



SunSpec Alliance

Information Standards for Distributed Energy

September 2015



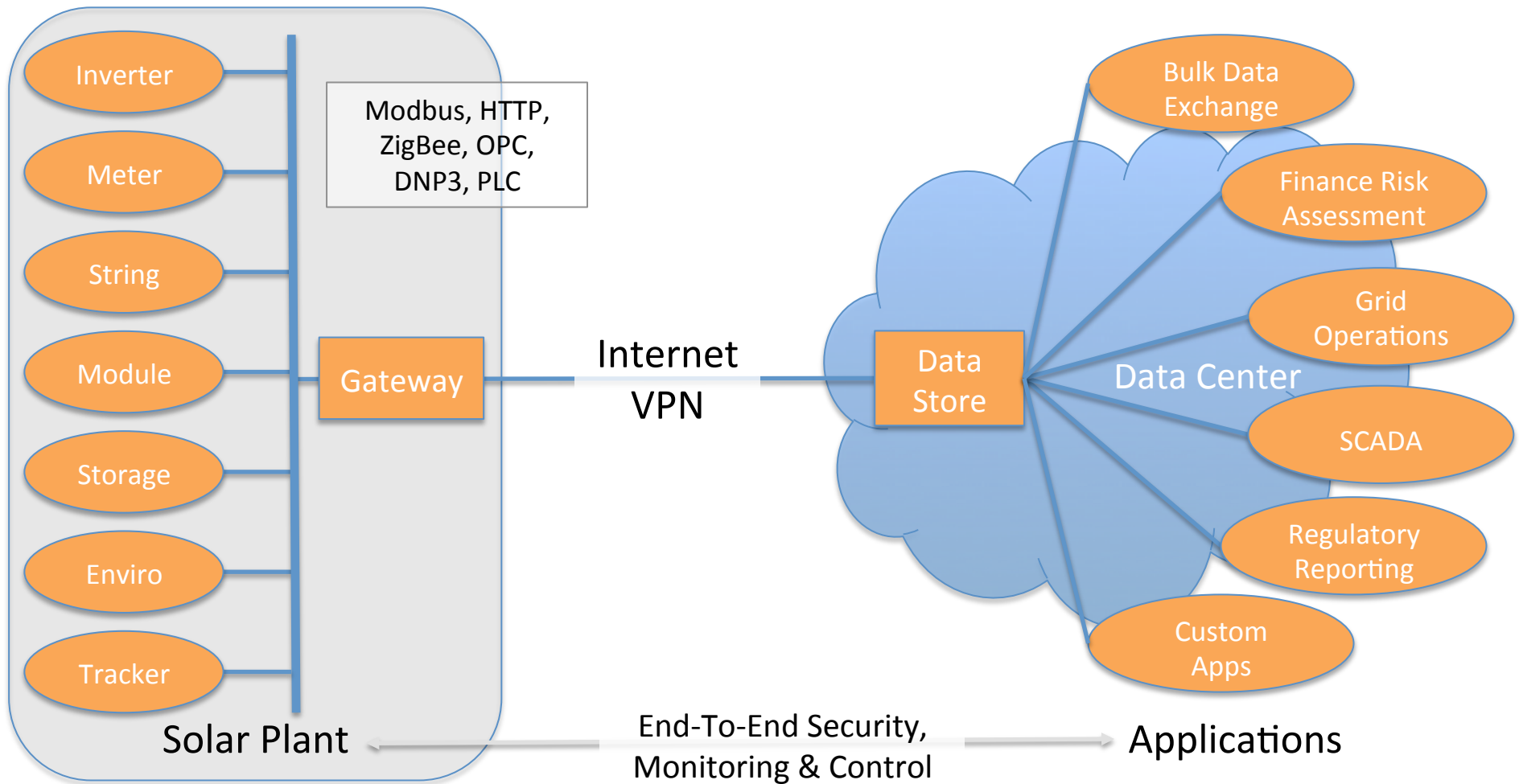
About the SunSpec Alliance

- ✧ A trade alliance of global competitors, collaborators & trading partners pursuing smart distributed energy market
- ✧ Producer of “de facto” open information standards for Distributed Energy
 - Provides bridge to industry adoption of international standards such as IEC 61850
 - Full testing and certification service for protocols
- ✧ Solar PV and storage market focus





