



# California's Interconnection Rule 21 Smart Inverter & the Smart Inverter Working Group



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## 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 18<sup>th</sup>: 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.energy.ca.gov/electricity_analysis/rule21/)

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

[www.cpuc.ca.gov](http://www.cpuc.ca.gov)

