Distributed Solar for Small Utilities

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Distributed Generation Interconnection Collaborative (DGIC)
May 18, 2017
Agenda

2017 DGIC News and Introductions
  o Emerson Reiter, NREL

Trico Electric Cooperative, Inc.
Marana, Arizona
  o Laree St. Onge, Supervisor of Public Affairs and Sustainable Energy Programs

Groton Utilities, Connecticut
  o Len Mediavilla, General Manager Key Accounts

Question & Answer
Distributed Generation Interconnection Collaborative (DGIC)

- Supported by the U.S. DOE SunShot initiative
- Launched following a stakeholder workshop in Oct 2013
- 16 webinars conducted to date

DGIC Background

**Area 1: Practices and Protocols**
- Document current best practices and standards
- Identify replicable innovation and consistency

**Area 2: Peer Exchange**
- Facilitate data and information exchange amongst stakeholders
- Provide platform for peer learning and outreach
DGIC Planned 2017 Activities

Area 1: Practices and Protocols
- Develop case studies on leading interconnection practices based on peer nomination
- Execute data analysis on pre-application reporting for interconnection applicants
- Curate and share cutting-edge DG research from DOE programs

Area 2: Peer Exchange
- Published “lessons learned” on community solar for municipal utilities
- DGIC blog posts
- New DGIC Website: www.nrel.gov/dgic
- 4 webinars with utility & industry experts
Data Transparency
As distributed PV systems are deployed more broadly in the United States, the availability of key data will only become more important and beneficial.

Business Models and Regulation
The growing role of distributed resources in the electricity system is leading to a shift in business models and regulation for electric utilities.

Application Processing
Several utilities that experienced a drastic rise in applications have taken innovative business and technical steps to speed processing, reduce paperwork, and improve customer service.

Analytical Methods for Interconnection
Many utilities and jurisdictions are seeking the right screening and analytical methods and tools to meet their reliability mandates and customer service goals.

Technology Solutions
Utilities and other stakeholders have become increasingly concerned about the resulting impacts on grid reliability.
This year, DGIC will extend peer exchange beyond the webinar format by producing a series of case studies on leading practices in distributed generation interconnection.

Do you know of an organization doing high-quality, innovative work on the interconnection of distributed generation? Can you help us identify industry leaders?

If so, PLEASE NOMINATE!

NREL will document their best practices, producing case studies to be posted to the DGIC website.

Go to: https://www.nrel.gov/dgic/nominate.html to nominate by June 30, 2017.
Placeholder for publications coming soon.
2017 DGIC Webinars

May 18, 2017 (Today)
Distributed Solar for Small Utilities

July 19, 2017
Plug and Play Solar

September, 2017
To be announced soon.
Participants are joined in listen-only mode.

Use the Q&A panel to ask questions during the webinar.

To ask a question: Type your question in the Q&A GoToWebinar toolbar.

The webinar is being recorded and will be posted on the DGIC site: http://www.nrel.gov/dgic.html
Today’s Webinar: Distributed Solar for Small Utilities

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Webinar slides and recordings available here!
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Distributed Solar for Smaller Utilities

Trico Electric Cooperative, Inc.
Marana, Arizona

Laree St. Onge
Supervisor, Public Affairs and Sustainable Energy Programs
About Trico

- Arizona Small Utility
- Distribution Cooperative
- 200 MW Peak Load
- 47,000 meters
- Regulated by the ACC
- Robust solar program
  - 2,000 DG installations
  - 20MW installed DG
Renewable Applications

Renewable Applications

![Renewable Applications Chart]

Applications

- 2005
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014
- 2015
- 2016

TRICO Electric Cooperative, Inc.
A Touchstone Energy Cooperative
Industry Changes

• Significant changes in how members use energy and rate design based on old model

• Erosion of fixed cost recovery and increasing inequities among members

• Fixed price contracts with power suppliers limiting rate design options

[Diagram showing Grid Cost, Fuel Cost, and Total Rate with values: 8.5 cents/kWh, 3.66 cents/kWh, and 12.16 cents/kWh]
Cost Shift
Trico Rate Case

