
ALECTRIS
SOLAR ASSET CARE INNOVATION.SM

Digital O&M: Optimising Management of Utility – Scale Solar Plants

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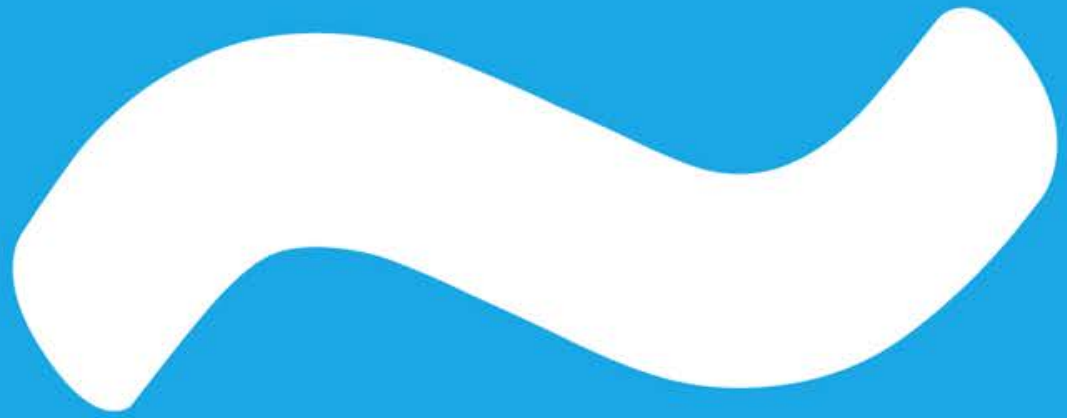


