



Large-Scale Systems Integrator - Reliability Needs

April 1, 2008

Laks M. Sampath
Executive Director of Technology



SPG Solar - Company Overview

- SPG Solar is a turnkey solar PV system developer/integrator
- Business Sectors Served:
 - Residential, Commercial, & Public Agency
- Founded in 2001
- High Growth
 - Entrepreneur Magazine Hot 100 Fastest Growing Companies
 - 150+ Employees in 7 Regional facilities throughout California
 - Expansion underway into Oregon, Nevada & Arizona
 - Over 1,000 "net-metered" Interconnected Projects
- Bonded California General B, Electrical C-10 & Solar C-46 Contractor, #759086





Services Performed



- Feasibility Studies
- Analysis + System Design
- Engineering + Permitting
- Construction
- System Commissioning
- Financing / PPA's
- Real-time Online
Performance Monitoring
- Customer Care Program



Importance of Reliability



- Performance Based Incentives
- PPA and their Financial Models
- “Production Guarantee”



Areas of Concern



- Uptime
- Warranty Terms
- Repair Response Time
- Customer Care



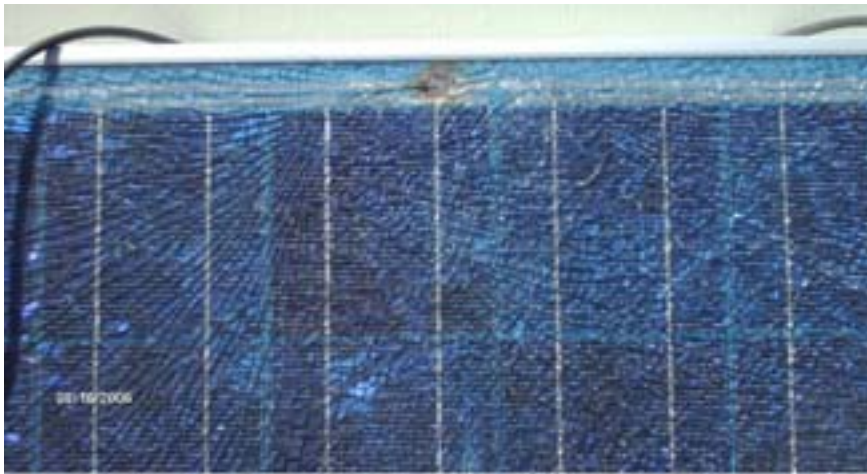
Components that have failed



- Modules
- Inverters
- Combiner Boxes
- AC Disconnect
- Fuses
- Foundation in Ground Mounts
- Roof Penetration Leaks



Modules – Failure Points



- Weak Links
 - ✓ Burn through
 - ✓ Junction Box failures
 - ✓ Poor soldering
 - ✓ Tab failure
- To a lesser extent, theft and vandalism have played a part.
- Finding Replacement Panels

