

# Florida Code Residential Photovoltaic (PV) System Installation Inspections

PI: Jeffrey Sonne

Co-PI: Donard Metzger

Florida Solar Energy Center

July 31, 2018

## Research Questions

This project is intended to answer the following code questions regarding new residential photovoltaic (PV) installations in Florida:

- 1) Are approved design specifications being followed? (Section 377.705(4)(d), *Florida Statutes*)
  - Attachments correct in number and placements
  - Array located in the correct zones on the roof, setbacks
  - Proper access to array based on roof type (hip or gable)
  - Damaged trusses repaired when lags miss
- 2) Are roof penetration flashings being installed correctly? (2017 FBC, Building, Section 1503.2)
  - Signs of leaks
  - Proper use and type of sealants
- 3) Are systems being grounded correctly based on racking system requirements?
  - Equipment grounding conductors (EGCs), integrated bonding hardware and aftermarket required products correctly used for PV modules according to manufacturer's instructions (2014 NEC 690.43)
  - Appropriate number of bonded rails per row of modules per manufacturer instructions (2014 NEC 690.43)
  - Appropriate DC grounding electrodes are installed (2014 NEC 690.47)
- 4) Is the proper type of listed equipment that is readily available being used for solar systems? (2014 NEC 690.4(B))
  - Approved listed junction boxes
  - Approved listed racking systems without mixing and matching hardware unless approved of by manufacturers
  - Wire managements clips, stainless steel plastic coated wire ties and strain reliefs with the correct number of holes based on wire type and numbers

- 5) Since January 1, 2018 have all systems been installed with rapid shutdown? (2014 NEC 690.12)
- 6) Are systems being appropriately labeled for informational and safety purposes? (2014 NEC 110.21)
- 7) How does PV system energy production compare with rated output (included if system delivered energy is available)?
  - To include PV shading assessment if roof is accessible
  - Results informative to Energy Rating Index (ERI) compliance method which includes on-site renewable power production credit (2017 FBC, Energy Conservation, Section R406.2)
  - Methodology:
    - i. If site has a datalogger function, download hourly data
    - ii. If datalogger just has cumulative total, record the kWh and date of installation
    - iii. If arranged site visit is during good sun hour, make one time measurement of insolation, output and cell temperature and calculate performance
    - iv. Record DC name plate rating, module type and inverter model.

## Background and Code Relevance to Florida

Florida is seeing a significant increase in solar PV installations. In a 2016 Miami Herald article, a Duke Energy Florida representative reported over 100 residential and business customers are installing solar per month, and a 400 percent increase in installations over the past five years<sup>1</sup>. Compiled Florida Public Service Commission data (Figure 1) shows similar increases statewide,

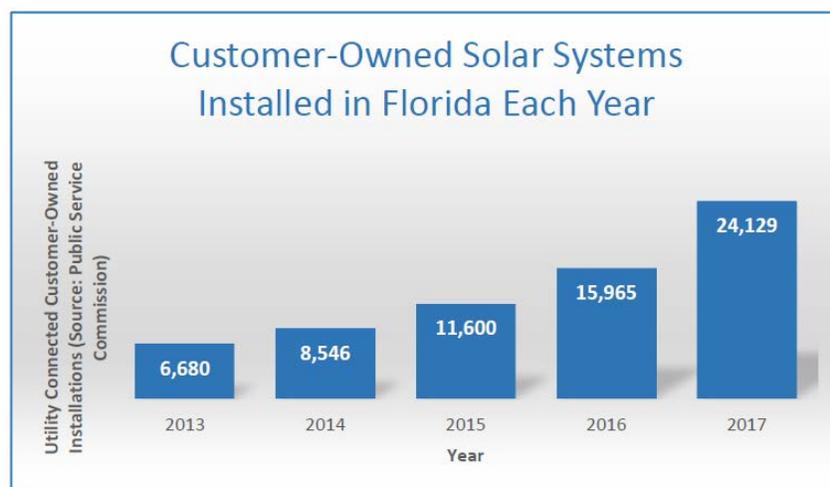


Figure 1. Customer-owned solar system installations in Florida from 2013 to 2017.