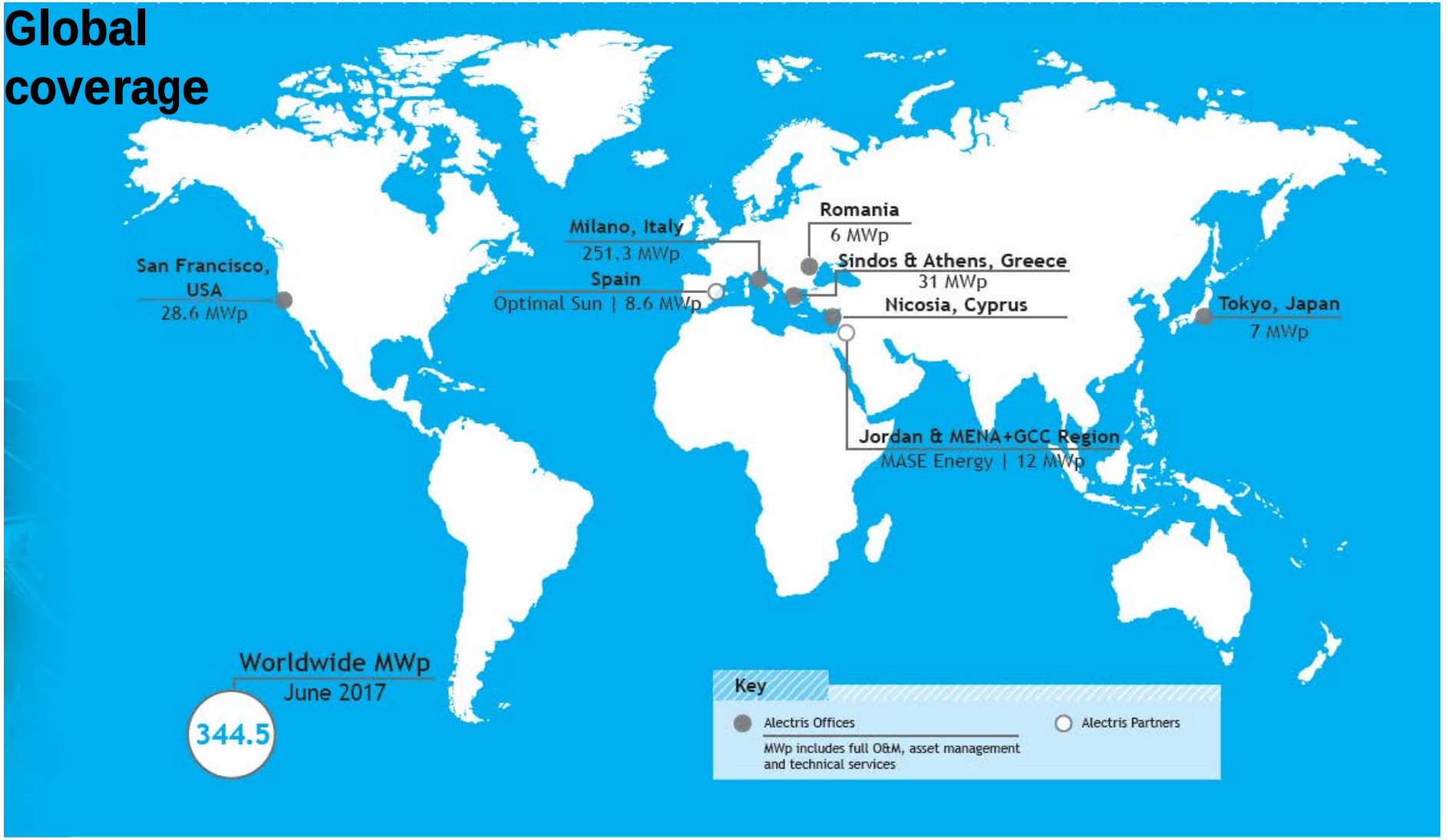
About Alectris

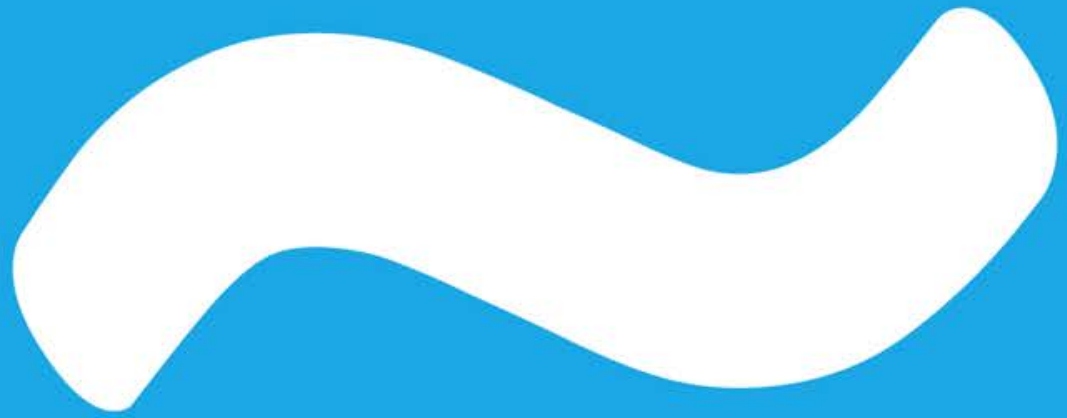
Alectris profile

ACTIS

- Alectris delivers asset care innovation for the global solar industry.
- With our integrated suite of products, services and award-winning software, we empower solar operators to increase plant productivity by providing one source for operations, maintenance and management support.
- With the aim of gradually improving the operational and financial performance of the PV investments entrusted to its services, Alectris has developed an advanced service organization infrastructure, monitoring tools and methodologies devoted to O&M, Asset Management & Improvement activities.
- Alectris is member of SolarPower Europe and Chair of the Best Practices Task Force

Global coverage





Short history of O&M evolution

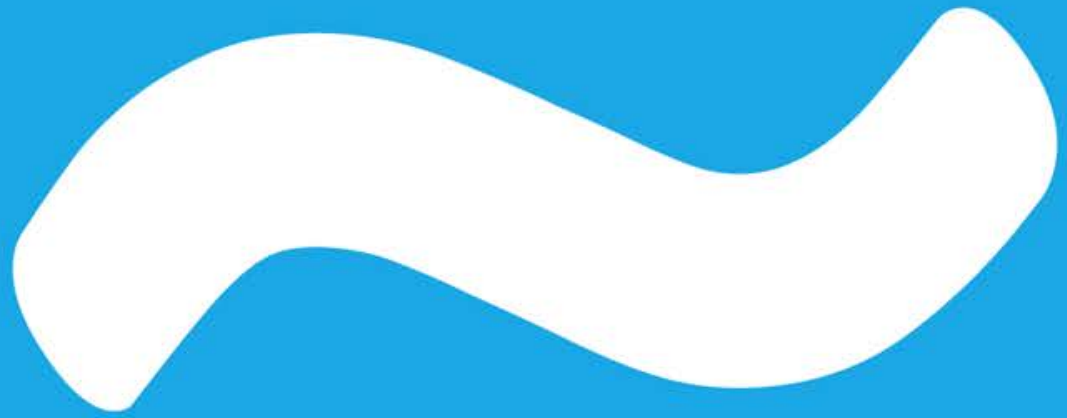
The early days or the “Golden age”

- Focus on development and construction due to high FiTs and cost of investments
- Fragmented market and small portfolios
- No distinct market for O&M
- Solar PV geographically contained (mainly Europe)
- O&M perception:
  - A burden for EPCs
  - A pure cost center for Owners
  - A necessity for Lenders who wanted long term contracts to be risk free
- O&M tied solely to the EPC contractor, no independent third party contractors
- Balance sheet was key criterion
- Software tools in general were not considered

O&M Today (a path to a mature market)

- **Reduced budgets & older plants, resulting in needs for optimization**
- **Consolidation and local and global growing portfolios**
- **Key role of O&M in achieving the needed optimization**
- **Software recognized as tool for enabling optimization**
- Better awareness of the value of high quality O&M (track records already exist)
- Lots of bankruptcies but also newcomers
- Balance sheet not a major criterion any longer
- Third party contractors – growing global market

