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PENNY WISE, POUND FOOLISH: WHY QUALITY INSTALLATION IS MORE THAN A BEST PRACTICE

Why is Quality Assurance Important?

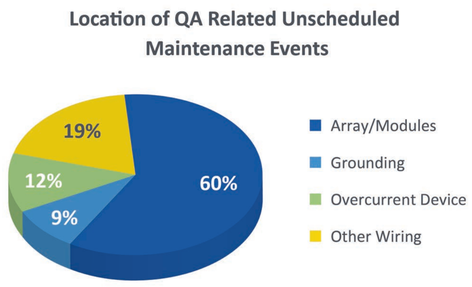
Owners of PV systems, whether residential customers or large leasing companies, rely on long-term savings to justify purchase and installation costs. High maintenance costs and downtime can seriously impact project financials. By ensuring that systems are well-installed and easy to maintain, a robust quality assurance program will:

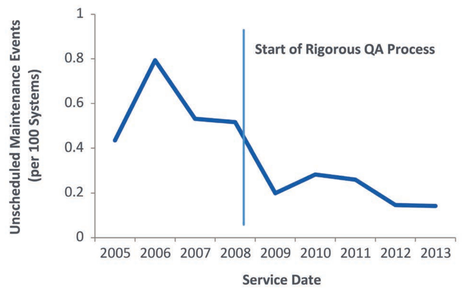
- Ensuring long-term savings
- Reducing operations and maintenance (O&M) costs
- Protecting customers
- Promoting a positive image for PV

Quality Assurance Reduces O&M Costs

22% of unscheduled maintenance events reported to the Massachusetts Production Tracking System (PTS) were related to QA issues, such as:

- Array Wiring Not Secured Properly
- Modules Not Secured to Racking
- Blown Fuses
- Disconnected Array Strings
- Ground Faults
- Water Ingress/Leaks



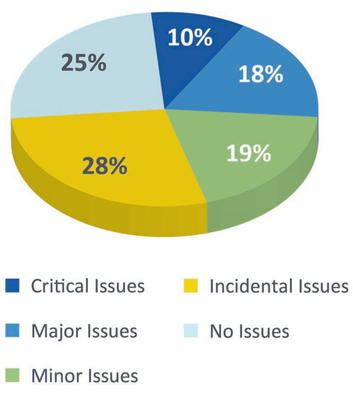


The average QA-related maintenance event resulted in 8 days of downtime and $700 in repair costs and lost revenue. Since implementing a rigorous QA program in 2008, reported unscheduled maintenance events related to QA issues have been reduced by more than 50%. While there may be other factors contributing to this improvement QA likely plays a substantial role.

How Do You Rate Something Like Quality?

Each system is evaluated based on the severity of the issues observed. More serious issues, like improperly rated equipment or exceeding current limits on interconnection, can lead to hazards or system failures. Less severe issues may lead to hazards or failures over the long-term or under specific conditions.

Defect Category	Definition	Examples
Critical	Imminent hazard or system not operating	Modules on roof loose, busbars overloaded, Missing/inadequate OCPD
Major	Very likely to create a hazard or cause system to fail	Water collecting in enclosures, EGC/GEC undersized, breakers undersized, component not grounded
Minor	May cause a hazard/failure over time or under special circumstances	AC disconnect wired backwards, conductors touching roof surface, missing expansion joint, GEC not continuous
Incidental	Unlikely to cause a hazard/failure but not code compliant	Missing/incomplete labels, missing conduit indoor/outdoor air sealing, improper wire coloring



Nearly 50% of systems inspected have one, or more, issues likely to cause a failure or hazard within the life of the system.

QA Requires a Robust Inspection Process

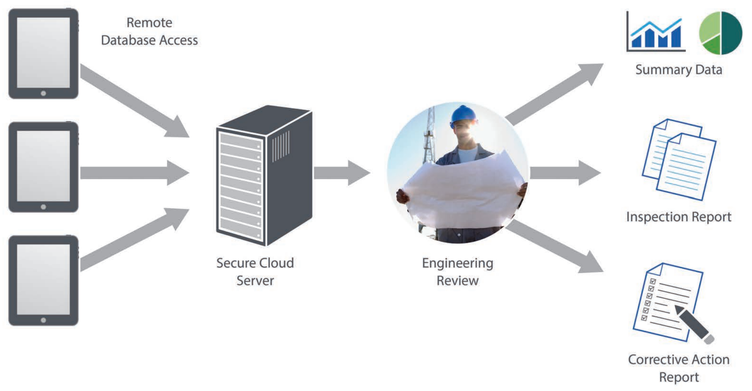
Protecting the public investment in solar PV requires a thorough inspection process that targets the ways a PV system could fail to safely deliver the expected energy benefits. A thorough inspection should include:

- Adequate solar resource
- Code compliance
- Equipment selection

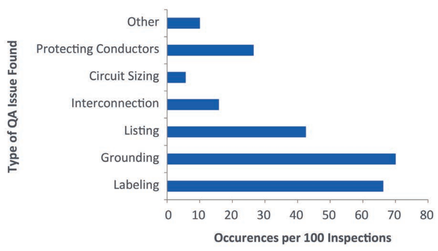
Beyond the Clipboard: The Role of Technology

In this digital age, use of tools like online databases can provide many benefits that go far beyond generating basic inspection reports. Analysis of data trends can:

- Pinpoint installation issues that require more training
- Help installers focus internal QA process
- Identify installers needing extra support or disciplinary action

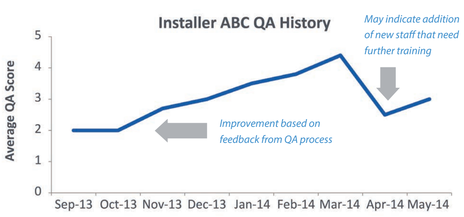


Advanced Data Collection Tools can Pinpoint Common Installation Issues and Guide Feedback/Training Efforts



Improperly supported conductors can be damaged by wind, snow, ice, and pests.

Improperly connected and flashed racking can cause leaks or structural damage to the array and/or building it is attached to.



Components not listed for their use can quickly fail and leave systems without proper grounding.

Conclusions

QA plays an important role in ensuring safe and reliable PV system operations that will continue for their full 20+ year life. In order to be most effective, though, QA programs need to include several key elements:

- A rigorous inspection program that looks at all aspects of the system
- A method of tracking performance and trends
- Training and feedback mechanisms to turn QA results into positive industry change
- Bringing these elements together is an important step in ensuring safe, reliable, and cost-effective PV incentive programs.

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