SunSpec Specifications

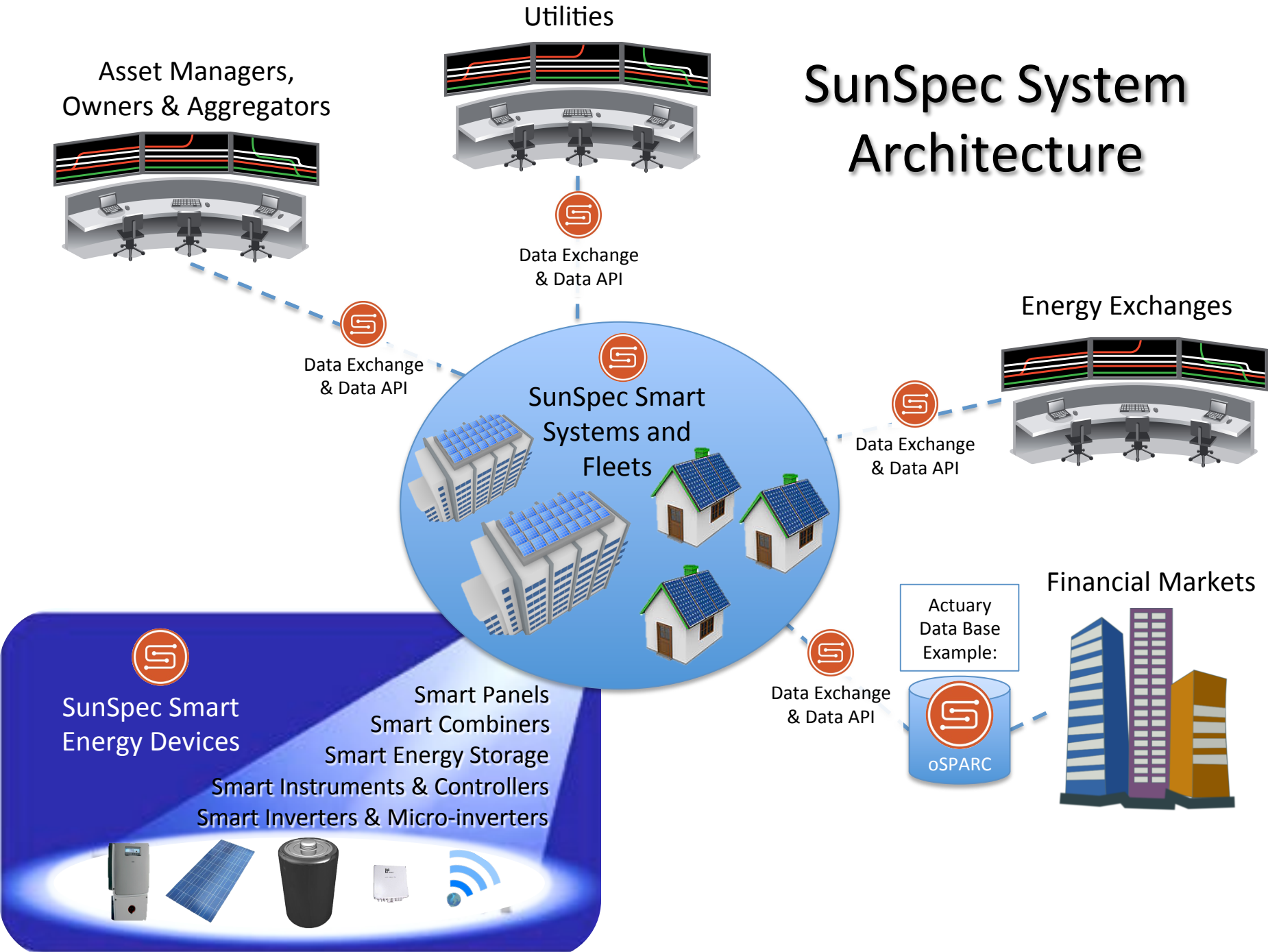




Compatible With International Standards

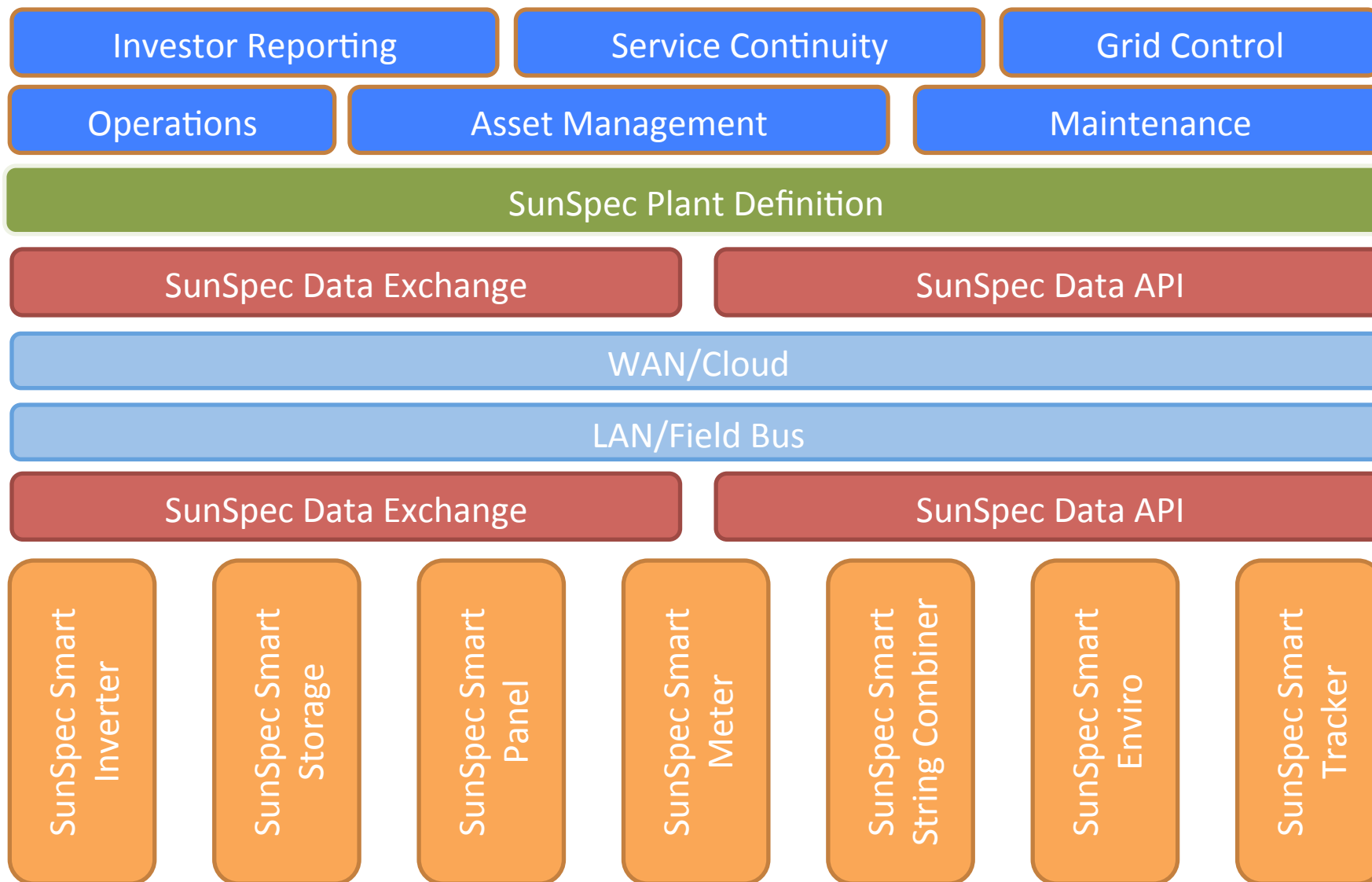
| Function | SunSpec | IEC 61850 | IEEE 2030.5 | DNP3 |
|---|---------|-----------|-------------|------|
| Nameplate Ratings | ✓ | ✓ | ✓ | ✓ |
| Basic Settings | ✓ | ✓ | ✓ | ✓ |
| Measurements and Status | ✓ | ✓ | ✓ | ✓ |
| Immediate Controls (Power, PF, and VAr) | ✓ | ✓ | ✓ | ✓ |
| Dynamic Reactive Current Control curves | ✓ | ✓ | ✓ | ✓ |
| -Volt=VAr | ✓ | ✓ | ✓ | ✓ |
| Watt-Power Factor | ✓ | ✓ | ✓ | ✓ |
| Frequency-Watt | ✓ | ✓ | ✓ | ✓ |
| Voltage Ride-through | ✓ | ✓ | ✓ | ✓ |
| Frequency Ride-through | ✓ | ✓ | ✓ | ✓ |
| Pricing Signals | ✓ | ✓ | ✓ | ✓ |
| Basic Scheduling | ✓ | ✓ | ✓ | ✓ |