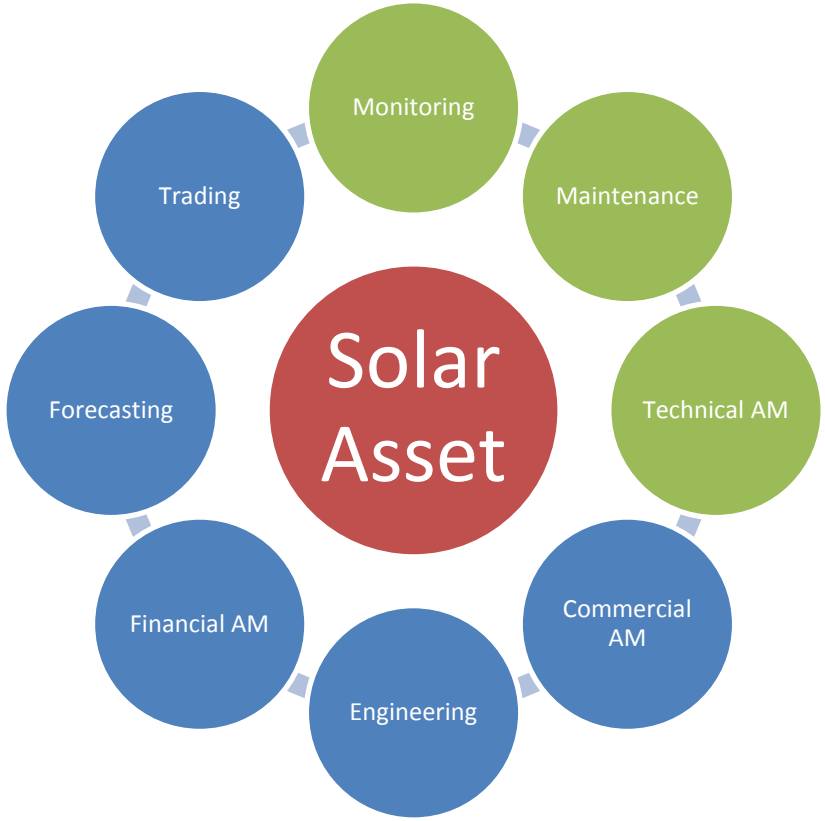
- Global growth of solar PV and hence O&M. Also in regions with zero track record and local knowhow
- Split between EPC and O&M
- Evolved monitoring systems including portfolio reporting and activities management
- Solar O&M stand alone market is born. Market still very young and differences in (quality of) offering is huge
- O&M market consolidation (similar to all other solar PV markets)



Current challenges and optimization

How do we optimize PV plants?

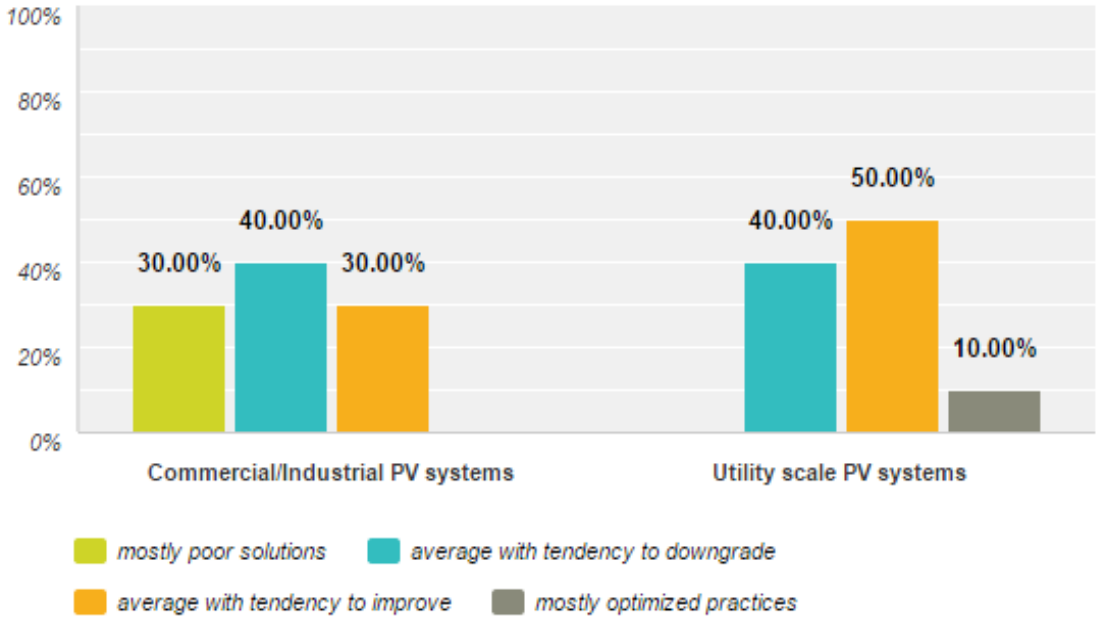
There are several potential areas of Optimization. We will mainly focus on O&M optimization



