FLORIDA SOLAR ENERGY CENTER®

Creating Energy Independence

ASES Solar 2023 Conference
Operation and Lessons Learned from Florida's SunSmart Emergency Shelter Program

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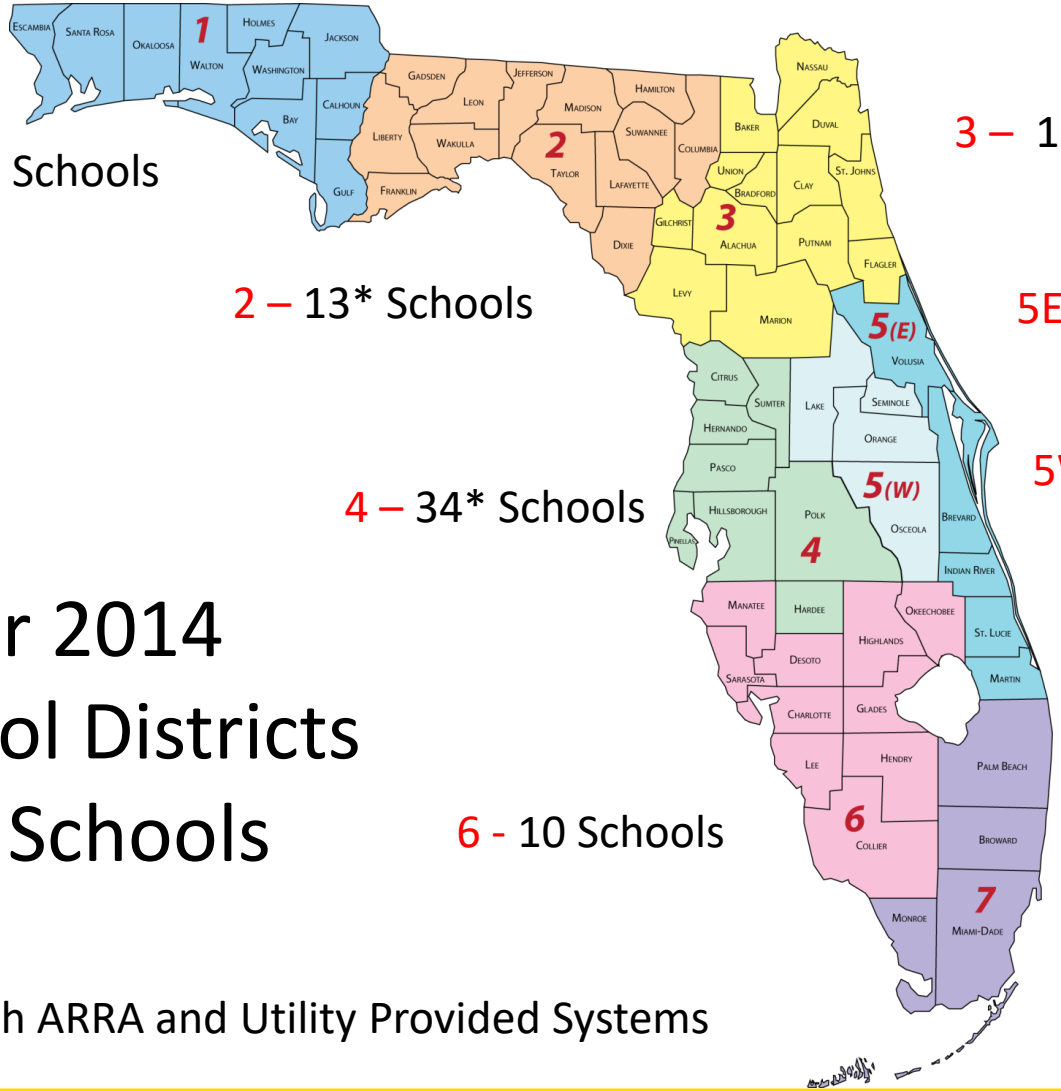
A Research Institute of the University of Central Florida

SunSmart Emergency Shelter Program Goals

- Provide Power to Critical needs in Emergency Shelters
- Generate Clean Electricity from the Sun
- Educate students, teachers and facilities personal about Clean Energy Technologies and Careers
- Creates jobs in Florida with American made
- Reduces Green House Gas Emissions
- Reduces Schools Energy Usage
- - Program started in 2010