SunSpec System Architecture





SunSpec Smart: End-to-End Solutions





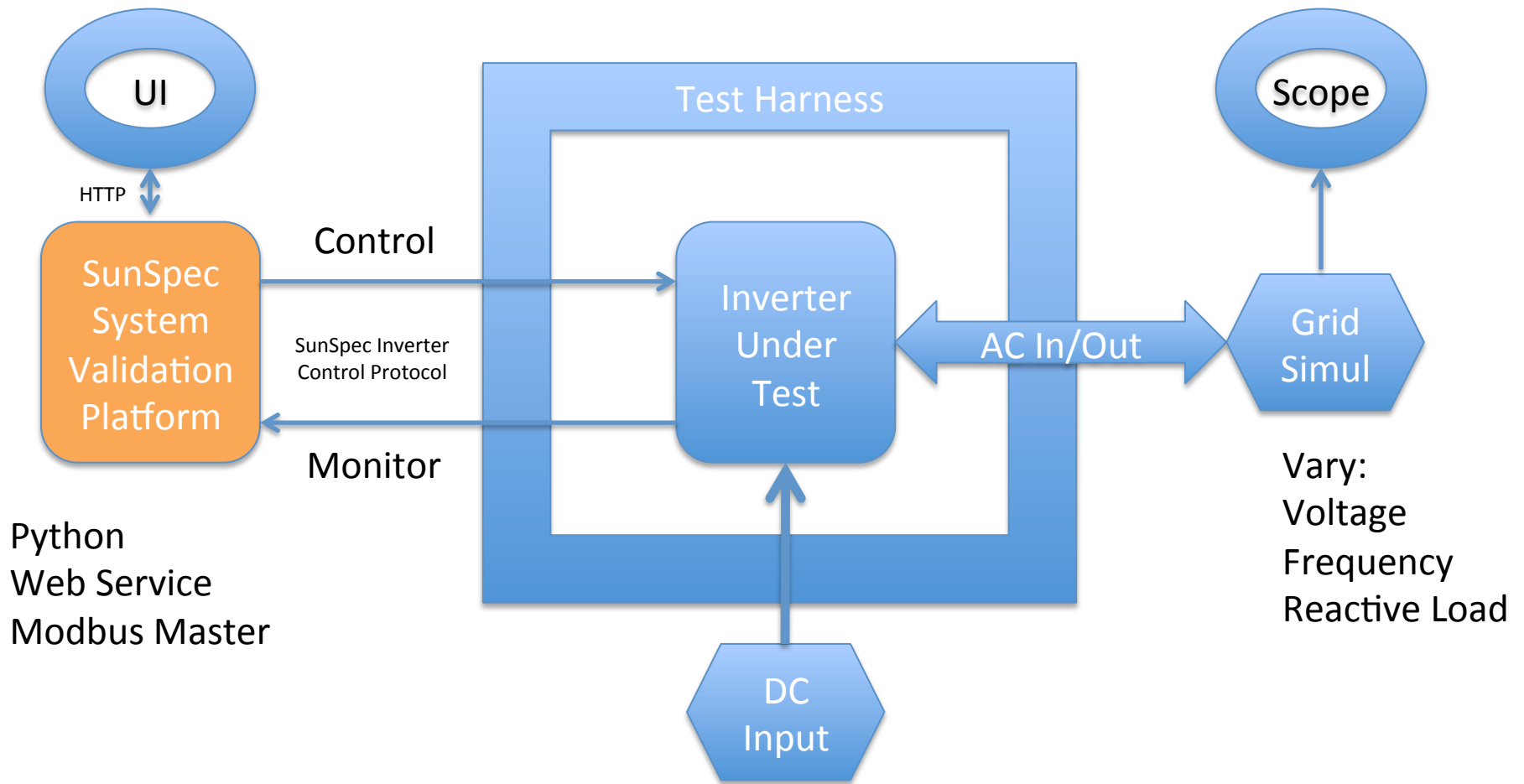
Resources For Specification Development

- ✧ Experienced specification development staff
- ✧ Subject matter experts from member organizations
- ✧ Test tools, reference software, web resources
- ✧ Access to (inter)national research laboratories
- ✧ Federal and state funding for market expansion



SunSpec Testing Framework

Test Case Matrix: Function by Region





SunSpec System Validation Platform

The screenshot displays the SunSpec System Validation Platform interface. The left sidebar shows a file tree with folders for Suites, Tests, Scripts, and Results. Under Scripts, there are sub-folders for Disable_Functions, INV1, INV2, INV3, and VV. The main window shows the configuration for the INV1 test protocol, organized into several sections: EUT Communication Parameters, INV1 Test Parameters, INV1 Timing and Pass/Fail Parameters, PV Simulator Parameters, PV Simulator Profile, and Data Acquisition and Triggering. Each section lists parameters with their current values and available options.

| | Default | Options |
|--|--------------------------|---|
| EUT Communication Parameters | | |
| Interface Type | RTU | RTU, TCP, Mapped |
| Interface Name | COM3 | |
| Baud Rate | 9600 | 9600, 19200 |