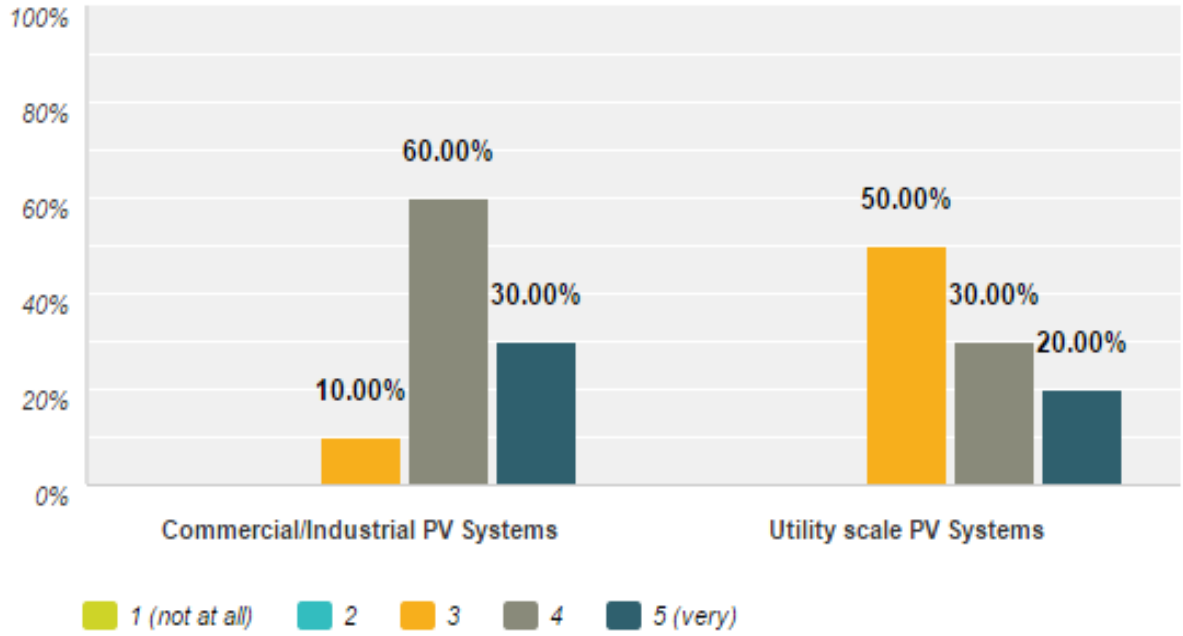
- Different picture between commercial/industrial and utility scale projects
- Better status for utility segment, however this segment needs optimization as well
- The strategy is affected by the country regulation

Current Practices and Room for improvement

"Do you believe that solar asset owners tend to disregard effective and optimized O&M practices due to deterrent investments costs, adopting only the minimum requirements? (pls. consider the potential returns/value)?"



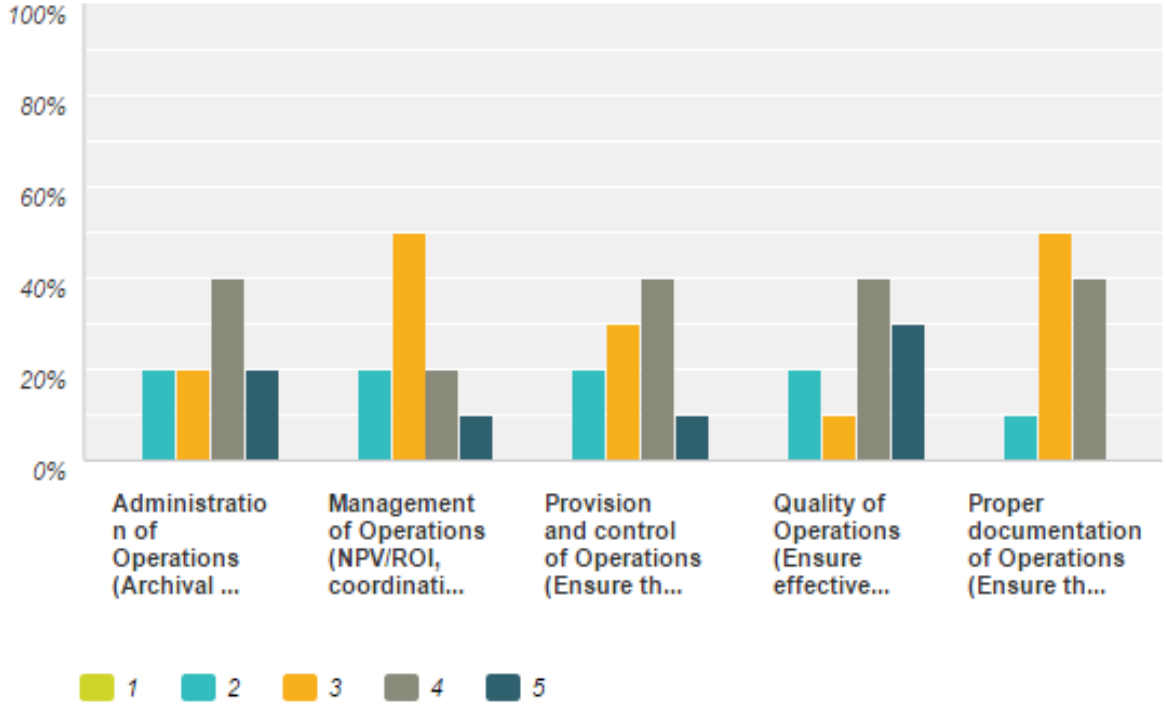
"Is the room of improvement big concerning the practices included in solar O&M?"



