PV Inverter Reliability

Integrator Perspective on Reliability
Quantity
Topics

Inverter Reliability – Integrators Perspective

• Reliability vs. Availability – Challenges
• Individual component and inverters – Impacts
• Non-technical items – how they can affect reliability
Reliability vs. Availability
Reliability vs. Availability

Availability counts – not a 1:1 relationship with inverter reliability

- Gray area between failure and lower performance
- Combination of individual component reliability and system design
- Downtime matters
- Measurement (visibility)
Reliability vs. Availability

- Performance & Components
- System Design
- MTTR
- Irradiance
Reliability vs. Availability

Evaluation is Difficult

• Series Connection

• Redundancy

Weakest Link

Multiple paths but not equal
Reliability vs. Availability

Distributed nature of the system combined with the variability of the fuel source makes understanding the impact of reliability of components difficult!
Individual Components and Inverters
Individual Component Impacts on Inverters

**AC**
- Grid and system stability
- External protection & control
- Advanced grid requirements

**DC**
- Modules and wiring
- Combiner boxes
- Ground fault protection
Individual Component Impacts on Inverters

Harness Combiner Box.
Individual Component Impacts on Inverters

AC – bigger impact
• Less components
• More standards

DC – Complicated – smaller incremental
• Difficult to analyze
• Challenging quality control - construction
Non Technical Impacts on Reliability
Non Technical Impacts on Reliability

- Standards and specifications
  - Measurable characteristics
  - Clearly identified performance characteristics
  - Well defined engineering specifications

- Operational logistics
  - Safety
  - Warranty commercial terms
  - Proximity of resources
  - Site access

- Vendor relationships and quality
  - Lines of communication
  - Tracking processes
Non Technical Impacts on Reliability

- Testing – Commissioning - Startup
  - Mfgr. testing
  - Factory Testing
  - Established startup procedures
First Solar Locations

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