| Parity | N | N, E |
| IP Address | 192.168.0.170 | |
| IP Port | 502 | |
| Map File | mbmap.xml | |
| Slave Id | 1 | |
| INV1 Test Parameters | | |
| Operation | Connect | Connect, Disconnect |
| Time Window (seconds) | 0 | |
| Timeout Period (seconds) | 0 | |
| INV1 Timing and Pass/Fail Parameters | | |
| Pre-Test Delay (seconds) | 0 | |
| Power Verification Threshold for Pass/Fail (W) | 50 | |
| Verification Delay (seconds) | 5 | |
| Post-Test Delay (seconds) | 10 | |
| Set INV1 to ON at the end of the test? | No | Yes, No |
| PV Simulator Parameters | | |
| PV Simulation Mode | Manual | TerraSAS, Manual |
| IP Address | 192.168.0.167 | |
| ENS0530 MPP Power (W) | 3000.0 | |
| ENS0530 MPP Voltage (V) | 460.0 | |
| TerraSAS channel | 10 | |
| PV Simulator Profile | | |
| TerraSAS Profile Name | None | None, STPsIrradiance |
| Initial Irradiance (W/m ²) | 1000.0 | |
| Data Acquisition and Triggering | | |
| Trigger Method | Disabled - Data from EUT | Disabled - Data from EUT, Create Local File for Sandia LabView DSM |
| Data Acquisition Method | Disabled - Data from EUT | Disabled - Data from EUT, Sandia LabView DSM, TCP Stream for Sandia LabView DSM |
| Data Acquisition Computer | 10 Node | 10 Node, DAS 3, DAS 5, DAS 8 |
| Node at Sandia - Used to ID DAQ channel | 10 | |