Survey conducted by: SolarPower Europe

Areas of improvement

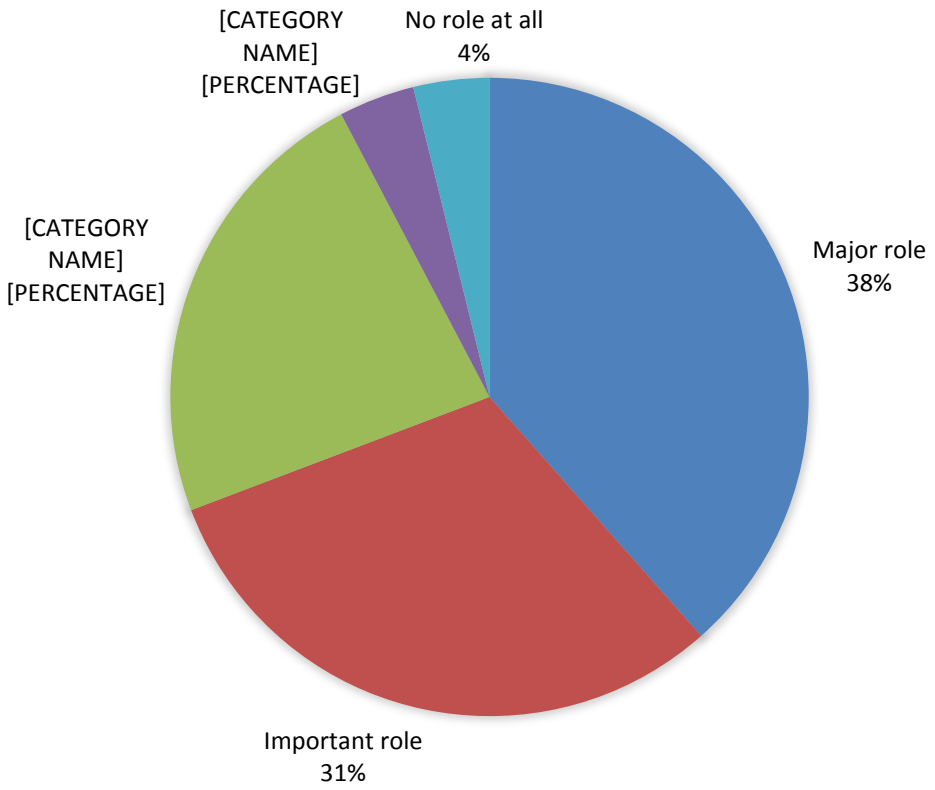
"In which of the following areas more attention and improvements is required? Pls. rank from 1 (no improvement needed) to 5 (much improvement needed)"

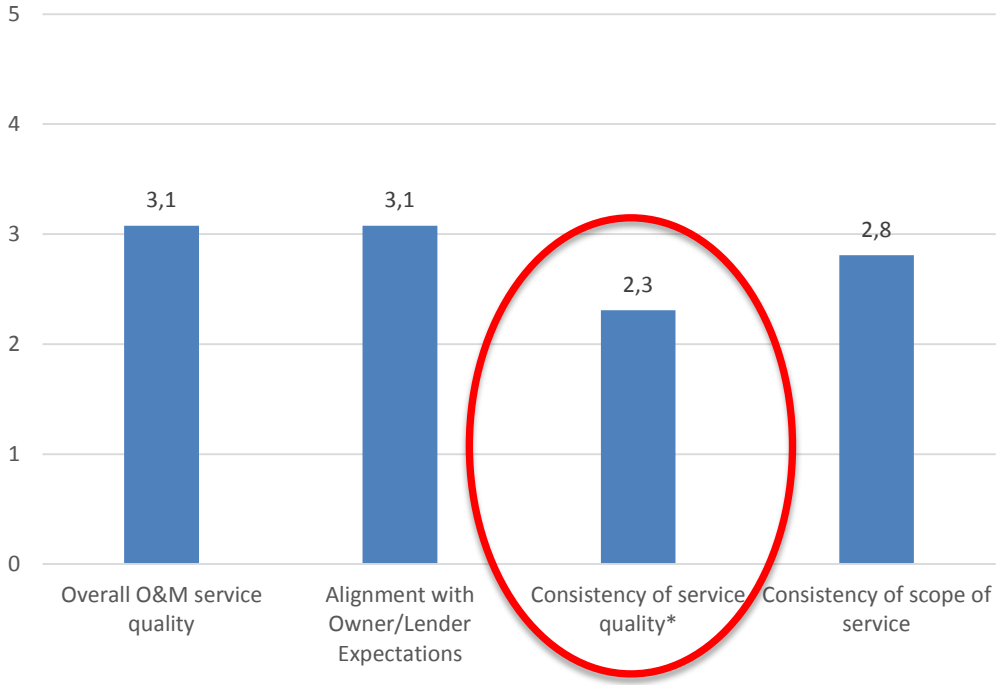


- All areas/steps require improvement
- More attention should be put on the quality of operations - **Ensure effective equipment monitoring and analytics**
- Equal attention to the administration, provision and control