- February 2015 - Modify Net Metering
- October 2015 – Rate Case Filing
- February 2017 - Rate Case Decision
DG Energy Export Tariff

- Energy generated in excess of Member’s needs purchased by Trico at $0.0770/kWh (reduced over time)

- Grandfathered existing residential DG prior to February 24, 2017
Program Growth Considerations

- Meter technology availability
- Rate design supports new technologies that reduce utility costs
- Billing system modifications
- Communication/Public Relations
- Interconnection process expectations
- Flexible program administration human resources
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http://www.nrel.gov/dgic
Webinar slides and recordings available here!
The Evolution of Groton Utilities Photovoltaics

Len Mediavilla
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Geographic Location
Groton Utilities
Bozrah Light & Power

Located in Southeast CT
Awards

• Groton Utilities is among the best in the nation when it comes to:
  • Reliability
  • Safety
  • Work Force Development
  • System improvement

• As a result, we have received a Reliable Public Power Provider – or RP₃ Designation from the American Public Power Association
US Naval Submarine Base
NLON
General Dynamics Electric Boat
Pfizer
Air Reduction Facility
CMEEC /GU 5MW Demand Response Generators
GU Residential Solar
GU Residential Solar
GU Basic Solar Metering Installation

Solar panels convert sunlight into clean green DC electricity.

During peak periods and at night, electricity is imported from the grid.

Excess electricity — when the solar system generates more electricity than your household uses — goes back into the grid and spins your meter backwards, adding credit to your electricity bill.

Inverter converts DC electricity into useable AC electricity.

Supply authority power grid.

Existing electrical switchboard with new bi-directional metering installed.
GU Solar Two Meter Installation

- Energy is brought from the panels through wires to the inverter.
- The inverter converts the electricity from Direct Current (DC) to Alternating Current (AC) that can be used to power the house.
- An AC Disconnect allows the system to be shut off.
- Energy from the solar system powers the main breaker of the home.
- The antenna on the inverter communicates alerts and production data to SolarCity via the homeowner’s broadband Internet service.
One-Line Solar Diagram

TYPICAL ONLINE LAYOUT

NOTES:
1. The intent of this diagram is a generic layout. The contractor must supply a detailed one-line design layout of the specific application to GI/EAP for approval.
2. Exterior Mounted Equipment to be in compliance with GI/EAP Information and Requirements booklet.
3. Load Center represents main and center and any/all sub-panels/main centers.
GU Residential Solar Facts

- 802 Solar residential Solar Units Installed
- 4,750,697 kWh – 4.1117MW produced
- 1,060 Tons of Greenhouse Gasses avoided via landfill recycling
- Avoided CO2 Emission
  - 3,339 Metric Tons
  - 705 Passenger Vehicles
  - 375,681 Gallons of Gasoline
  - 7,730 Barrels of Oil
SUBASE Polaris Park Ground Mount Project 12-1-16
SUBASE Nautilus Park Ground Mount Project
12-1-16
SUBASE Trident Park Ground Mount Project
12-1-16
GU Solar Farm Facts (Operation Pending)

- 5,400,000 kWh – 3MW produced
- 1,448 Tons of Greenhouse Gasses avoided via landfill recycling
- Avoided CO2 Emission
  - 4,196 Metric Tons
  - 769 Passenger Vehicles
  - 476,535 Gallons of Gasoline
  - 9,763 Barrels of Oil
GU Solar Farm Facts

- Total System Size (3 sites) 6.73 Mega Watts
- 28 acres of coverage
- Project cost range approximately $15-20MM
  - Including interconnection, permitting, and construction
GU Solar Farm Facts

- Total of 21,726 panels installed
- Total of 2,869 posts driven
- Over 7,000ft of trenches excavated
- Over 90,000ft of conduit installed or ~ 19 miles of conduit
- Over 691,000ft of wire pulled/installed or ~ 131 miles of wire
- Over 12,000ft of fence installed or ~ 2 miles of fencing
GU Solar Farm Facts