Emergency Management Regions



1 - 12 Schools

2 – 13* Schools

3 – 10 Schools

5E - 13 Schools

5W – 15* Schools

4 – 34* Schools

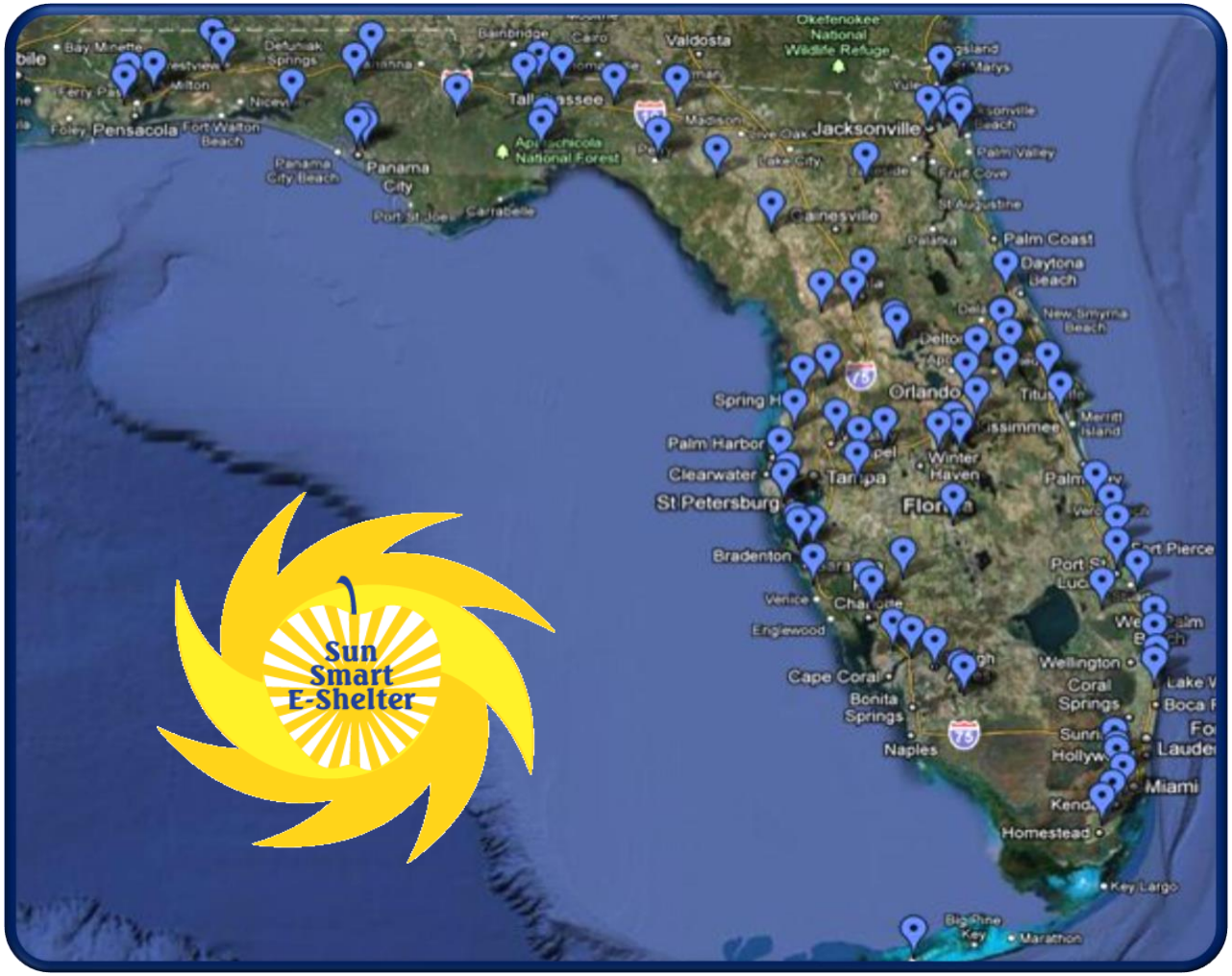
6 - 10 Schools

7 - 11 Schools

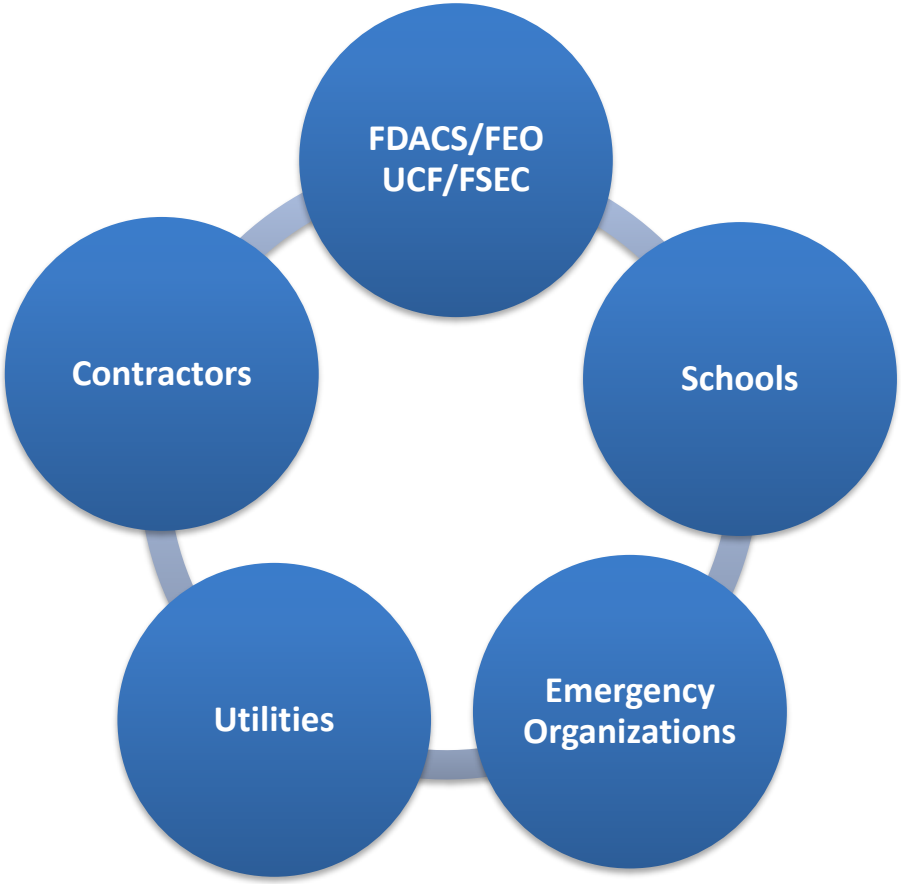
Year 2014
46 School Districts
118* Schools

*Includes Both ARRA and Utility Provided Systems

SunSmart E-Shelter School Locations



Program: Team Members

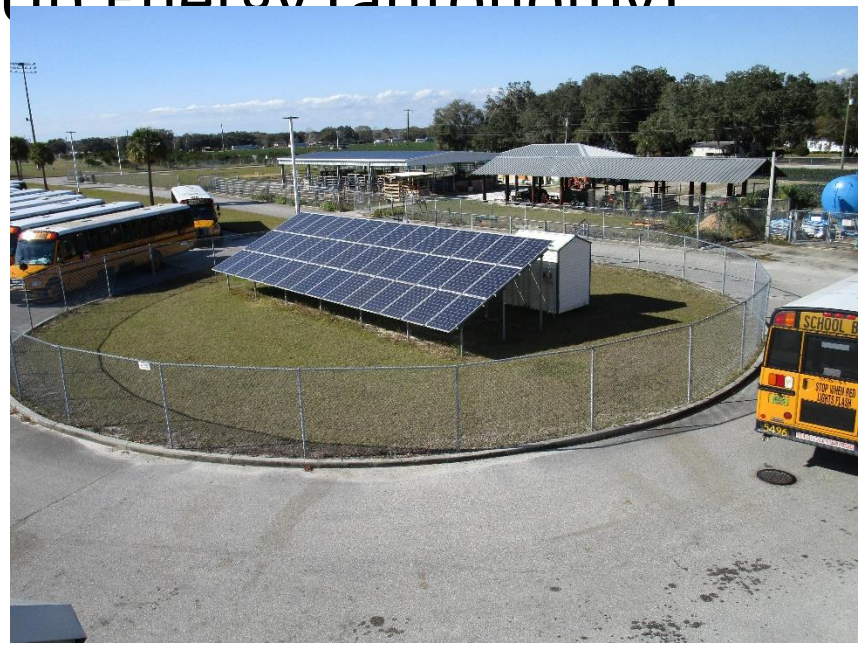


ARRA – Utility - FDACS – UCF/FSEC Funding

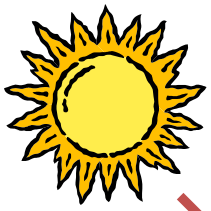
Coordinated Team Effort

Program – Solar for Shelters

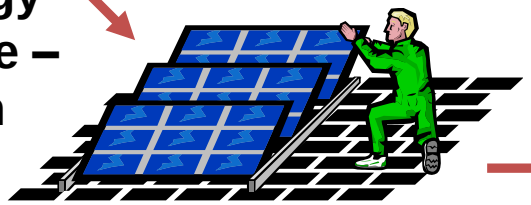
- 10 kW Photovoltaic System (array)
- 2~1000 Square feet area
- 5/33/48 kWh Battery Back-Up Energy (autonomy)
- 3 Phase Building Electricity
- Utility Grid-Connected
- Net Metering Power
- Data Monitoring
- Ground Mounted Array
- Property of School