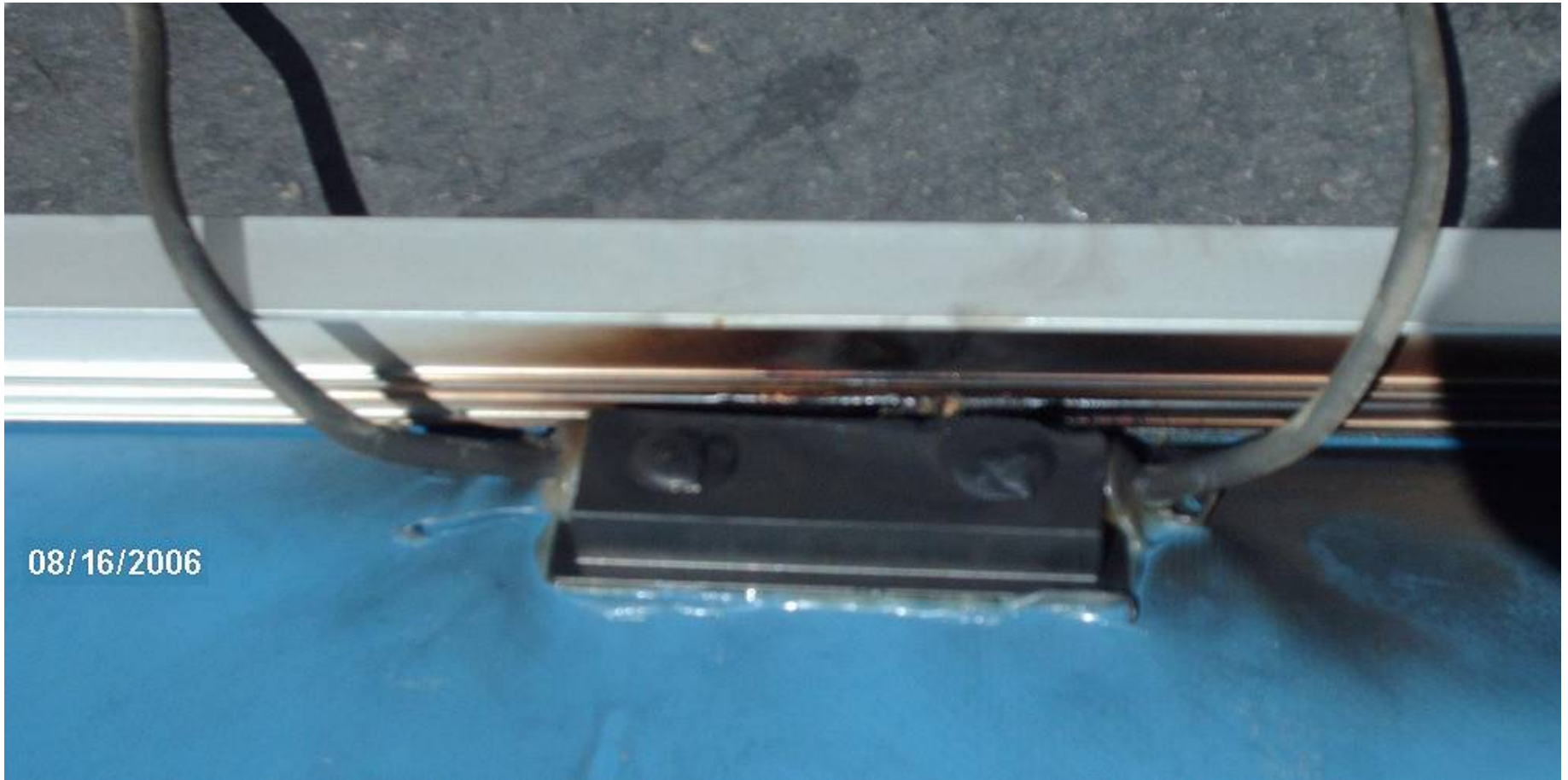


Modules – Junction Box





Modules – Junction Box



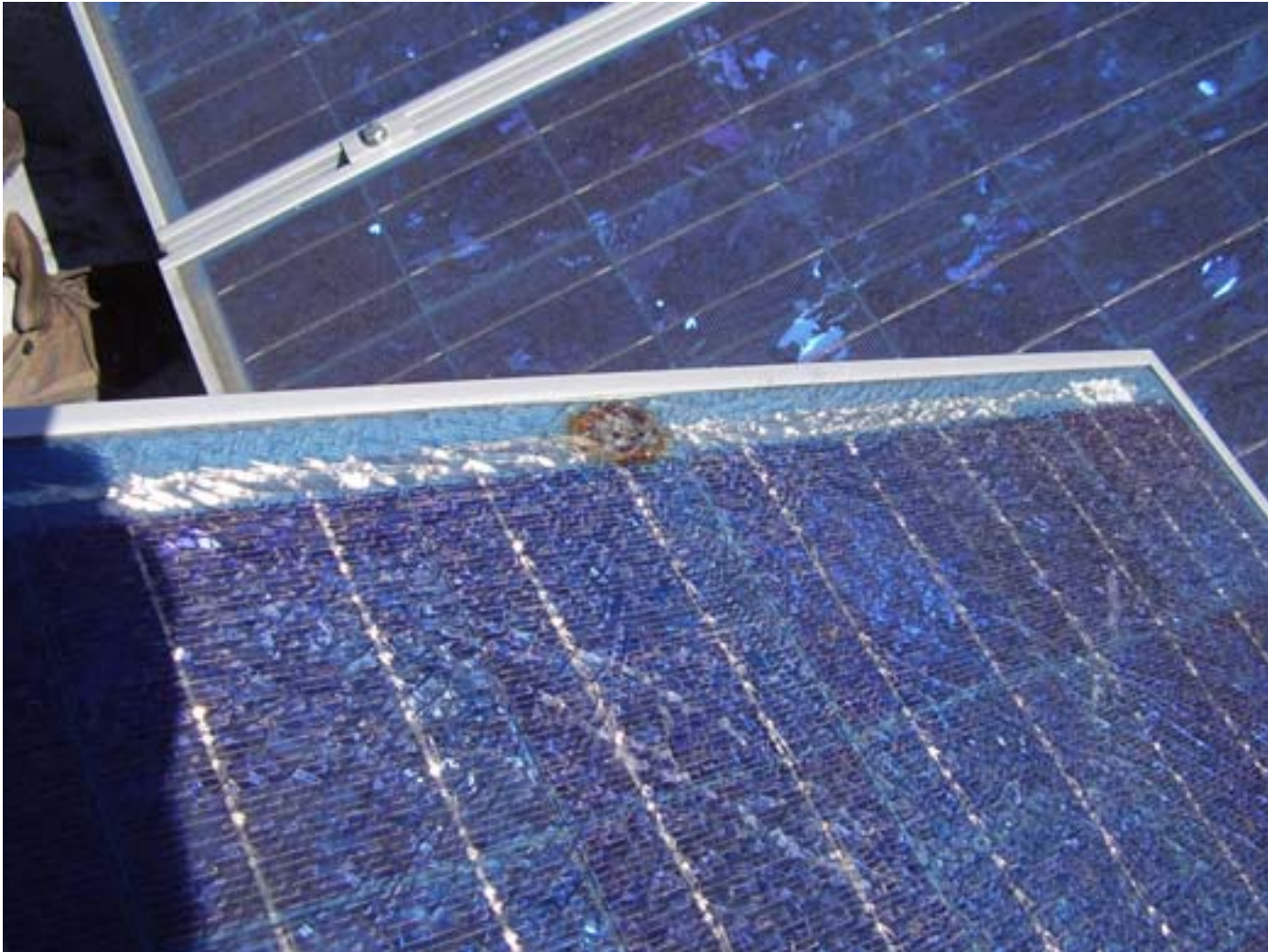