SunSpec Device Probe



SunSpec DNP3 Conformance Test

Your Name

Test Run 27

Device's IP address

127.0.0.1

- Read BI
- Set BO
- Test & Set Fixed PF Mode

Execute Test



oSPARC Dashboard



oSPARC Actuarial Database



- Dashboard
- Accounts
- Plants
- Reports
- Help
- Logout

Welcome

oSPARC Admin

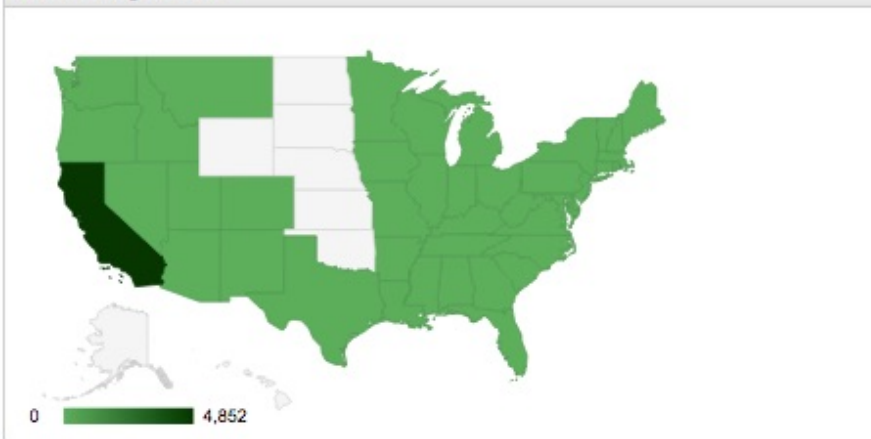
Total Plants

5312

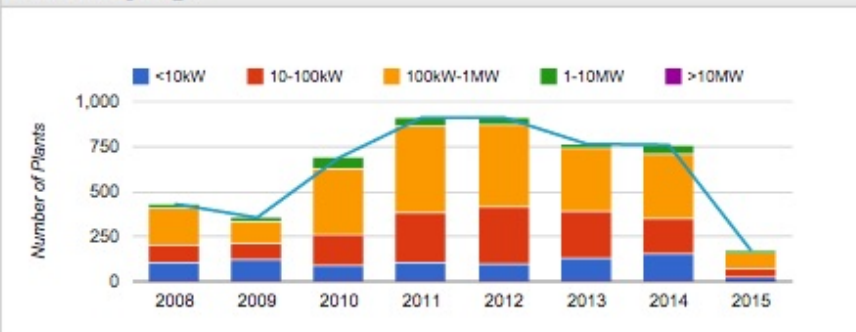
Total Rated DC Capacity

1.29 GW

Plants By State



Plants By Age



Performance Metrics

Plants Reporting Energy 3818
 Total DC Capacity 921.27 MW

| KPI | Mean | Median | Min | Max |
|-------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| DC Power Rating | 241.3 kW | 115.5 kW | 200.0 w | 5.95 MW |
| Daily AC Energy | 1.03 MWh | 475.25 kWh | 122.16 Wh | 26.0 MWh |
| Daily GHI | 5.62 kWh/m ² | 5.71 kWh/m ² | 1.16 kWh/m ² | 8.49 kWh/m ² |
| Daily Yield | 4.09 | 4.18 | .09 | 7.57 |
| Performance Ratio | 67.5 % | 68.98 % | 1.91 % | 103.83 % |

Solar Risk Assessment Resources

- [SunSpec Asset Lifecycle Performance Specifications](#)
- [PV System Performance Assessment](#)
- [Best Practices in Solar Operations and Maintenance](#)
- [About oSPARC](#)



CSI4: Smart Inverters + CEA 2045





CEC PON: Smart Inverters + Storage





Current SunSpec Work Groups

- ✧ Asset Lifecycle Performance
- ✧ SREC
- ✧ Inverter
- ✧ Energy Storage
- ✧ Panel-Level Rapid Shutdown



Thank You



SUNSPEC
— ALLIANCE —

*Expanding the Solar PV Market Through
Data Standards and Interoperability*

Contact Tom Tansy: tom@sunspec.org



Communication Signal For Rapid Shutdown



Communication Signal For Rapid Shutdown Mission Statement

- ✧ Define a simple, multi-vendor, multi-device communication interoperability specification
- ✧ Applicable to inverter, module, string combiner, and other types of components
- ✧ Supportive of NEC 2014, NEC 2017. and UL 1741 module-level rapid shutdown requirements



Rapid Shutdown Leaders/ Schedule

✧ Leaders

- Larry Sherwood, Sherwood Associates
- Tom Tansy, SunSpec Alliance

✧ Schedule

- Every Wednesday at 8:00am PT via GotoMeeting



Rapid Shutdown Work Products

- ✧ SunSpec Communication Signal for Rapid Shutdown specification
- ✧ Information model mapping to PLC transport
- ✧ Information model mapping to “wireless” transport
- ✧ SunSpec Certification test procedure