Basic Components of a PV System

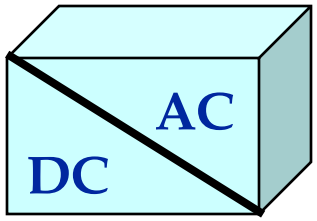


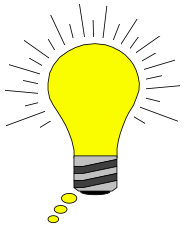
Energy source – Sun



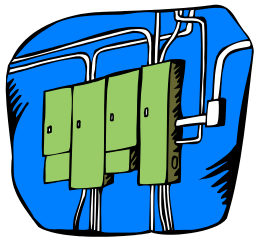
Energy conversion - Photovoltaics

Power conditioning - Inverter and controllers





Energy use - critical loads

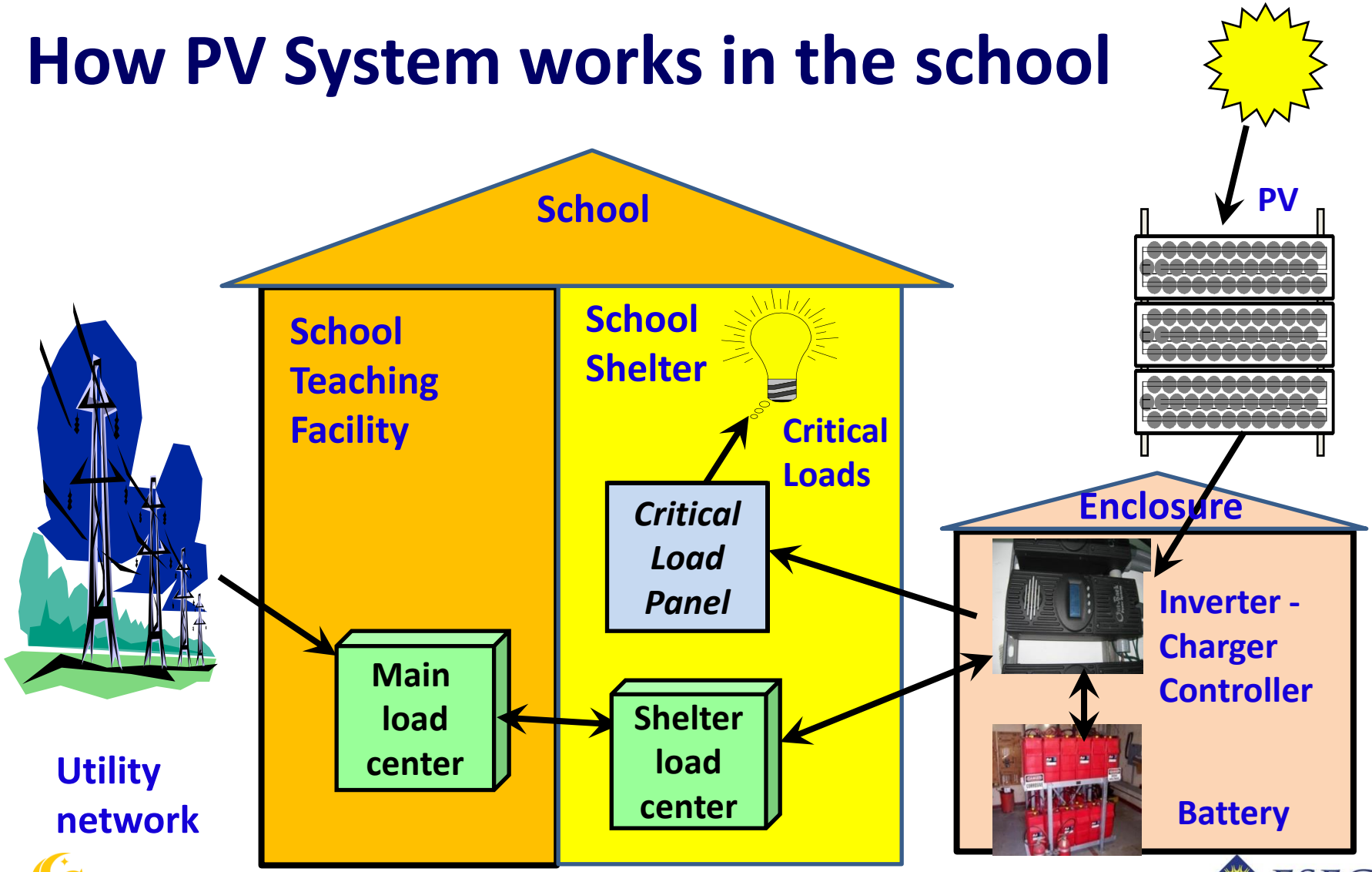


Connecting to the Grid – Critical Load Panel

Energy storage - Battery

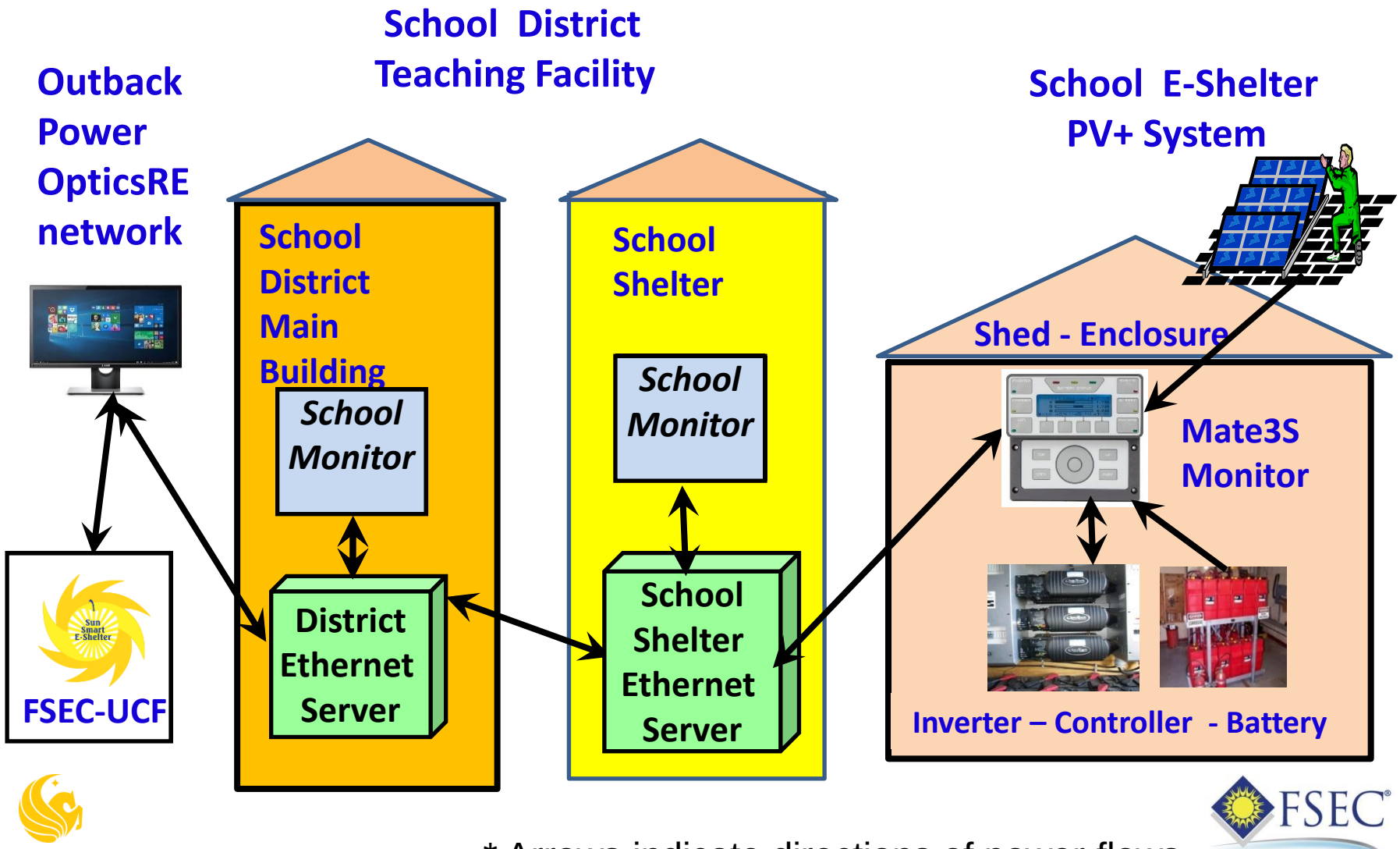
Electric grid - Utility network

How PV System works in the school



* Arrows indicate directions of power flows

How SunSmart DAS works in the Program



ARRA PV System Details

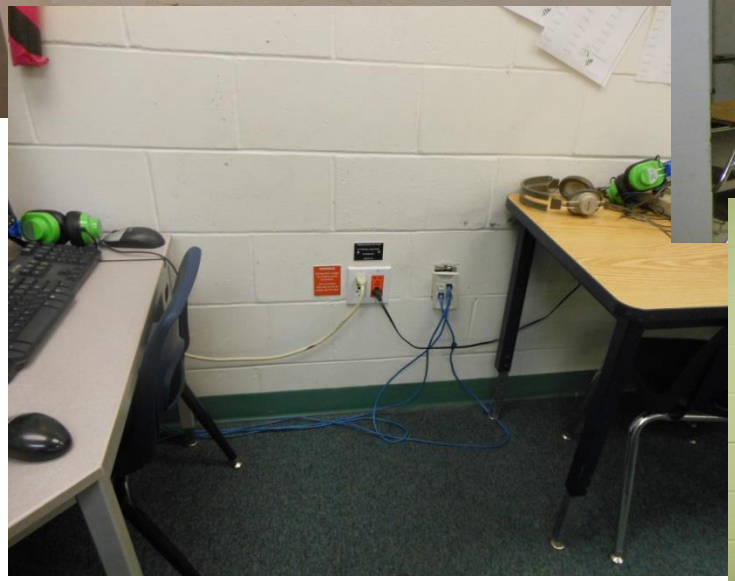
* Some School Districts required Enclosures and not Sheds.

Power to Critical Loads

The system will power the following for 24 hours:

- 9 to 12 light fixtures (94 W each)
- 1 to 2 power outlets (350W each)
  - Outlets are intended for shelter management use
  - Outlets may be use for life support equipment

Shelter Critical Loads



SunSmart E-Shelter Program
2014 Initial Status

- 118* PV E-Shelter Systems Installed as of May 2014
- Training materials developed and provided
- Web site developed and provided with system data
- 14 Teacher Workshops and Facility Manager Webinars
  - By 2014
- 500+ Teachers and Facilities Managers Educated
- 1.54 MWhrs Hours of Electricity Produced
