authorization (79-1151A)
  - Customer, contractor and facility location and size information
  - Sign-off on rate selection, agreement terms and third party authorization
  - Submitted alone, or at the same time as the Application
- Application for Interconnection (79-1151B)
  - Generating facility equipment and configuration details
  - Submitted only after final inspection

Why the Changes Were Made

- Simplify the process and forms
- Make it easier for customers and installers to fill out the forms
- Facilitate customers to sign properly completed forms
- Improve equipment data quality in the PG&E asset registry
- Enable machine reading to reduce errors and processing costs
- Further shorten the time needed to issue a Permission to Operate (PTO) letter
Part II – Description of the Generating Facilities

D. AC Disconnect Switch (Write “None” if not applicable. See Part III Section C for requirements):

<table>
<thead>
<tr>
<th>AC Disconnect Manufacturer</th>
<th>Model Number</th>
<th>Rating (amps)</th>
<th>Distance from Meter (ft.)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: PG&E’s Electric and Gas Service Requirements, also known as the “Greenbook” requires the AC Disconnect Switch to be located 10 feet or less from PG&E’s electric revenue meter at the point of common coupling or interconnection and easily seen from the panel. If the AC Disconnect Switch is greater than 10 feet, a variance request must be submitted as outlined in Part II, Section A.

E. Basic Single-Line Diagram (SLD) for Solar Projects (check one):

- [ ] I certify that the SLD below and the PV equipment information in Part II accurately represent the Customer’s service, the Generating Facility (there are no other Generator Facility(ies) connected to the service, and the project does not require a Variance Request.

  Utility Service: (if using the SLD to the right)

<table>
<thead>
<tr>
<th>Panel Voltage</th>
<th>Main Breaker</th>
<th>PV Breaker Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- [ ] I will submit a custom SLD for one or more of the following reasons: there is/are existing Generating Facility(ies) connected to the service, I am modifying an existing Generating Facility, the Basic SLD does not accurately reflect the project, or I am submitting a Variance Request.

  (See Part III Section D for Custom SLD details.)

F. Service Panel Short Circuit Interrupting Rating (SCIR) (for systems larger than 11 kW):

SCIR of the service panel connected to this Generating Facility:_______________
AC Disconnect and Variance Logic Standard NEM

- **Line Side Connection (Above Main Breaker)?**
  - Yes → Fusible AC Disconnect and Signage Required
  - No

- **3Φ at Service Point?**
  - Yes → 3Φ at Service Point
  - No → Is Meter Panel Transformer Rated?

- **Is Meter Panel Transformer Rated?**
  - Yes
  - Yes → AC Disconnect and Signage Required
  - Yes → Install Optional AC Disconnect and Signage? (Recommended)
  - Yes → AC Disconnect > 10 ft. from Service Panel?
  - No → Yes
  - Yes → Yes
  - No → Yes

- **Is Meter Panel Rated > 320 Amps?**
  - Yes → Yes
  - No → No

- **Install Optional AC Disconnect and Signage? (Recommended)**
  - Yes → AC Disconnect & Variance Not Required
  - No

- **AC Disconnect > 10 ft. from Service Panel?**
  - Yes → AC Disconnect + Signage
  - No

- **Installing > 1 AC Disconnect?**
  - Yes → Install AC Disconnect(s) and Signage & Variance and Custom SLD Required
  - No
G. ENGINEERING REVIEW DETAILS

Interconnection Technical Framework Overview

Complete/Valid Interconnection Request

Does the Applicant choose to go directly to Detailed Studies?

No

Yes

Non Export/Net Energy Metering (NEM) or Export?

Non Export / Net Energy Metering

Pass

Initial Review Screens A-H

Networked Secondary A

Certified Equipment B

Voltage Drop C

Transformer Rating D

Single Phase Generator E

Short Circuit Current Contribution F

Short Circuit Interrupting Capability G

Line Configuration H

Fast Track Eligibility MW Limit

Fail

Go to Electrical Independence Tests and Detailed Studies

Does quick review of failed screens determine requirements to address the screens?

Yes

Pass All Screens

Will power be exported across the PCC?

No

Yes

Generating Facility ≤ 11kVA?

No

J

Yes

Is Generating Facility a NEM project whose nameplate capacity is ≤ 500kW?

No

K

Yes

T. Dependency / Stability Test

Are requirements determined without further study?

Yes

Pass All

Penetration Test

Power Quality & Voltage Fluctuation

Safety and Reliability Test

Pass

No

Fail Any Test

Aggregate generation ≤ 15% of line section peak load?

Proceed with interconnection subject to requirements determined by Initial Review or SR, if any

No

Go to Electrical Independence Tests and Detailed Studies

(P)
Standard NEM Engineering Review

Engineer
Check SLD for 1Ø connections, possible solution(s):
- Balance inverters on all phases
- Install new panel/meter
- Install new dedicated service if resolved, proceed with review

ADE (assistance from Engineer)
- Check SLD to validate conditions
- Check thermal limit of Tx
- Check voltage rise due to Gen
- Check secondary & service capacities
  After completion, proceed with review

Pass*3 with Condition
- Install reclose blocking and/or
- Cogen mode on Line Regulator

*Note1: If non-certified inverters used, Supplemental Review required
*Note2: See AC Disconnect Variance Logic
*Note3: Subject to engineering validation
*Note4: Engineering review to be done after application is submitted

Aggregate Gen = Existing Gen + New Gen
SLD = Single Line Diagram
Future Process Improvements

- Some modifications to the current forms shown today
  - Minor wording changes
  - Battery storage options
  - Incorporate closed rate relinquishment acknowledgement

- Standard NEM Web Portal Features
  - Real-time data entry or completed form upload
  - Auto populated fields from billing and asset registry databases once Customer is identified
  - Automated engineering review
  - Drop down equipment lists matching the Go Solar California website
  - Front-end error checking
  - On screen help
  - Electronic signature option
Standard Net Energy Metering Interconnection

Welcome to the Standard Net Energy Metering (NEM) interconnection tool for photovoltaic (PV) solar and wind generating facilities 30 kW or less interconnecting with PG&E. For an overview of the program and to download forms, refer to the Standard Net Energy Metering page for Frequently Asked Questions.

I am here to:

- Start by completing an Agreement and Customer Authorization
  - Online
  - Upload form
- Add a signature to a pending Agreement and Customer Authorization
  - E-sign now
  - Upload a signature
- Complete a Net Energy Metering Application (after submittal of a signed Agreement and Customer Authorization)
  - Online
  - Upload form

*PG&E* refers to Pacific Gas and Electric Company, a subsidiary of PG&E Corporation. © 2014 Pacific Gas and Electric Company. All rights reserved.
Contact Information

- For further information or questions, Bob Woerner can be reached at:
  - Email: Bob.Woerner@pge.com
  - Office: 415-973-2300
Minimum Day Time Load Calculation and Screening

The “Minimum Day Time Load Calculation and Screening,” webinar will feature speakers Babak Enayati, Senior Protection Engineer at National Grid, Dora Nakafuji, Director of Renewable Energy Planning at Hawaiian Electric Company (HECO), and Anthony Hong, Director of Principal Distribution Planning at HECO. The webinar will explain the Massachusetts Technical Standards Review Group’s recommendation to adopt 100% minimum day time load screen and provide an example of how minimum day time load data is gathered and incorporated into the screening process.

https://www3.gotomeeting.com/register/170442518
Thank you!