Ginlong Solis Presentation
to GMLC Interoperability meeting
On behalf of Sunspec Alliance

Prepared by Susanna “Qiang” Huang
Ginlong (Ningbo) Technologies, Co. Ltd. – Ginlong Solis USA
May 9th, 2017
Global Market Leader in PV String Inverters

Award-winning ultra-reliable, bankable, cost effective and innovative Ginlong Solis PV String Inverters

430,000 square feet
3GW annual production capacity
Global Company and Local Optimization

Over 12 years of design and supply history

- **Long History** – One of oldest and largest string inverter manufacturers in the world since 2005
- **Bankability** – Approved vendor list of leading banks and financial institutions, i.e. JPMC, Mosaic etc.
- **Reliability** – 3rd Party inverter qualification testing completed by DNV GL. Proven track record in US since 2009
- **Innovation** – High frequency switching technology, up to 4 MPPT’s, US local product optimization
- **Global company** – Unmatched experience across 60+ countries on 6 continents
- **Local Service** – Warehoused in California, NABCEP certified training program and local technical support nationwide
SunSpec Alliance Vision

Open Architecture
End-To-End
SunSpec Alliance Today

- Global alliance of 100+ Distributed Energy Resource (DER) industry participants
- Driver of industry growth and efficiency via open communication and information standards
- Developer of open source testing tools and software reference implementations for DER devices and applications
- Certification authority for SunSpec approved DER device and application standards
Unlocking Grid Data Supporters

- Fronius
- GreenCharge
- Silicon Valley Leadership Group
- SolarCity
- solis inverter
- sunrun
- TESLA
- UTILITYAPI
- MOXA
- BOSCH
- CESA
- SEIA
SunSpec 2017 Program
California Now Requires Advanced Inverters With Communication

<table>
<thead>
<tr>
<th>Autonomous Functions &amp; Data Communication for CA Rule 21</th>
<th>SunSpec</th>
<th>IEEE 2030.5</th>
<th>IEEE 1815</th>
<th>IEC 61850</th>
<th>IEEE 1547</th>
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<tbody>
<tr>
<td>Nameplate Ratings</td>
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<td>Basic Settings</td>
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<td>Measurements and Status</td>
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<td>Immediate Controls (Power, PF, and VAr)</td>
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<td>Dynamic Reactive Current Control Curves</td>
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<td>Volt-Var</td>
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<td>Watt-Power Factor</td>
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<td>Frequency-Watt</td>
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<td>Voltage Ride-Through</td>
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<td>Frequency Ride-Through</td>
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<td>Pricing Signals</td>
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<td>Basic Scheduling</td>
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CA Rule 21

- Phase 1 – Autonomous functions
  - Mandatory 9/8/2017 (date of interconnection request)

- Phase 2 – Communications
  - IEEE 2030.5 is default protocol
  - Utility may communicate with:
    - DER
    - Plant Management System
    - Aggregator

- Phase 3 – Additional functions
  - Use revised IEEE 1547 to specify requirements for any additional functions.
  - SIWG meetings continuing – Thursdays 1:00 Pacific
  - IOU hosted stakeholder meeting ongoing - Mondays 9:30 Pacific
## SunSpec CA Rule 21 Phase 2
## IEEE 2030.5 Certification Test Standard Plan

<table>
<thead>
<tr>
<th>Program Element</th>
<th>Description and Notes</th>
<th>Planned Delivery</th>
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</thead>
<tbody>
<tr>
<td>PICS template</td>
<td>“Protocol Information Conformance Statement” template allowing implementers to declare how products comply to the IEEE 2030.5 standard for DER and CSIP requirements.</td>
<td>06/17</td>
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<tr>
<td>Communication protocol certification test standard draft</td>
<td>First review draft of test procedures sufficient to evaluate and certify DER systems for IEEE 2030.5 compliance.</td>
<td>06/17</td>
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<tr>
<td>Communication protocol certification test standard final</td>
<td>Royalty-free test procedures sufficient to evaluate and certify DER systems for IEEE 2030.5 compliance. Starts clock for CA Rule 21 Phase 2.</td>
<td>10/17</td>
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</tbody>
</table>
SunSpec Orange Button Application Taxonomy & API Program

SUNSPEC OPEN SOLAR DATA EXCHANGE

FEASIBILITY
- Real Estate
- Economic Analysis
- Interconnection
- Permitting
- Off-Taker Credit
- Customer Assessment

OPERATION
- Monitoring
- Reporting
- Asset Management
- Forecast Reconciliation
- Accounting
- Decommissioning

FINANCE
- Project Finance
- Portfolio Finance
- Insurance
- Underwriting
- Construction Finance

DESIGN
- System Engineering
- Scope of Work
- Budget
- Equipment Assessment
- EPC Selection
- Vendor Selection

CONSTRUCTION
- Installation
- Inspection
- AHJ Approvals
- Warranties
- Commissioning
- Contracts

DATA TAXONOMY
INFORMATION MODELS
APPLICATION PROGRAMMING INTERFACES (APIs)
COMPLIANCE TEST SUITE
SunSpec Communication Signal For Module-Level Rapid Shutdown Program

- A multi-vendor, multi-device communication interoperability specification
- Supportive of NEC 2017 module-level rapid shutdown requirements
- Developed by 30 SunSpec member companies and ready for mass adoption

- Functional and test specifications available now
SunSpec SVP Expansion For Devices & Apps

- Extend DER certification to IEEE 2030.5 and IEEE 1815
- Add application-level interface certification for Orange Button standards
Cybersecurity Workgroup Starting Up

- Starting 2H 2017
- Integrated with DoE Energise and CEC Solar+Storage programs
- Will provide digital certificate infrastructure for the industry
SunLamps: Solar + Storage Investment Risk Assessment Program

- Liquidity and Price Transparency
- Feedback from Rating Agencies and Investors
- oSPARC + O&M Cost Modeling
- Investor Confidence in Asset Performance
- Consistency in Cash Flows
- Tools to Conduct Due Diligence

- Integrated solution delivery planned 4Q 2017
PV O&M Cost Model Web Application

- Software as a Service: codifies best practices to determine financial value of O&M program
- Built on standard Application Programming Interface (API) for easy integration
- Ties O&M program to long-term system and financial performance
Orange Button Developer Program

Data Producers & Owners

Owners
Developers
Investors
Operators

ORANGE BUTTON

Data Users & Consumers

Asset managers
Investors
Utilities
Governments

Application Developers

Sharing the same API across the solar asset lifecycle opens up a big new world of opportunity

Launching at Intersolar North America 2017
New Programs for 2017

- California Energy Commission test & certification for IEEE 2030.5
  - Sub to EPRI

- California Energy Commission test & certification for IEEE 1815
  - Sub to EPRI

- CA Rule 21 Phase 3 validation program with IEEE 2030.5
  - 30 unit field deployment with Sunrun
  - Digital Certificate infrastructure for inverter & gateway providers
  - Sub to EPRI

- DOE Energise program for high penetration
  - 10,000 device grid circuit simulation
  - 100 device live field trial
  - Cybersecurity workgroup to define best practices
  - Sub to Sandia
DOE Energise Collaboration With Sandia
The Future is Now

Open Architecture
End-To-End

Asset Managers, Owners & Aggregators
Utilities

SunSpec Smart Systems and Fleets

Energy Exchanges

Financial Markets

SunSpec Smart™ Energy Components

Smart Panels
Smart Combiners
Smart Energy Storage
Smart Instruments & Controllers
Smart Inverters & Micro-inverters

nec 2017 Edition

Actuary Data Base Example:

California Rule 21

Sunspec Alliance
Thank You!