

Cloud Based Communications Reliability for Utility Scale Photovoltaic Plants

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Presentation Outline

- About JSI
- JSI installed assets
- JSI SCADA System
- JSI "Cloud-based" Communications Reliability
- Examples of Data Use
- JSI and Subnet: Problem Solved!



ABOUT JSI



Who is JSI?

- JSI is Juwi Solar Inc.
- JSI is owned by the Juwi Group, one of Europe's largest solar/wind/biofuel companies.
- JSI is an EPC (Engineer / Procure / Construct)
 company with a strong O&M group and an
 interest in keeping our plants in tip-top shape.



JSI INSTALLED ASSETS



JSI Installed Assets

- JSI presently controls 46 MW DC of PV assets across five states (New Jersey, Ohio, Texas, Colorado, Florida)
- There are currently 25 MW entering the construction phase (Nevada, New Jersey, Arizona).
- That's > 70 MW across seven states.



Jacksonville: 15 MW DC





Wyandot: 12 MW DC





New Jersey: 2.2 MW DC





Blue Wing: 16MW DC + Test Facility





Plants Under / Near Construction:

- 4.4 MW DC Plant in New Jersey
- 500 kW DC facility for Mars Candy
- 20 MW DC Plant connecting to SRP





THE JSI SCADA SYSTEM

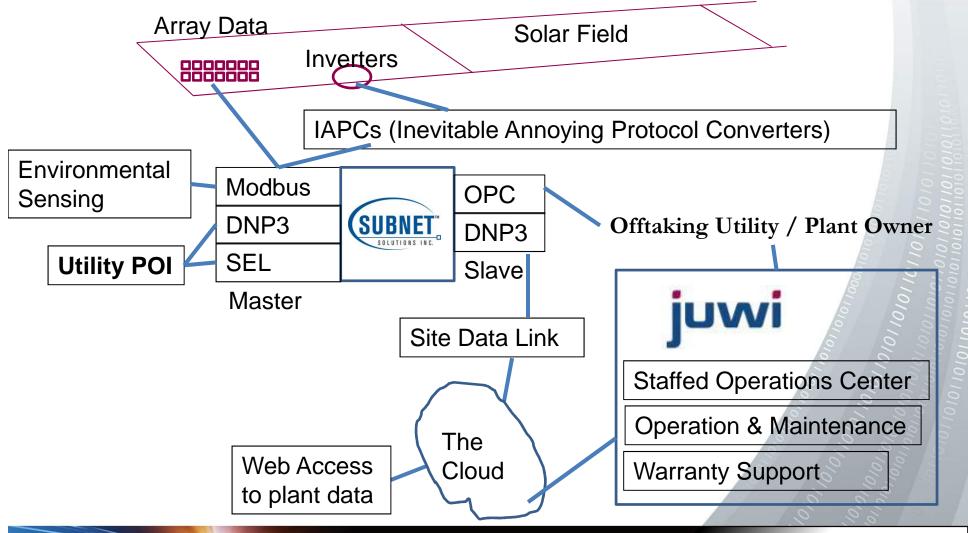


JSI SCADA System goals:

- Operations and Maintenance / reliability
- Plant performance and power delivery assurance
- Monitoring data for all involved stakeholders
- Reliable unstaffed site operation
- VAR Control / Dispatch control
- Solar Resource Monitoring and Prediction



JSI SCADA General Layout





The "Site Data Link"

- JSI needs to get data from its sites to its operations center in Boulder.
- The O&M budget isn't sufficient to allow for any sort of long-distance dedicated communications systems.

JSI does not own any data communications infrastructure



JSI Doesn't own any data infrastructure

This means we really kind of get stuck using the cloud...



JSI Doesn't own any data infrastructure

We move data via the following technologies, depending on what's available at each site:

- 1. DSL Modem
- 2. Cable Modem
- 3. Steal Someone Else's Access (Port 80, most likely)
- 4. Cellular Data Radio



The Cloud, you say?

- JSI Maintains our SCADA master and operator consoles at our offices in Boulder, CO
- We host our hot failover machine in a colocation facility elsewhere in Colorado
- Our VPN is hosted in several places:
 Cellular through a VPN SIM provider in Chicago
 SSL-based VPN links through a virtual server in Texas
 Site to site VPN through commercial VPN appliances



On-Site SCADA Hardware: Blue Wing



Site Data Link: DSL to Texas VPN host.