Modules – Junction Box





Modules – Junction Box





Modules – Tab failure





Modules – Tab failure





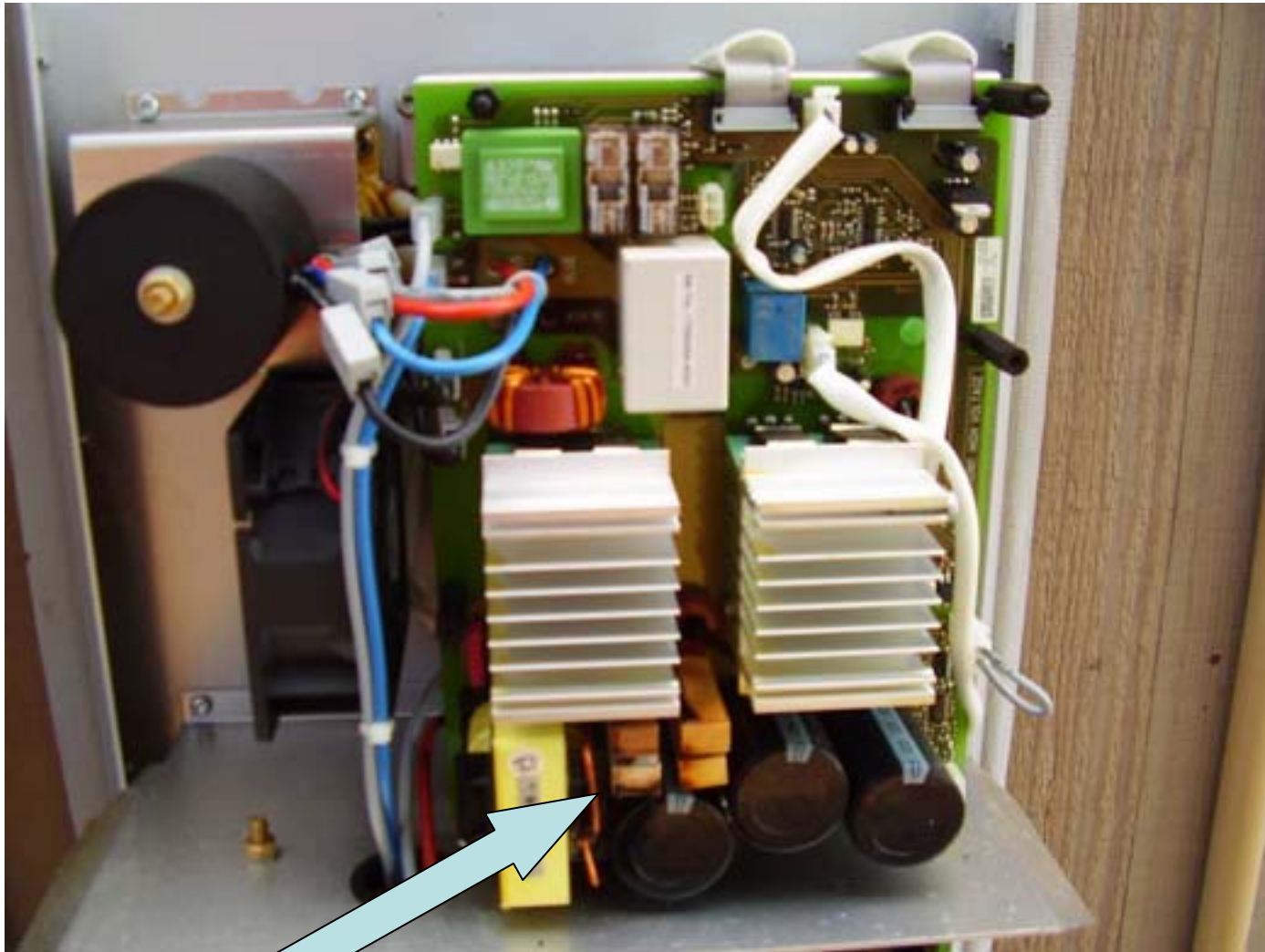
Inverter



- Weak Links
 - ✓ Component shorting
 - ✓ Loose connections
 - ✓ Voltage windows
- First Line Support Training
- Escalation Support