- Employed 95 men and women over the course of 6 months to perform the installation and startup
- Over 20 CT based sub-contractors to perform:
  - Deliveries
  - Trucking
  - Electricians
  - Concrete purchased
  - Sanitation services
  - Machinery rental
  - Signage
  - Temp fencing
  - Office and storage unit rental
  - Printing
  - Landscaping services
  - Material suppliers
  - Fuel services
  - Food services
  - Hotels
GU Solar Farm Facts

- Renewable energy revenues funnel into the Housing re-capitalization accounts which directly support our military families by:
  - Improving long term housing sustainability
  - Providing capital improvements to the homes
- Renewable energy generated:
  - Supports the President’s and the Secretary of the Navy’s renewable energy goals
  - Helps CMEEC and GU stabilize electrical costs in the Groton Region
  - Provides energy security for CMEEC and GU with local generation
THE CITY OF GROTON, DEPARTMENT OF UTILITIES

Groton Utilities
Net Metering Rider
Applicable to Customers on Rates RS and SGS
with Alternate Power Source

AVAILABILITY:

This rider is applicable to Customers with approved Alternate Power Source(s) ("APS"), as defined below, of electricity (with a capacity of less than 10 KW) other than electricity supplied by Groton Utilities (GU). Customer generation on Customer’s premises relieves customers from paying for purchase of power to the extent of such generation, but does not relieve GU of the obligation to deliver all power requirements.

DEFINITIONS:

Alternate Power Sources (APS): Any non-utility electric energy source located on the Customer’s premises and approved by GU to provide electric power service to the Customer.

Capacity Responsibility Obligation of GU: GU’s Responsibility Obligation shall consist of the sum of Partial Requirements Service, and Standby Delivery Service, mutually agreed upon by GU and the Customer that is adequate to meet the Customer’s expected power requirements.

Interconnection Costs: Any and all costs attributable to the Customer’s decision to interconnect and operate its APS in parallel with the GU electric system. All interconnections must conform to GU equipment and engineering standards as set forth in Policy.

Metering Costs: Any and all costs above and beyond that normally needed to provide full requirements service that are attributable to the Customer’s decision to interconnect and operate its APS in parallel with the GU electric system. All metering installations must conform to GU equipment and engineering standards as set forth in Policy.

Parallel Operation: The Customer’s APS must be operated in compliance with the GU Policy for parallel operation of self-generating facilities. GU may suspend parallel operations of the Customer’s APS if, in GU’s opinion, continued operation would endanger the operation, physical integrity of any GU equipment or personnel or if such operation would cause or contribute to a system emergency.
METERING REQUIREMENTS:

Metering equipment shall be installed, at Customer’s expense, for the purpose of accurate measurement of the electricity supplied by GU to the net-metering Customer and accurate measurement of the total electric usage by the Customer, including the Customer’s own generation. Such metering must be approved by GU. TECHNICAL REQUIREMENTS DESCRIBED HERE OR ELSEWHERE.

BILLING FOR NET METERING CUSTOMERS:

The net metering Customer shall be billed the monthly customer charge, and the transmission and distribution charges for Customer’s full load which are part of the bundled rates of the Residential and Small General Service rate schedules. These rate components are shown below. Customer shall be billed the generation charge, any Purchased Power Adjustment, and any Transmission Cost Adjustment charge only for Customer’s net usage, representing the electricity supplied by GU less the electricity supplied by the Customer’s APS back to GU’s facilities during any billing period. If Customer’s net usage is negative (customer generation fed back to the utility exceeds generation supplied by the utility) during a billing period, Customer shall be credited at the applicable generation, Purchased Power Adjustment, and any Transmission Cost Adjustment rate for such generation.

Distribution and Transmission Delivery Charges:

Rate RS $0.04915 per kWh

Rate SGS $0.05048 per kWh

RULES AND REGULATIONS of the Department governing service hereunder as to application for service, character of service, connection, seasonal service, disconnection, reconnection, termination, etc., are on file in the Department.

