Smart Inverters

within Electric Tariff Rule 21 Interconnection Proceeding R. 11-09-011

NARUC
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Smart Inverter Technology Comes to California in 3 Phases:

- Learn from the German Experience – high penetration distributed energy resources + smart inverters
  - Prevent cascading outages
  - Increase DER penetration levels
  - Increase reactive power system balancing from renewable sources & other grid reliability benefits
- CPUC & CEC partner and launch the Smart Inverter Working Group (SIWG)
  - Phase 1: Autonomous Functionalities
  - Phase 2: Communications Protocols
  - Phase 3: Smart Inverter Functionalities that May or May not Require Communications

Phase 1 Smart Inverter Functionalities

2006 – 2012
The Electrical Ecosystem with Distributed Energy Resources
What is normal anymore? EPRI studies.
CEC determines that Smart Inverter Functionalities are needed

Feb – June 2013
CPUC calls for formation of Smart Inverter Working Group (SIWG).
First Technical Recommendations Document + Workshop
3 Phases developed

Dec 2013 – June 2014
SIWG submits Phase 1 Autonomous Functionalities Technical Recommendations Document to CPUC

June 2014-December 18 2014
Ruling Requests Draft Phase 1 Rule 21 Updates
Draft Tariff Revisions received, comments received, draft Proposed Decision written and released, comments and replies received, Commission Decision **D. 14-12-035 (Dec. 2014)**

Utilities to motion FERC to harmonize with WDAT? // PJM is first.

Phase 1 Autonomous Functionalities

SWIG recommends that Smart Inverters should support anti-islanding to trip off under extended anomalous conditions:

- **low/high voltage ride-through** of excursions beyond normal
- **low/high frequency ride-through** of excursions beyond normal
- **volt/var control** through dynamic reactive power injection through autonomous responses to local voltage measurements.
- program default and emergency **ramp rates** with high and low limits
- Provide **reactive power** by a fixed power factor.
- "soft-start" reconnection programs (e.g. ramping and/or random time within a window)

Electric Tariff Rule 21 Interconnection

CPUC Commissioners approved Electric Tariff Rule 21 Smart Inverter Phase 1 Amendments on December 18, 2014. The Commission Ordered that the utilities file Rule 21 tariff amendments incorporating the Phase 1 Recommendations in January 2015.

Phase 1 Autonomous Smart Inverter Functionalities will be mandatory for all new inverter-based distributed energy resource systems by mid- 2016 after

- UL 1741 testing protocols is updated to provide testing and certification for Phase 1 autonomous smart inverter functions. UL 1741 protocols are *almost* ready for ballot now.
- Furthermore, IEEE 1547 is being updated to incorporate many of California's Phase 1 Autonomous Smart Inverter functionalities.

Phase 2 Smart Inverter Functionalities

Feb – May 2014 **Scope out Phase 2 Technical Work for smart inverters communications protocols discussions**
May – July 2014 Phase 2 Communications Protocols Work Commences Submit outline of work to Commission, set Workshop Date
October 27, 2014 Phase 2 Communications Protocols Technical Workshop held at CPUC Including Cyber Security and Privacy Issues Unofficial comments and replies submitted to SIWG on draft document
February 2015 Final Draft Phase 2 Communications Protocols Technical Requirements Document Submitted to Commission. Commence Phase 2 Procedure to incorporate Communications Protocols into Rule 21
March 2015 Commence scoping technical work for Phase 3!

Phase 2 Communications Protocols

SIWG recommends communication protocols for utilities and between utilities and 3rd parties:

- *Utilities to DER Systems*
- *Utilities to Facility Energy Management Systems*
- *Utilities to Aggregators*

Smart Inverter Working Group Phase 3 Functionalities

- *Has just begun!*

Smart Inverter Working Group
and the
Distribution Resources Planning Process

- AB 327 Sec 8 states that July 1, 2015, the three investor owned utilities will file Distribution Resource Plans with the Commission. SWIG is collaborating with the DRP working Group ("The More Than Smart" Working Group). So we expect that the utilities are planning to utilize smart inverter functionalities on the distribution grid as they will be helpful!

Links to Smart Inverter Documents

Rule 21 Website
http://www.cpuc.ca.gov/PUC/energy/rule21.htm
Phase 1 Autonomous Functionalities Recommendations
http://www.cpuc.ca.gov/NR/rdonlyres/DF1E5DBE-C5F8-4276-8E96-56B60AD0DE9F/0/SIWGworkingdocinrecord.pdf
Smart Inverter Working Group Phase2 Communications Protocols Scoping Document
http://www.cpuc.ca.gov/NR/rdonlyres/4421DC1D-873A-42FA-B7D8-7CF01B47F9E6/0/R_1109011_Motion_of_SDGE.pdf
Interim Decision Adopting Revisions to Electric Tariff Rule 21 to Require "Smart Inverters"
http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M143/K827/143827879.PDF
Phase 2 Communications Protocols Recommendations

See Rule 21 Website for posting

Thank you!

http://www.cpuc.ca.gov/PUC/energy/rule21.htm

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