California’s Interconnection Rule 21
Smart Inverter &
the Smart Inverter Working Group

Jamie Ormond
415-703-1193 – jo2@cpuc.ca.gov
Lead Analyst - Grid Planning & Reliability - Energy Division
California Public Utilities Commission
Summary

- Advanced Smart Inverter Functionalities already exist & are in use today (in Europe)
- Rule 21 procedural history
- National Standards are changing
- Smart Inverter Working Group (SIWG) document production
- No need to retrofit!
Smart Inverter Functionalities Already Exist – In Europe

• European Countries with high penetration DG already use Smart Inverter Functionalities to assist with grid stabilization & reliability
• European Smart Inverter Functionalities Standards have been imported to the US.
• SIWG Consultant, Group Leader & Standards Expert, Frances Cleveland has helped to shepherd international standards throughout the country and the world. *She flies around the globe. She is the best!* 
• Many Inverter Manufacturers sell inverters both in Europe, with the Smart Functionalities turned on, and in the US, with the Smart Functionalities “Switched Off” - because they not allowed to be used currently.
• **California in the process of modifying Interconnection Rule 21 to “enable” smart inverter functionalities to be used in the State of California**
Smart Inverter Functionalities Can Promote Grid Stability

Very high level:

- DG injects spikey power onto the grid
- Smart inverter functionalities can ensure that DG power integrates into the distribution grid’s electrical ecosystem more smoothly.

- Each utility adding ~ 3000 rooftop solar systems/month
- San Diego Gas & Electric thinks that a combination of smart inverters and storage will solve all problems.
Procedural History of California’s Interconnection Rule 21 (Past)

- Rule 21 is the distribution grid interconnection rule for generation (and storage) devices that fall under CPUC jurisdiction.
- Early 2000s – Rule 21 Working Group developed to create a tariff that is size and technology neutral, offers simplified interconnection, sets out operating & metering standards, improves communications
- September 2011 – CPUC issues a Distribution Interconnection Proceeding R. 11-09-011 to review the rules and regulations governing interconnection over generation and storage resources
  - Goal: to promote efficiency, cost-effectiveness, transparency, non-discrimination
- Sept. 13, 2012, CPUC Decision 12-09-018 approves “Revised Rule 21 Settlement” with modified technical screens, a Fast Track process, Pre-Application process
Rule 21 Procedural History Phase II

• Sept. 25, 2012 Phase II Scoping Memo identifies additional issues to address in the proceeding including Smart Inverter Functionalities
  – California Energy Commission notes that Smart Inverter Functionalities are a technology in need of further exploration in 2012 Integrated Energy Policy Rulemaking (IEPR) findings

• Feb. 13, 2013, Announced the Creation of the Smart Inverter Working Group (SIWG) via Rule 21 Service List
  • Divide Smart Inverter Functionalities development into “Three Phases”
    – Phase I: Autonomous Functionalities
    – Phase II: Communications
    – Phase III: Advanced Inverter Functionalities that may or may not require communications

• Workshop held on June 21, 2013
  – Discuss “Kitchen Sink” Document (a little bit of everything)

• January 2014- SIWG submits revised recommendations on Phase I Autonomous Functions
Procedure - Current

- **Feb. – May 2014**: CPUC hold Pre-Hearing Conference
- Interconnection Proceeding Assigned to new Commissioner, Michael Picker
- New ALJ assigned to proceeding
- **May 13, 2014**: New scoping memo issued
- **Due July 18th**: PG&E, SCE, and SDG&E to file proposed Rule 21 tariff revisions incorporating Phase I Autonomous Smart Inverter Functionalities
  - Creative Regulatory Process to Follow
Standards are Changing

• American standard IEEE 1547 states that anything (here, inverters) that connect to the grid may (1) change DC power to AC power AND (2) turn OFF when there is a “grid event”

• “Grid Event” would be when the inverter senses that the voltage or frequency of a circuit moves outside normal parameters

• IEEE 1547a (Amendment) will allow things that connect to the grid to follow state recommendations
  – SIWG Recommendations for Smart Inverter Functionalities contains those recommendations.
  – Initial ballot passed with 94% in favor – Sept. 2013
SIWG Early Document Production

• Smart Inverter Technological Developments divided into 3 Phases
  1) Autonomous Functionalities, no communications required
  2) Communications Protocols (*currently in process*)
  3) Advanced Functionalities which may or may not require Communications

• Focus first on Autonomous Functionalities
  – Low hanging fruit
  – Can be switched on most easily
  – Set them and go – very helpful for DG
Phase I: Autonomous Functionalities

- SIWG recommends autonomous inverter function settings for 7 autonomous functions:
  - Low/High Voltage and Frequency Ride Through (4 set points)
  - Power Factor Settings
  - Ramping (Up and Down) Settings (2 settings)

- On Mandating functions:
  - After we “enable” the functions to be used, they will be studied.
  - If they are proven to be helpful, potential for mandating Autonomous Functionalities (via Decision or another unspecified process) 18 months after use commences
No need to retrofit!

- Inverters (Smart and Dumb) have a functional life of 7-9 years and require replacement during a solar panel system’s 20+ year lifespan
- By the time we mandate anything, new Smart inverters will be able to replace older ones
- Enable now so we’ll have them for later!
References

http://www.energy.ca.gov/electricity_analysis/rule21/

http://www.cpuc.ca.gov/NR/rdonlyres/DF1E5DBE-C5F8-4276-8E96-56B60AD0DE9F/0/SIWGworkingdocinrecord.pdf