



**FLORIDA SOLAR ENERGY CENTER™**

*Creating Energy Independence*

# **Research, Innovation and Energy Efficient Technologies for Water Heating**

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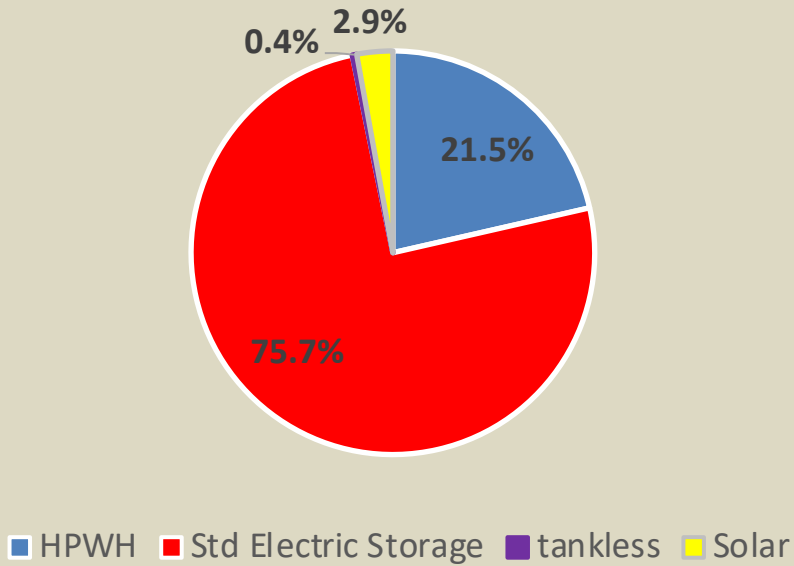


*A Research Institute of the University of Central Florida*



# Water Heating as Reported in Residential Energy Ratings Climate Zone 2 – Past Five years (2013-18)

### Electric Water Heater Type



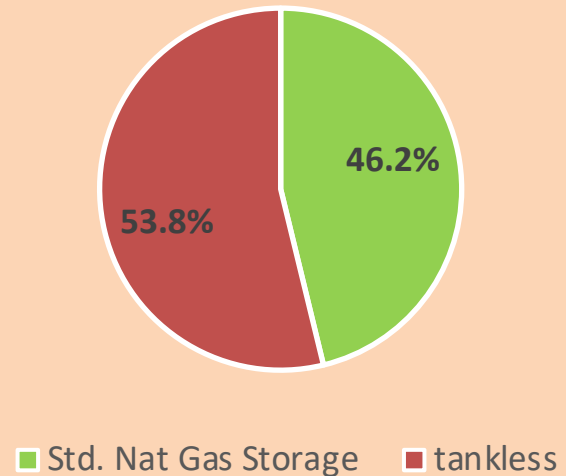
Weighted by records of past 5 Years:

Florida = 25,189

NC = 3,636

SC = 2,950

### Natural Gas Water Heater Type



Source: FSEC Energy Gauge Office Residential Ratings. Database Records



# FSEC Water Heating Research Activities

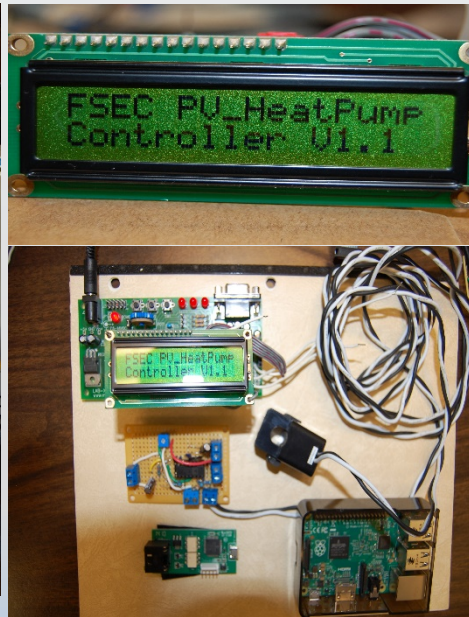
Improvements to PV Assisted  
Heat Pump Water Heaters