<sup>1</sup> <https://www.miamiherald.com/news/politics-government/election/article114377458.html>

with customer-owned solar system installations in the state increasing from 6,680 systems in 2013 to over 24,100 systems in 2017<sup>2</sup>. Florida is also starting to see a number of all-solar communities.<sup>34</sup> Even with the significant increase in installations PV is still a relatively new code item, and the quality of PV installations has structural, electrical, fire and roofing integrity ramifications.

## Critical Research Need

As rooftop photovoltaic (PV) installations become increasingly common in Florida, this project will provide an assessment of how well these installations are following Florida code requirements and report any issues observed. Improvement recommendations for code PV installation and inspection requirements will be made as needed based on project results.

## Proposed Research

A field research study is proposed to inspect new residential Florida rooftop PV installations. The study will be conducted in 40 homes around the state. Tasks will include:

- Home Recruitment: After identifying eligible homes via building department searches and/or rating database queries, FSEC will mail postcards to homeowners, offering \$150 incentives to allow us to inspect their PV system<sup>5</sup>
- PV System Inspections: FSEC will inspect each study home's PV system using a protocol that addresses the seven questions in the Research Questions section above and, if available, compare with the Professional Engineer's report
- Conclusions and Recommendations: Study conclusions and, if applicable, code recommendations will be provided based on inspection results.

A search for candidate homes will begin in October 2018. Home visits will be conducted from January through April 2019.

## Expected Outcome and Impact on the Code

The outcome of this research will be a report summarizing project activities and PV installation inspection findings. Based on project results, recommendations will be made regarding if there is a need for additional code inspection improvement.

---

<sup>2</sup> <http://www.floridapsc.com/ElectricNaturalGas/CustomerOwnedRenewableEnergy>

<sup>3</sup> <https://www.bradenton.com/news/business/article164022262.html>

<sup>4</sup> <https://www.babcockranch.com/>

<sup>5</sup> While this recruitment method has historically worked well, it resulted in a poor response rate for a 2017/2018 DBPR air leakage testing verification study. It is anticipated that the method will be effective again for this study since PV system owners have made a significant investment, and therefore should see considerable benefit in having their system third-party inspected via this study.

## Deliverables

The deliverables for this project are an interim progress report, a final report and work hours breakdown:

- The interim report will be delivered by February 15, 2019 and provide a summary of progress to date, including recruitment activities and status, inspection scheduling status and initial results of any study home visits. In addition, the interim report will be presented to the Commission's Energy Technical Advisory Committee at a time agreed to by the Contractor and Department's Project Manager.
- The final report will be delivered by June 15, 2019 and include a summary of project activities including recruitment, inspection results, discussion and any recommendations. In addition, the final report will be presented to the Commission's Energy Technical Advisory Committee at a time agreed to by the Contractor and Department's Project Manager.
- A breakdown of the number of hours or partial hours, in increments of fifteen (15) minutes, of work performed and a brief description of the work performed will be provided. The Contractor agrees to provide any additional documentation requested by the Department to satisfy audit requirements.

## Budget

The budget for completion of the project is \$79,000 for 40 homes, or if funding is not sufficient, \$65,000 for 30 homes.

## Period of Performance

10/01/2018 – 6/30/2019

## References

*Florida Building Code, Building, 6th Edition (2017)*. (2017). Country Club Hills, IL: International Code Council, Inc.

*Florida Building Code, Energy Conservation, 6th Edition (2017)*. (2017). Country Club Hills, IL: International Code Council, Inc.

FL Stat. § 377.705(4)(d) (2018).

*NEC 70: National Electrical Code, 2014 Edition*. NFPA (2013).