Inverter





Inverter





Inverter





Inverter



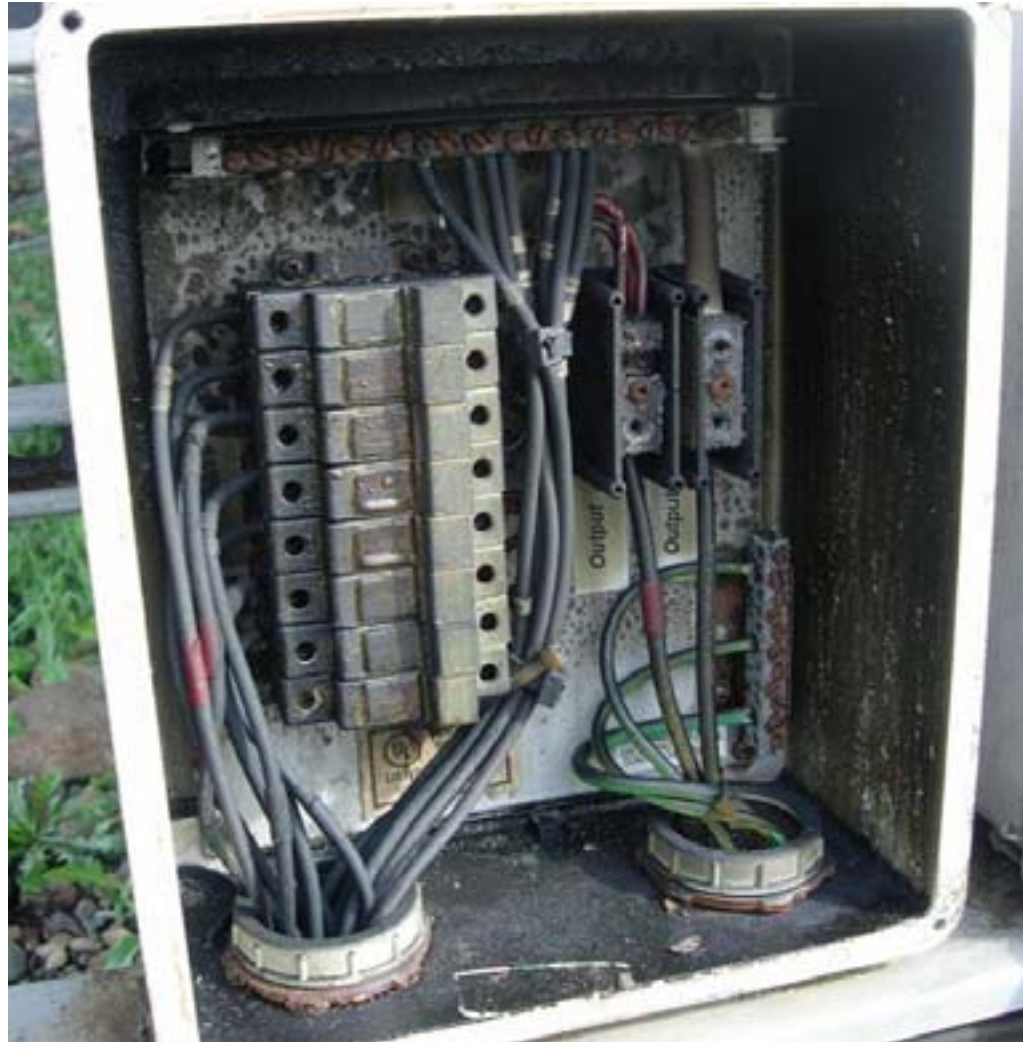


Inverter





Combiner Box





Combiner Box





AC Disconnect





AC Disconnect





Combiner Box Fuses

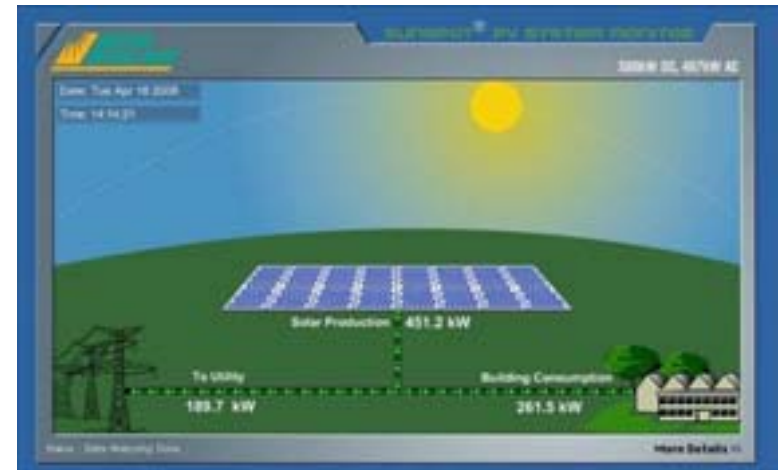


- Fuse most likely to fail
- One String of 2 KW in a 1 MW



Monitoring as a solution

- Monitoring of system performance
 - power flow
 - accumulated energy usage
 - solar insolation
 - ambient temperature
- Real-time Web access
- String sensitive monitoring
- Ability to guarantee annual power output
- Key in today's "performance-driven" incentive environment





Failure points in Monitoring



- Range from the trivial to the complex
 - On the trivial end of things
 - Customer forgets to pay their DSL bills and Internet service is terminated
 - On the Complex end
 - Revenue Grade meter burns out repeatedly



Conclusion

- PV Power Plant – Production... Production... Production.
- MTBF numbers from Manufacturers
- Accelerated aging tests of Modules and Inverters
- Reliable systems are key to continued acceptance of PV Systems

- Questions and Answers



Single-axis Tracking PV Arrays

- Ground-mounted, provides 15-25% more power (kWh's) annually than a fixed tilt system
- Delivers the lowest installed cost per kWh
- Up to 250 kW AC driven by a single motor & screw drive
- GPS-driven Controller
- Remote Operation





Floatovoltaic™ Mounting System



The Floatovoltaic™ PV System is designed to float on water retention ponds and basins. Uses previously unbuildable space to generate clean, renewable power and mitigates and reduces extensive water-borne algae, reducing facility operation and maintenance costs.

The first commercial Floatovoltaic system is currently installed at a Northern California Winery.