*Patent pending*

Low Cost - Smart Controllers

Water Heater Storage  
Insulation system

*Patent Pending*



50-80 gallons (125° → 140 °F)  
2 to 2.7 kWh Storage Potential

IoT , Smart Controls,  
Plug/Play  
Autonomous

Innovative Insulation  
System

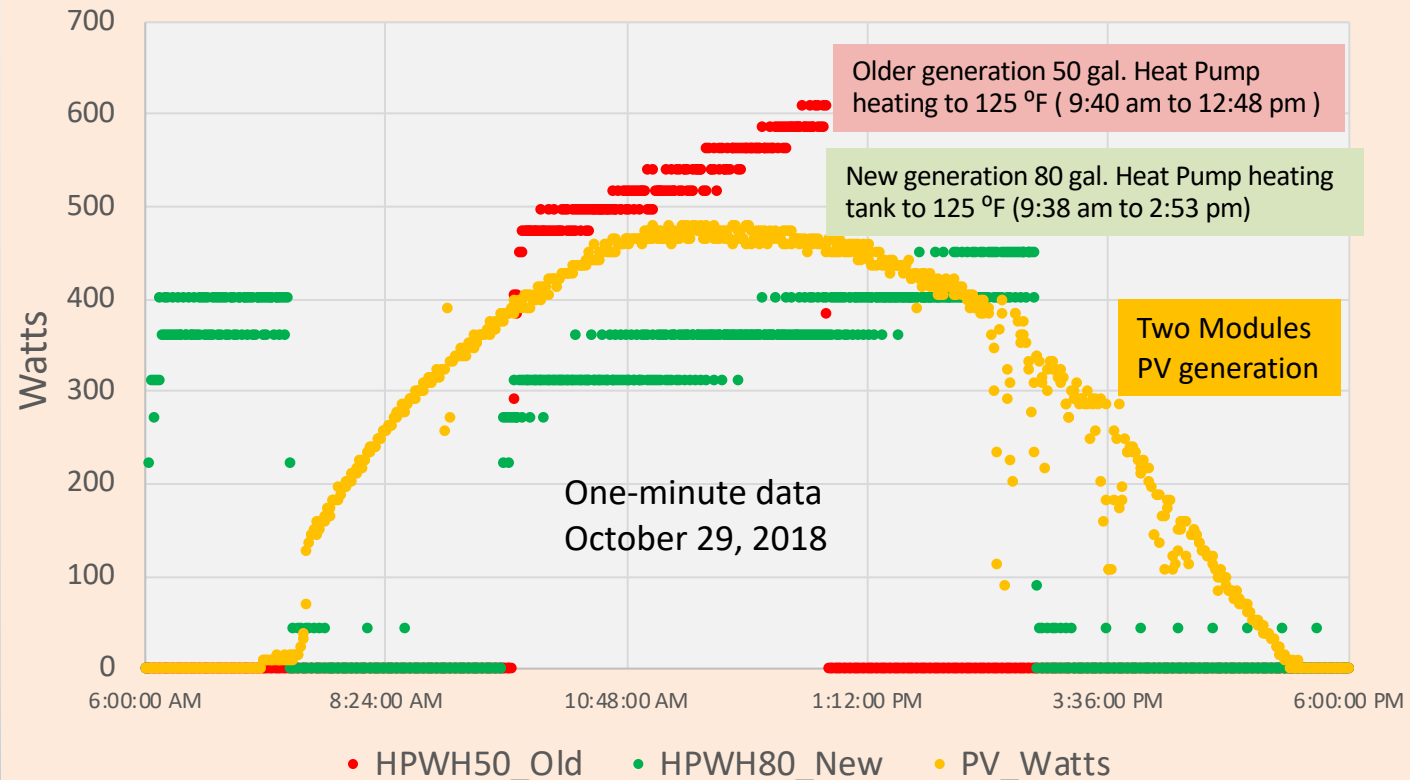


# FSEC's PV Assisted HPWH – Original Prototype

- Older Generation 50 Gal HPWH (GE)  
Electric COP = ~2.5 (Florida)
- Add dedicated 620 Watts Photovoltaics & micro-Inverters
- Use Mixing/Anti-scald valve: set @125 °F
- Add Smart Controls & Program for Additional thermal storage above 125 °F
  - Normal thermostat set: 125 °F (52C)
  - When solar availability = High, Auto- thermostat to 140 °F (70 C)
    - Use of electric resistance past 140 °F
    - When compressor stops at 140 °F engage low power resistive heating
- Overall PV-HPWH COP = 5.2 (Florida)