EFFECTIVE DATE: With all billings on and after October 1, 2008, and thereafter until revised.
Interconnection Guidelines
For Customer-Owned Generation

Effective August 26, 2009
Revised January 9, 2015
Pages 1 - 34
GU Load Curve vs. Solar Generation Curve

Aug. 12, 2016 by Hour

 ISO-NE System Peak

GU Total Load

Solar Generation

Aug. 12, 2016 by Hour
CMEEC

- A regional public power cooperative that provides electric services to several municipals utilities and participating wholesale customers located in the Northeast
- Currently serving over 70,000 residential, commercial and industrial customers
- Total load estimate for 2016 is 1.75mm MWh
- Entered into a 20 MW-DC PPA with Brightfields and SolarCity to develop solar within their existing service territory
CMEEC
Brightfields and Solar City
Contacts

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Automatic operation, easy to maintain
Hydro,2 Heat INC.
Current Projects

• Water purification & Desalination for mining operations and surrounding communities (Botswana, South Africa)

• Combined electric and water desalination project (electric power generation coupled with large desalinization units powered by the heat generated from the Parabolic Solar Trough (Senegal)

• Desalination for Agricultural Farming Project (Jordan)

• Desalination and Power Generation: Dubai (Proposal submitted), Taiwan and US Universities

• Arizona Municipalities – Waste Water Biological Sludge Drying

• Chile – A 10MWt Parabolic Solar Trough Field for Copper Mining

• California – 3-4 MWt Parabolic Solar Trough field for Food Process Heat

• Argentina – 1-2 MWt Parabolic Solar Trough field for Food Process Heat
Heat Transfer Fluid is circulated through the Solar Field until the desired temperature is achieved. Thermal Energy Storage Tank stores up to 12 hours of thermal energy in Summer and 4 hours in Winter. This hot water is fed through a desalination unit to produce pure clean water from salt, brackish or contaminated water. It can also be used to dry bio solids (sludge) at a wastewater treatment plant.
Contact Us

info@heat2hydro.com
Heat2Hydro Inc. | 1 Liberty Plaza, 35th Floor New York, NY 10006, United States | +1.212.734.7675
1. **Over what time frame will Trico transition from the current payback rate to completely avoided cost?** Trico is working through the plan of administration at this time that will determine the transition timeframe to avoided cost. Per the Arizona Corporation Commission’s Value of Solar decision, it is likely that the rate will not decrease by more than 10% per year.

2. **Do you have an online interconnection application program?** All of our interconnection documentation and applications are available online, but the submission of the completed forms is done by email, rather than through an online portal. We are investigating the use of an online application portal for the future.

3. **How many FTE were hired due to solar interconnections in 3-4 years?** Due to the increase in applications, we hired a part-time employee to assist the existing FTE with application processing. However, even with the additional assistance, the time to process applications grew quite lengthy at times. Ramping up/down employees to accommodating an ever changing level of applications has been one of the most difficult tasks to manage.
4. What level of staff resources is devoted to interconnection (in FTE)? Have you taken any steps to streamline the process? Trico’s renewable energy programs are managed by one and one half (1.5) FTE, along with a supervisor that manages several other programs. We have three meter technicians that replace the meters and conduct the interconnection inspections. These three individuals are also responsible for all other meter activities at the cooperative and only spend a portion of their week doing interconnection inspections and meter sets for the renewable energy programs. We also have two distribution designers who assist with the review of the interconnection plans and applications of larger systems or non-standard system installations.

5. How do you communicate with your customers about the interconnection process? Is there any education you do? Do you track customer satisfaction? Trico provides all of its interconnection documentation/requirements on its website as well as a very detailed interconnection application process document. No additional education is provided except that Trico will work with individual members and contractors, as requested, to explain the process either in person or over the phone. Trico does not actively track customer satisfaction as it relates to its renewable energy programs, but we actively monitor phone calls and try to address any frequently asked questions or concerns through FAQ responses posted on our website or through articles in our monthly member newsletter.
6. Where do you think your utility will be with distributed solar in 3 years time? What challenges or opportunities do you see in the near-to-mid-term? Trico anticipates that the installation of distributed generation systems may decrease over the next couple of years, but that the installation of large, utility scale systems will become more prevalent. Other opportunities in the near-term include the installation of battery systems both for distributed generation and utility scale installations.