On-Site SCADA Hardware: Wyandot



Site Data Link: Cellular Data Link to Chicago VPN SIM provider



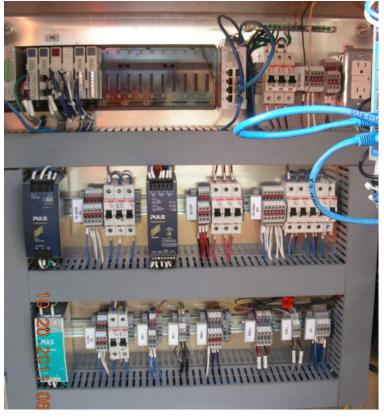
On-Site SCADA Hardware: Loveland



Site Data Link: 900 MHz Radio link to "Steal Someone Else's", then on to Texas VPN host



On-Site SCADA Hardware: Mill Creek



Site Data Link: Cable Modem to Texas VPN host







JSI Communications Reliability: Bandwidth

- Use of DNP3 means we could use dial-up lines of at least 19.2 kbps for any of our site data links.
- Remote admin is difficult via RDP over such slow links. This dictates the order of our preferred communications options:
- 1: DSL 2: Cable 3: Steal Someone's 4: Cellular Radio / Satellite



JSI Communications Reliability: Uptime

- Our Texas virtual server has had zero unplanned outages since first commissioned (14 months).
- Our DSL lines have had zero unplanned outages since first commissioned (20 months).
- Our Cable lines have also had zero unplanned outages since upgraded (6 months ago, at Jacksonville.. See next slide)



Jacksonville: Auurghhh...

- Originally connected via Cellular data via our Chicago VPN SIM provider.
- Cellular Link Failed nearly every week, had to return three cellular modems.
- After lots of sleuthing over the phone...



Giant Radar Planes...

- Aircraft sporting 10 MW radar sets flying low altitude training from the local air base.
- Replaced Cellular radio with Cable Modem, communications problems vanished





Communications Reliability:

 Use of disjoint "cloud based" communications technologies have lead to a reliable SCADA system, with no forced outages due to any of our communications lines going down, save for that Jacksonville cell modem.

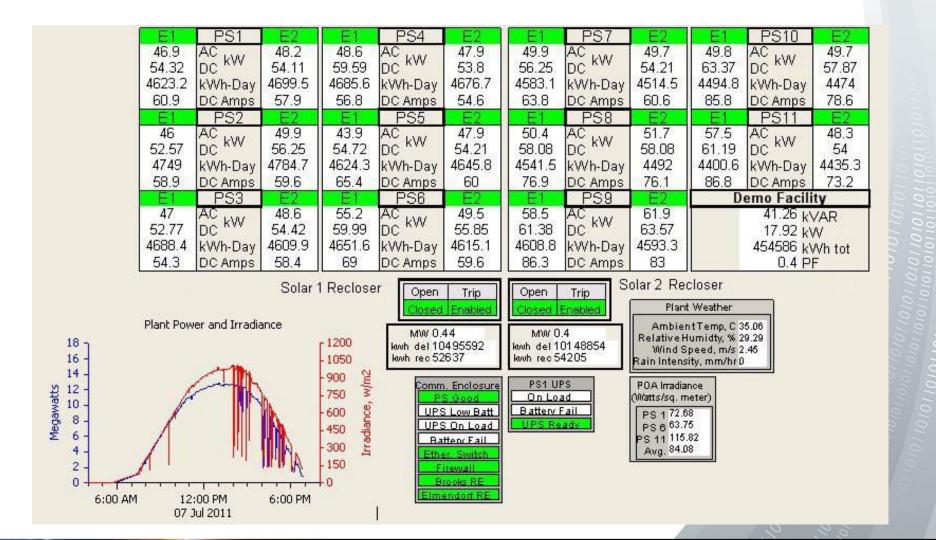




SCADA DATA APPLIED: WHAT DO WE DO WITH THIS?



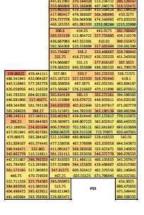
Real Time Data





Historical Data: Integrated Array Energy











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JSI AND SUBSTATION SERVER, PROBLEM SOLVED.



Substation Server is now JSI Standard

- Previous JSI Assets were ~1,000 points / MW worth of string currents.
- Future projects have more inverter points (~400 / MW) plus tracker systems (an additional 300 points / MW)
- Going from 1000 points / MW to close to 1700 points / MW, on a 20 MW plant.



Substation Server is now JSI Standard

- Substation Server's CSV config imports combined with the repeating nature of solar field points makes it an ideal software platform for doing solar field data aggregation.
- Future plants will use cabled links, plus a cellular backup as an option, plus redundant SSNET on-site machines to simplify system upgrades.