- 668.57 Tons of CO2 Reduction

* ARRA and Utility Systems

SunSmart E-Max Inspection Findings

as of Late 2019

- 115 School Shelter PV Systems inspected
- 4 PV Systems Removed by School District
- PV Systems not priority to school operations, but
- 34 PV Systems operational in some form
- 6 PV Systems fully functioning
- 2 Damaged from a hurricane - Ian -
- For Hurricane damaged System - PV used else ware
- Most Batteries “dead” beyond their life
- 32 DAS still collecting data
- Half of original school personal replaced
- 15 School Districts disconnected CLP and rewired loads
- 13 School Districts made repairs

SunSmart E-Shelter Program
Late 2022 Repair Progress

- 114* PV E-Systems in the Program as of July 2023
- Expansion of schools facilities reduced # systems
- Climate Change reduced number of systems
- 96 PV E-Systems Repaired as of July 2023
- Covid impacted inspection and repair and team work
- Supply Chain impacted getting parts for repair
- Labor and transportation across State
- Data Monitoring a big issue and problem
- School knowing System existence and operation
- Mounted new information signs on Systems
- A few parts no longer available – utility meters

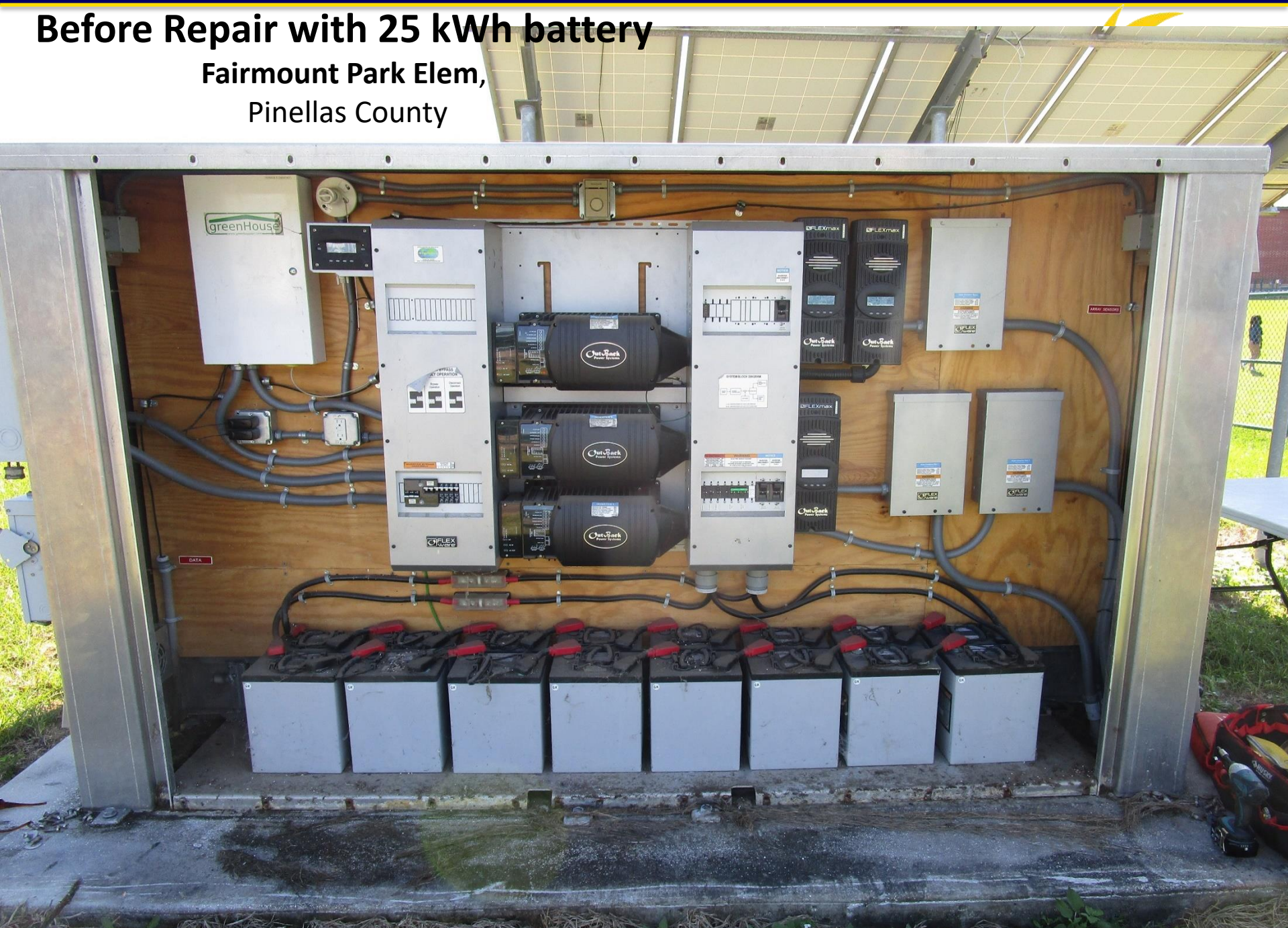
Fairmount Park Elem,
Pinellas County


10 kWp PV array at
Fairmount Park Elem,
Pinellas County
Sun Smart E-Shelter
Shelter Building