Survey conducted by: SolarPower Europe

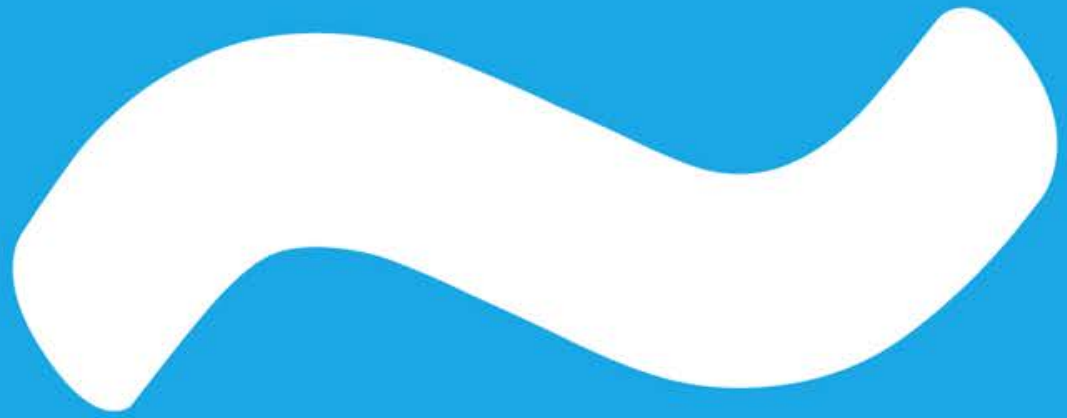
How important is O&M?





- Almost 70% responded that solar O&M is either **important** **or** **very important**
- Main Concern: **Consistency of quality**

Survey conducted by: SolarPower Europe



O&M in the future, Optimization

Optimizing the existing portfolios, O&M in the future

The needs

- Higher efficiency of Operations.
- recovering profitability.

targets

- Analysis and revision of key areas, with the aim to:
  - highlight the «bottlenecks» or «obstacles» and then remove them.
  - Identify the gaps, bridge them and improve using enabling tools

Key areas in scope

1) Process 2) Organisation and Resources 3) Tools

actions

- The procedures available in the organisation for managing operations and relevant tasks;
- The workload detailing each task performed by the team in order to split the activities into “added value” requiring high skilled people to attend to, and “routinely” where lower skills are needed;
- The tools available in the organisation for managing operations and relevant tasks;

How to optimize O&M?

Digitalization

•Software tools are enablers of improvement, increasing the work automation and reducing the manual activities and the risk of mistakes. They also increase the standardization

Standardization

•Best practices to increase quality of services. Clarity and consensus from all stakeholders leading to increased and healthy competition

Plant management evolution

•Evolution from Plant monitoring to Portfolio management – high complexity more difficult to manage. Complexity is also an opportunity to achieve economy of scale

- Cost reduction and rationalization
- Efficiency
- Transparency
- Contractors need to master more skills besides maintenance:
  - ✓Technological solutions
  - ✓Operational excellence
  - ✓Engineering skills
- Software tools need to keep up with the market evolution

Digitalization and plants optimization

Digital technology can also be used, particularly in utility-scale solar plants, to reduce operational costs and increase asset performance.

Improved asset lifecycle management

- Data can be analysed at several levels, plant, inverter, string and module

Predictive maintenance

- using patterns to predict component failures or system failures could reduce maintenance costs

Remote sensoring and control

- embedded test electronics and data analysis can help diagnose faults remotely

Cloud computing

- used to store data from data loggers on site

Digital field workers

- mobile technology can make field operations more efficient

Drones

- Visual and infrared thermal imaging of modules, wiring and other plant components

Satellite forecasting

- Satellite-based data services are accurate across the year and are less prone to systemic errors.

3D printing

- reduce spare parts management costs by reducing the number of spare parts in storage, decrease lead times and manufacture spare parts closer to site

A white paper developed by: SolarPower Europe

Tasks and software tools available

Software packages:

- CMMS
- AM Software
- ERP / Accounting software
- Monitoring / SCADA
- Project Management
- Office applications (eg MS Office)
- Forecasting software
- Trading software