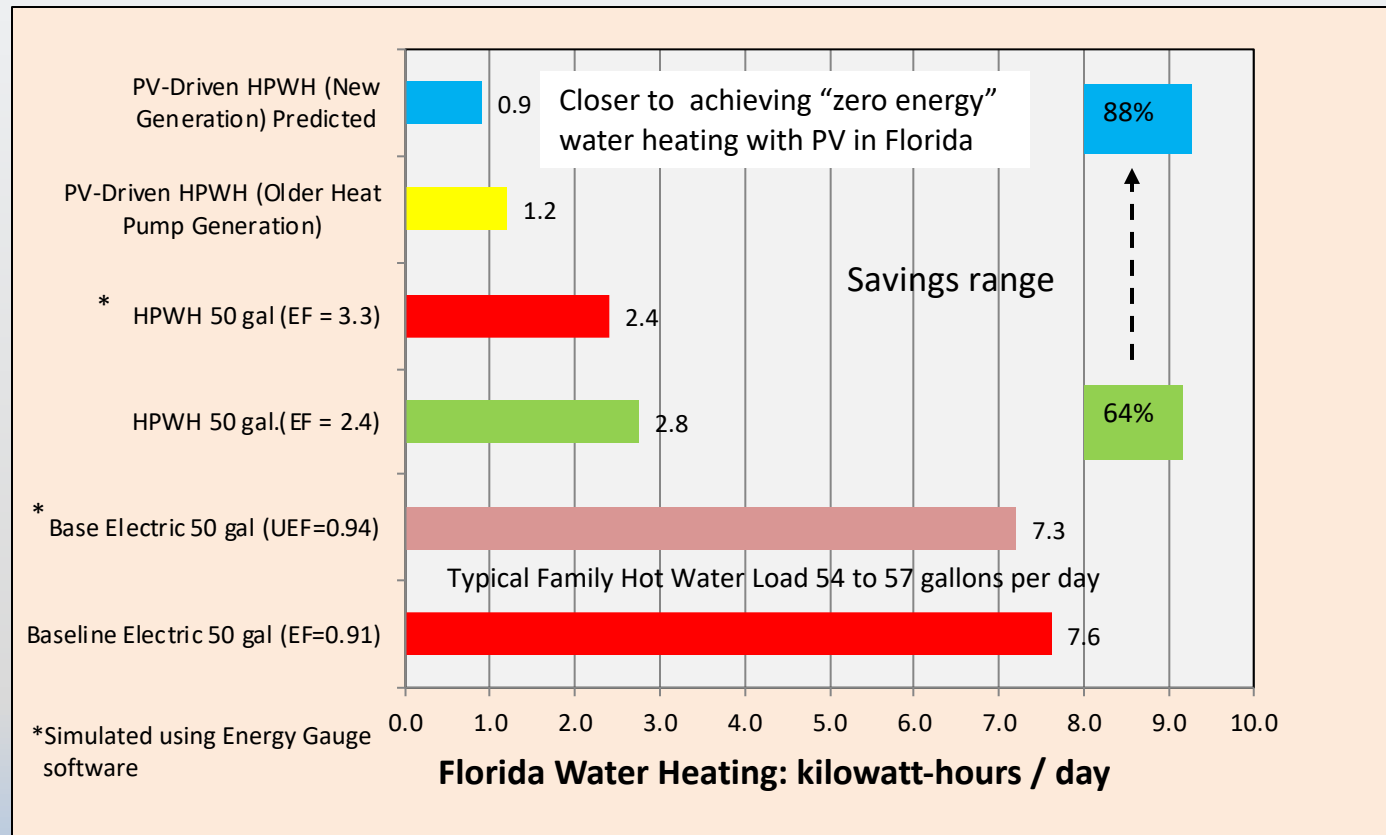
# Two 300-Watt Photovoltaic Modules and New Generation of Heat Pump Water Heaters



New generation of heat pump water heater compressor shows 25 to 28% reduction in power consumption



# Standard Electric, Heat Pump vs PV Assisted Heat Pump Water Heating



# Mylar Balloons + Polysterene Beads = FlexCap!



Jacket Insulation: Single layer double bubble wrap with ½" air space



- Installs easily
- FlexCap molds around pipes & Valves
- Quick payback
- No airborne or itchy fiberglass!



For Utility Energy Storage / DSM Programs:  
Reduced standby losses when thermostat setting is increased.



# 50 gallon Electric Water Heater Tank with and without FlexCap Insulation