Balance Of System Components In Enclosure at Fairmount Park Elem, Pinellas County

Before Repair with 25 kWh battery

Fairmount Park Elem,
Pinellas County



After Repair with 33 kWh battery an Mate3s

Sebastian River high, Indian River County

Apollo Elementary,
Brevard County

Apollo Elementary,
Brevard County


Apollo Elementary
Brevard County

Apollo Elementary, Brevard County

Before and After repair

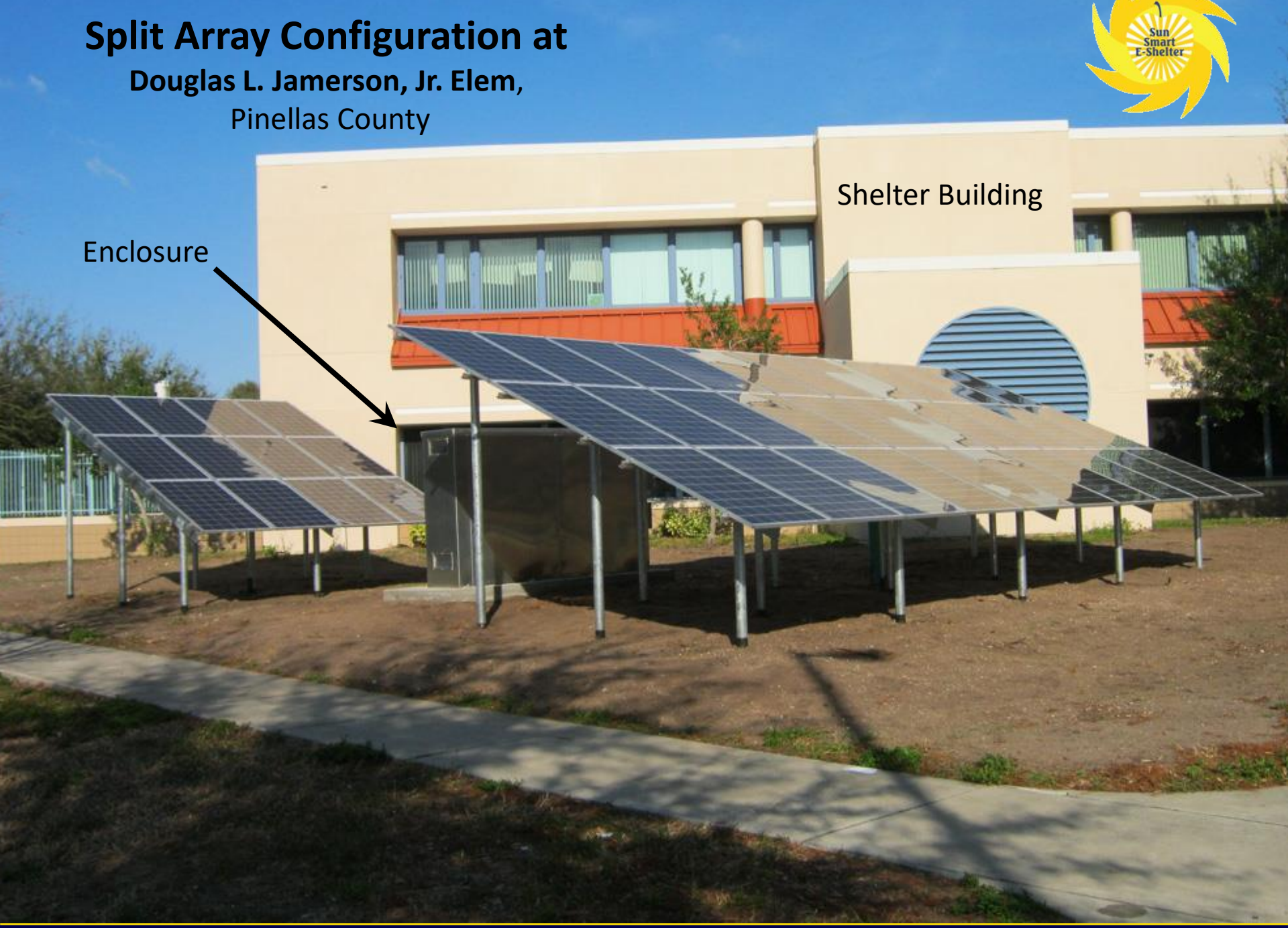
Outback Power PV string inverters system --- Enphase PV module micro-inverter system

Douglas L. Jamerson, Jr. Elem,
Pinellas County

Split Array Configuration at

Douglas L. Jamerson, Jr. Elem,

Pinellas County



Clearwater Fundamental Middle,
Pinellas County

Utility Provided System (Plus-UP)

Clearwater Fundamental Middle
Pinellas County

Utility Provided System (Plus-UP)

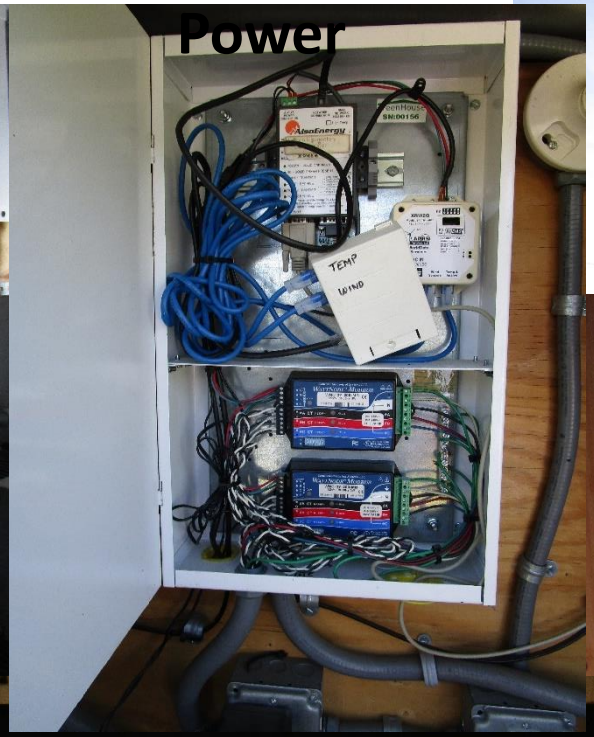
Clearwater Fundamental Middle
Pinellas County