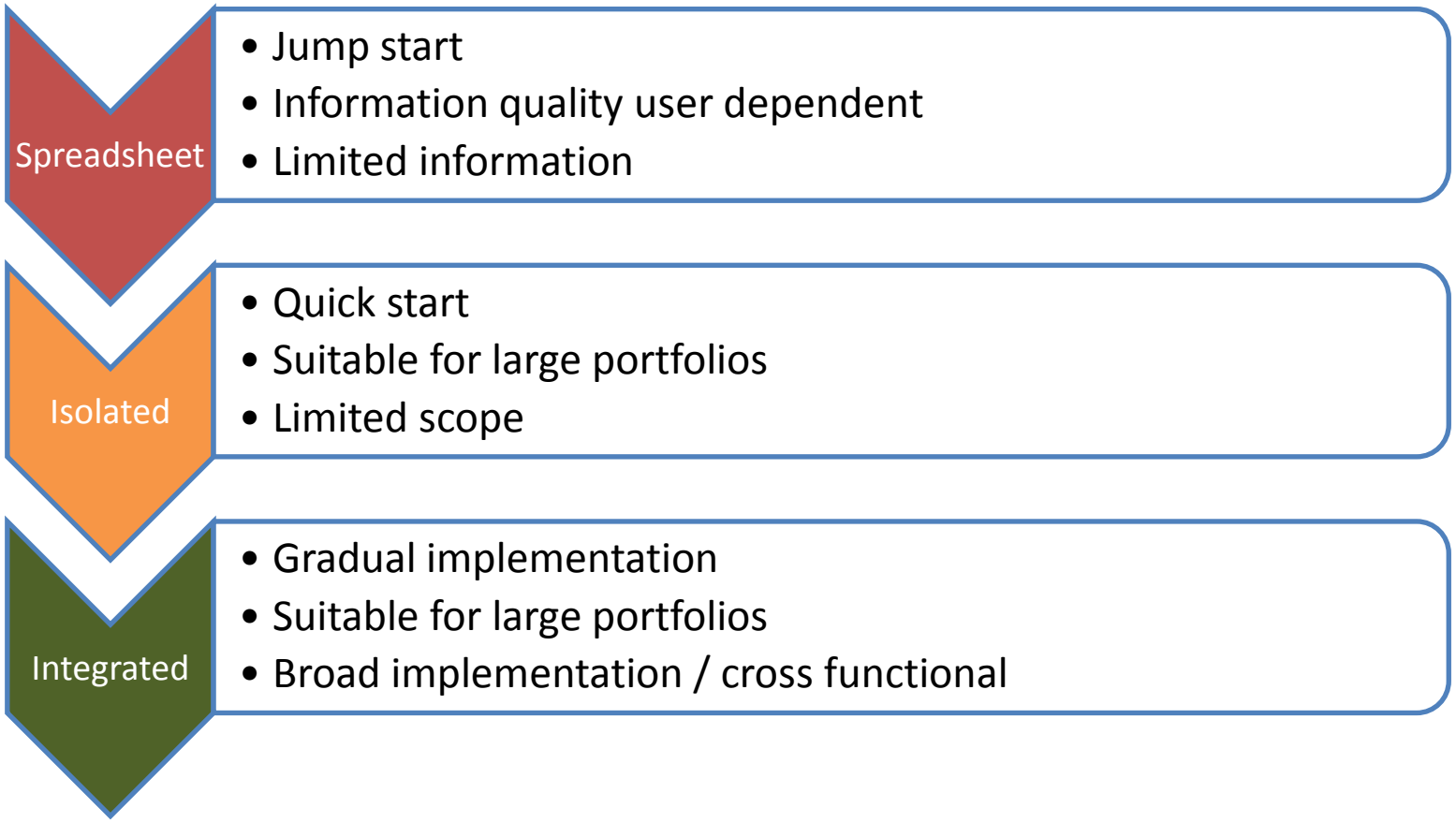
General requirements:

- Document management
- Security
- Usability
- Mobility
- Flexibility
- Customizable

Functionalities and requirements

Operations & Maintenance Reporting Cost management and control KPI calculation Spare Part management Warranty management Health & Safety Compliance Technical Analysis Scheduling Training Invoicing & Billing Root cause analysis Incident handling and impact analysis Dispatching	**Asset Management** Contract management and compliance Reminders, task scheduling and escalation Reporting KPI calculation Invoicing & Billing Budgeting and Base Case scenarios comparisons Warranty management Bank reconciliation Financial reporting (Cash Flow, P&L, Budget) Performance management Loan management PPA	**Monitoring** KPI calculations (PR, AVA etc) Real time alerting Long term alerting Analytics Technical analysis	**Project Management** Tasks Milestones Budget Cost and payments management Activities management
General requirements	Document management Security Usability Mobility Flexibility Standardization Automation	Customizable Reporting Contact & Account management Communications tracking Integrated reporting Workflows	

Software evolution



Software evolution

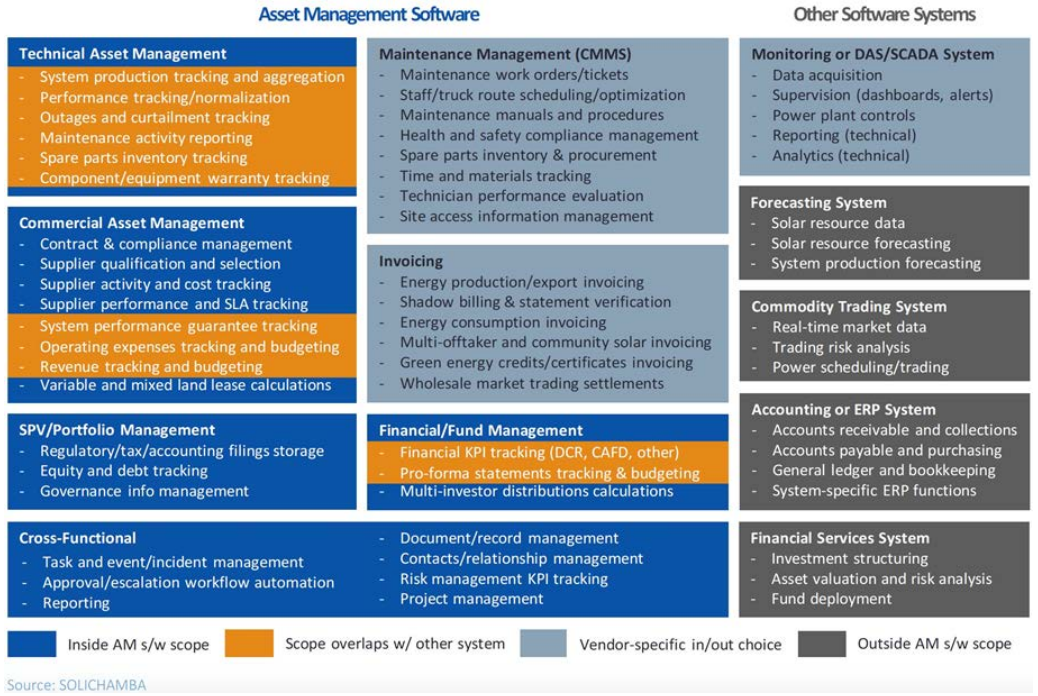
"Many asset management organizations still use Excel spreadsheets and manual processes to manage their portfolios."