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1. Over what time frame will Groton transition from the current payback rate to completely avoided cost?

GU bills the solar customer on an identical unit cost as a none solar customer:

- Basic service charge of $11.50
- Metered Energy Charge $08.2874 / kwh
- Purchase Power Adjustment $0.002090 / kwh
- Transmission Cost Adjustment $0.005950 / kwh
- State Conservation Charge $0.002500 / kwh
- Total energy consumed by the home (Utility and Solar use) for State Conservation Charge and Solar T and D Charge $0.049150
- The solar customer is credited on a monthly basis for the energy sent back to the utility at
  - $0.082874 / kwh
  - Transmission Cost Adjustment $0.005950
  - Purchase Power Adjustment $0.002090 / kwh
2. Do you have an online interconnection application program? No, but GU does have an approved, multipage, Interconnection Policy and Procedure Guideline (IPPG) that has definitions, applications, fees by KW output, and one-line wiring diagrams.

3. How many FTE were hired due to solar interconnections in 3-4 years? The existing personnel in different departments took on the responsibilities I.E. Customer Service, Engineering Department, Project Management, Meter Department, Billing Department.

4. Does the DG customer pay for the meters directly or how is that cost recovered? The Legacy customers (like the university and a multiple building research facility) all have combined cycle distributed electric generation and large steam loops. They had the electrical load magnitude and multiple distribution circuits supplying their load in the past, so the metering was bought and paid for by the utility. The latest DG installations, consisting of three(3) units and several MWs of generation, have three(3) meters. That arrangement was part of GU’s interconnection conditions. Now the DG customer is the financial benefactor of the DG concept and has become responsible for the added expense including the meters.
5. **What level of staff resources is devoted to interconnection (in FTE)?** Combining all the utility responsibilities to integrate solar PV to the electric distribution system has become several department’s shared responsibility within their jurisdiction. Departments involved include Engineering, Project Management, Meter Department, Key Accounts, Customer Service, and the Billing Department. No additional FTE’s were hired as the work was load allocated across six departments.

6. **Have you taken any steps to streamline the process?** Yes, PV inquiries are referred to the Key Accounts Department where the initial contact to the customer/installer explain the process. A project number is assigned to customer/address for tracking. All departments are contacted via an “Internal Solar Group” email address with any contacts/updates as the project progresses over time. The inquirer is emailed the “Interconnection Guidelines Document”.

7. **How do you communicate with your customers about the interconnection process?** Via email, telephone, face to face conversations and written application forms.

8. **Do you track customer satisfaction?** We receive feedback from our customers which is circulated to the “Internal Solar Group” handling the installations and management reviews the feedback. Some are very pleased, few customers feel the investment is not what they expected, and producing less energy than proposed.
9. **Where do you think your utility will be with distributed solar in 3 years’ time?** Groton Utilities will reach our 15% renewable energy target with the completion of the fourth solar farm and the 818 residential installations this year. We are carefully watching the impact on the distribution system, ready to control and monitor the 3 MW solar farm battery, and conducting a “Cost of Service Study” with consideration of the PV’s energy generation displacement. To adjust for the revenue changes in the near term, increased fixed cost escalations are seriously being considered for the standard rate tariffs. The future installation of cost effective batteries will be another utility milestone to resolve.

10. **What challenges or opportunities do you see in the near-to-mid-term?**

   **Challenges:** GU meets revenue requirements to maintain and cover the utility’s fixed operating costs while the commodity based charges change. Develop fair and equitable rates for all concerned. Not everybody can afford PV, it doesn’t fit on everybody’s structure, and it isn’t the pot of gold it is believed to be.

   **Opportunities:** Retain and improve the utility reliability, cost effectiveness, and Utility’s reputation.

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