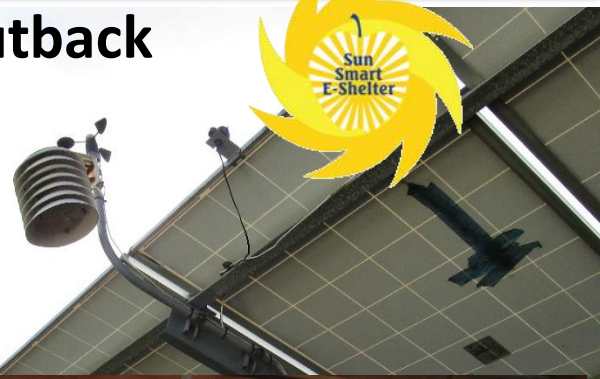
Clearwater Fundamental Middle

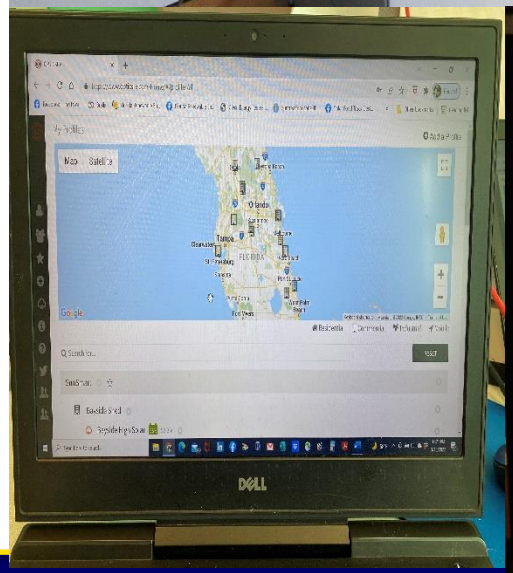
Pinellas County

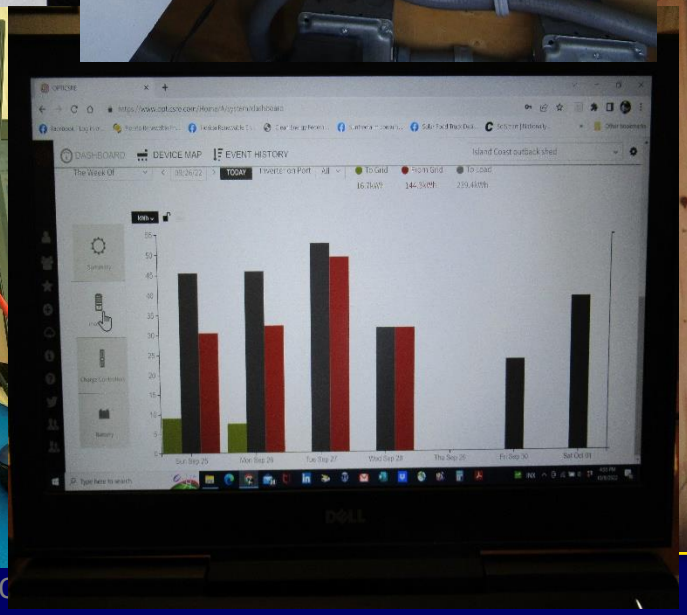
Plus-UP System

DAS – New Data Acquisition System for Outback

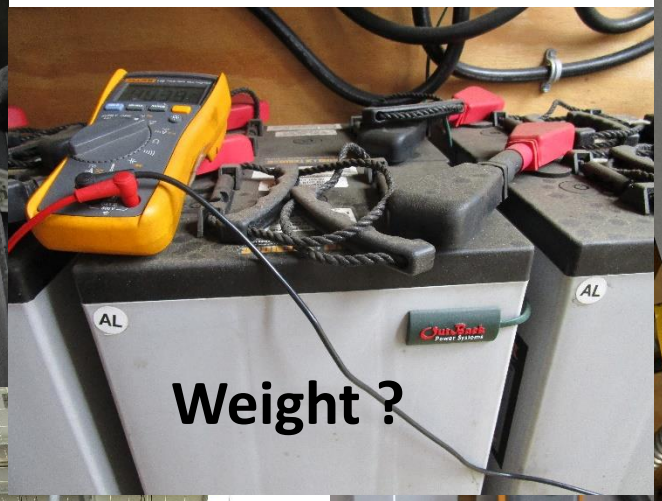




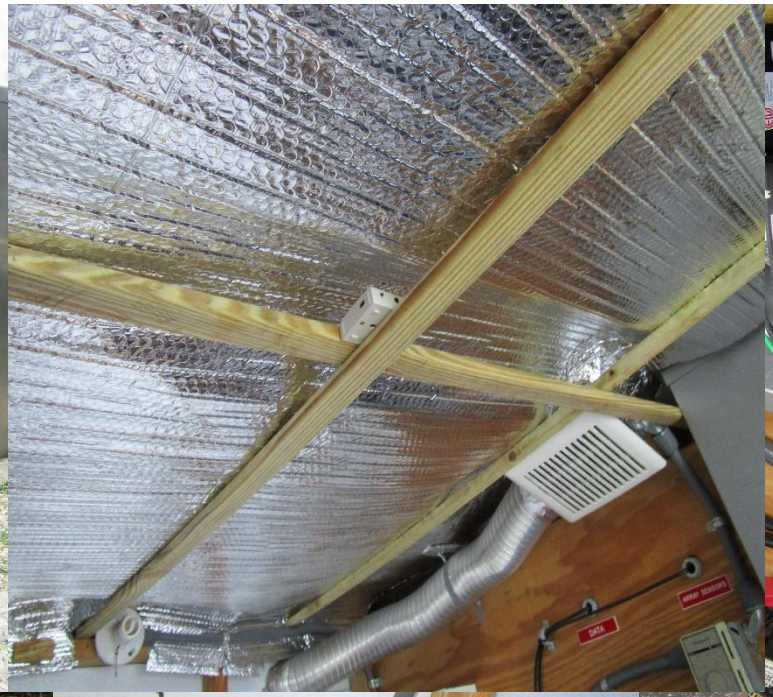


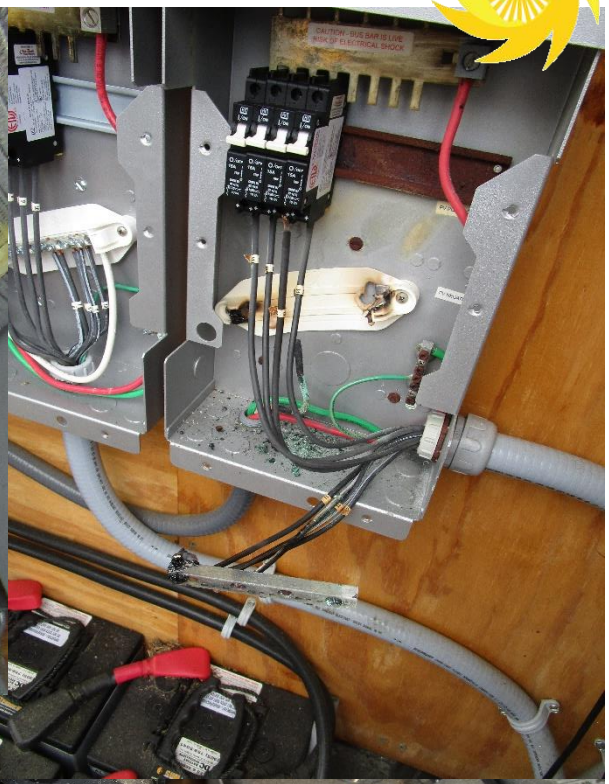


Testing - IV Curve, Thermal Radiation and Power



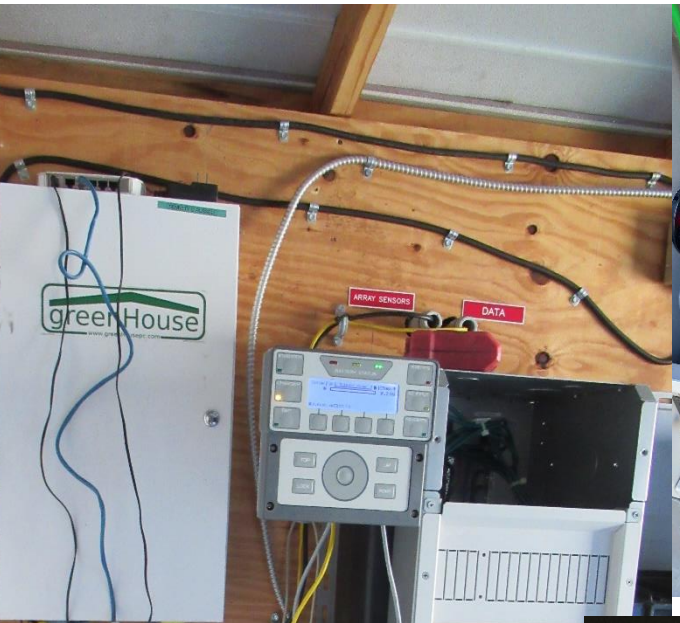
SunSmart Problems and Issues

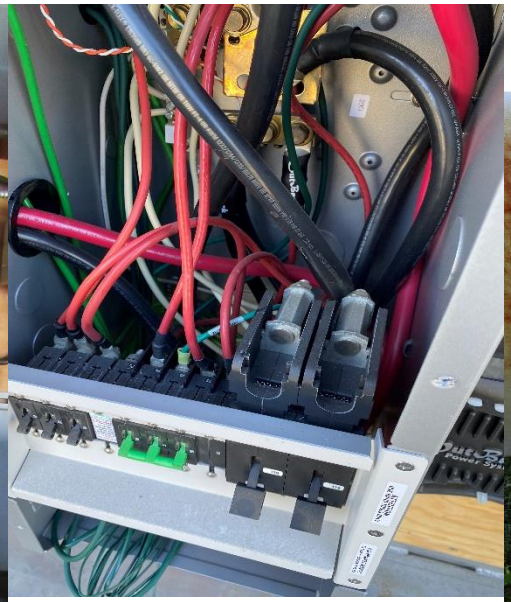


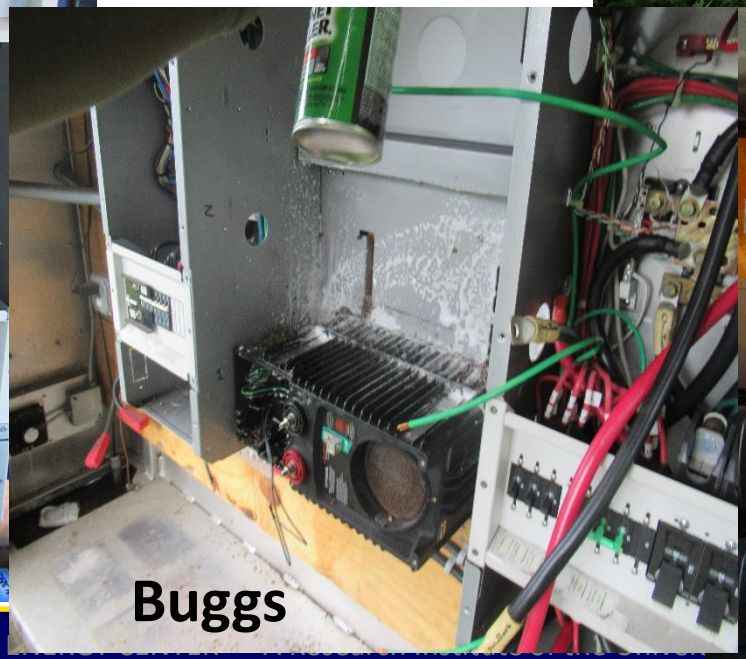


Photovoltaic Module and Array Issues

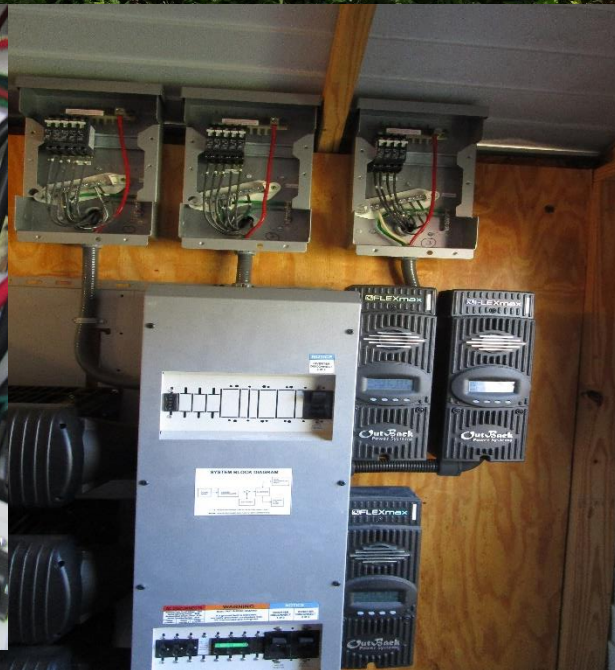
Repair Process

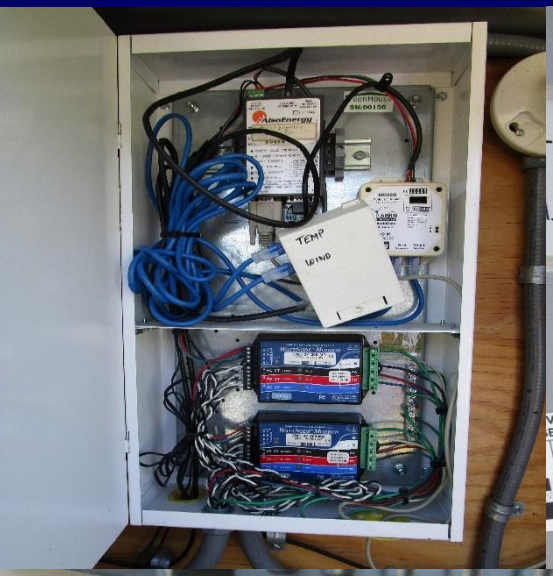


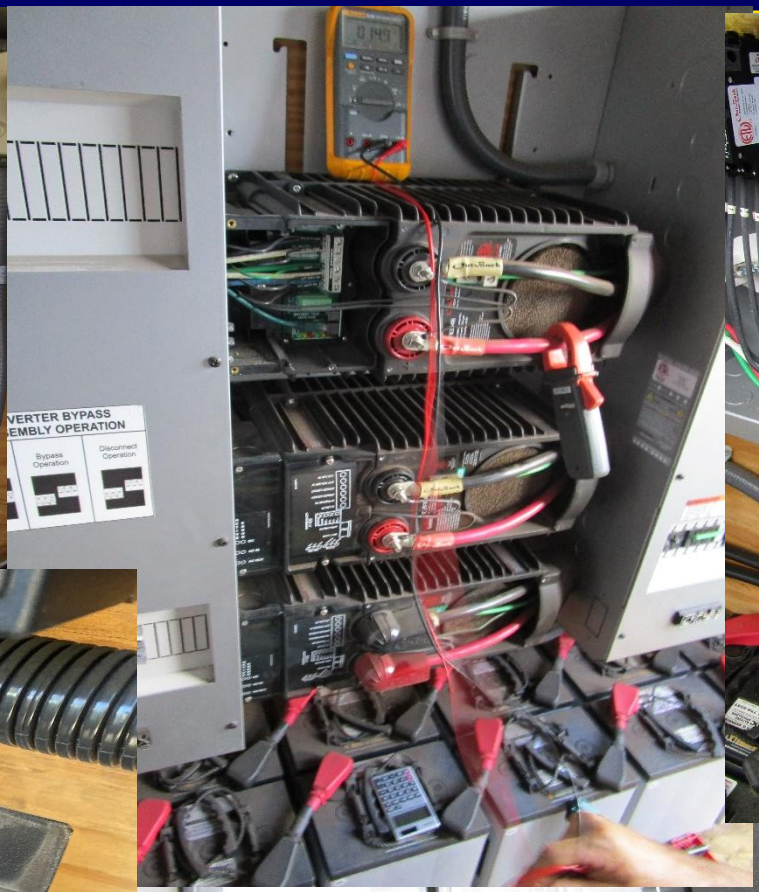


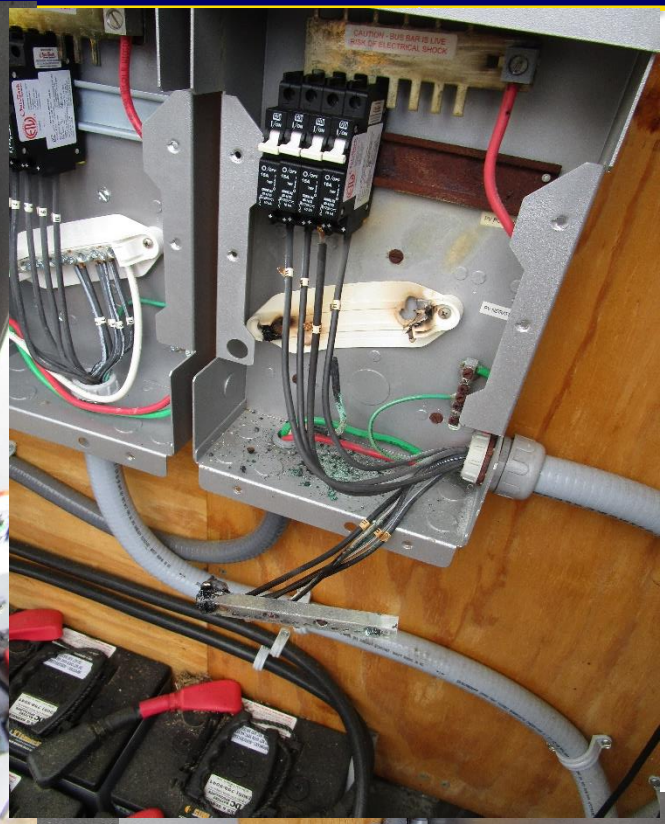


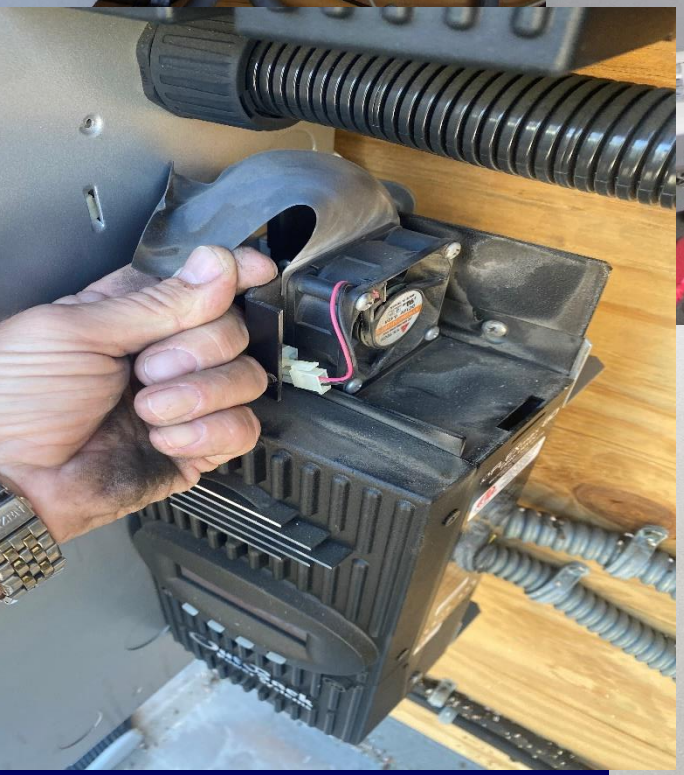
Buggs



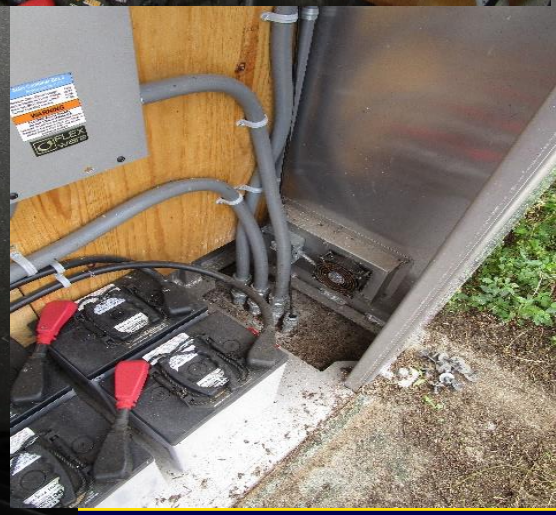

TEMP
WIND


VERTER BYPASS
EMBLY OPERATION
Bypass Operation
Disconnect Operation






E R
DC
AC IN
AC OUT
BATTERY TEMP
MATE / HUB
FULL
OK
LOW
INVERTER
AC IN
ERROR
G Y R
BATTERY
G Y R
STATUS



ENERGY PRODUCTION & COST SAVINGS

PV Watts is a performance calculator for grid-connected PV systems. The monthly and yearly energy production are modeled using the selected PV system parameters and weather data that are typical or representative of long-term averages. Because weather patterns vary from year-to-year, the values in the tables are better indicators of long-term performance than performance for a particular month or year. PV performance is largely proportional to the amount of solar radiation received, which may vary from the long-term average by ± 30% for monthly values and ± 10% for yearly values. ARRA systems.

Station Identification	
City:	Tampa
State:	Florida
Latitude:	27.97° N
Longitude:	82.53° W
Elevation:	3 m
PV System Specifications	
DC Rating:	10.0 kW
DC to AC Derate Factor:	0.770
AC Rating:	7.7 kW
Array Type:	Fixed Tilt
Array Tilt:	25.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	12.0 ¢/kWh

Results			
Month	Solar Radiation (kWh/m ^{2}/day)	AC Energy (kWh)	Energy Value ($)
1	4.46	1004	120.48
2	5.14	1035	124.20
3	5.70	1254	150.48
4	6.57	1366	163.92
5	6.02	1281	153.72
6	5.67	1151	138.12
7	5.55	1158	138.96
8	5.76	1215	145.80
9	5.33	1087	130.44
10	5.35	1147	137.64
11	4.74	1006	120.72
12	4.14	924	110.88
Year	5.37	13628	1635.36

PVWatts

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Questions?

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