"…Asset Managers currently use more than 10 different software systems"

GTM Research
Solar PV Asset Management 2017-2022
May 2017

- **198 investors** account for **55 GW** in net operational solar PV capacity
- **46 third-party asset managers** provide AM services to **17.6 GW** of PV in operation
- **10 software vendors** supply asset management automation solutions for **12.5 GW** of PV in operation

Integration needed!



Integrated capabilities

- Technical Asset Management
- Commercial Asset Management
- SPV/Portfolio Management
- Financial/Fund Management
- Cross functional features
  - ✓ Task Management
  - ✓ Approval & Escalation automation
  - ✓ Reporting
  - ✓ Document/Records Management
  - ✓ Contacts/Accounts Management
  - ✓ Risk Management
  - ✓ Project Management
- Maintenance Management
- Invoicing

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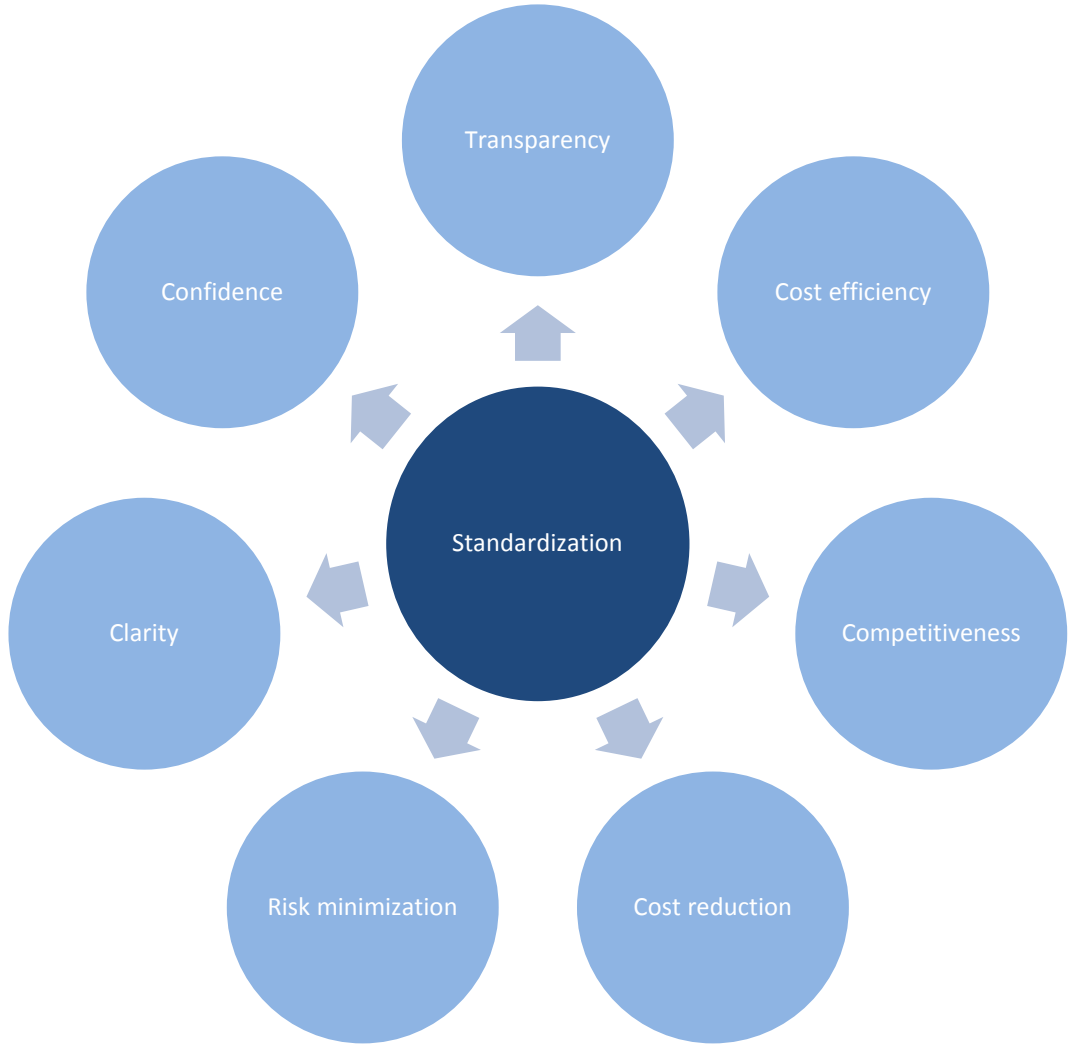
What is Standardization good for?

Standardization defines **HOW** and less **WHAT** actions are taken, while at the same time listing a **minimum set of activities**.

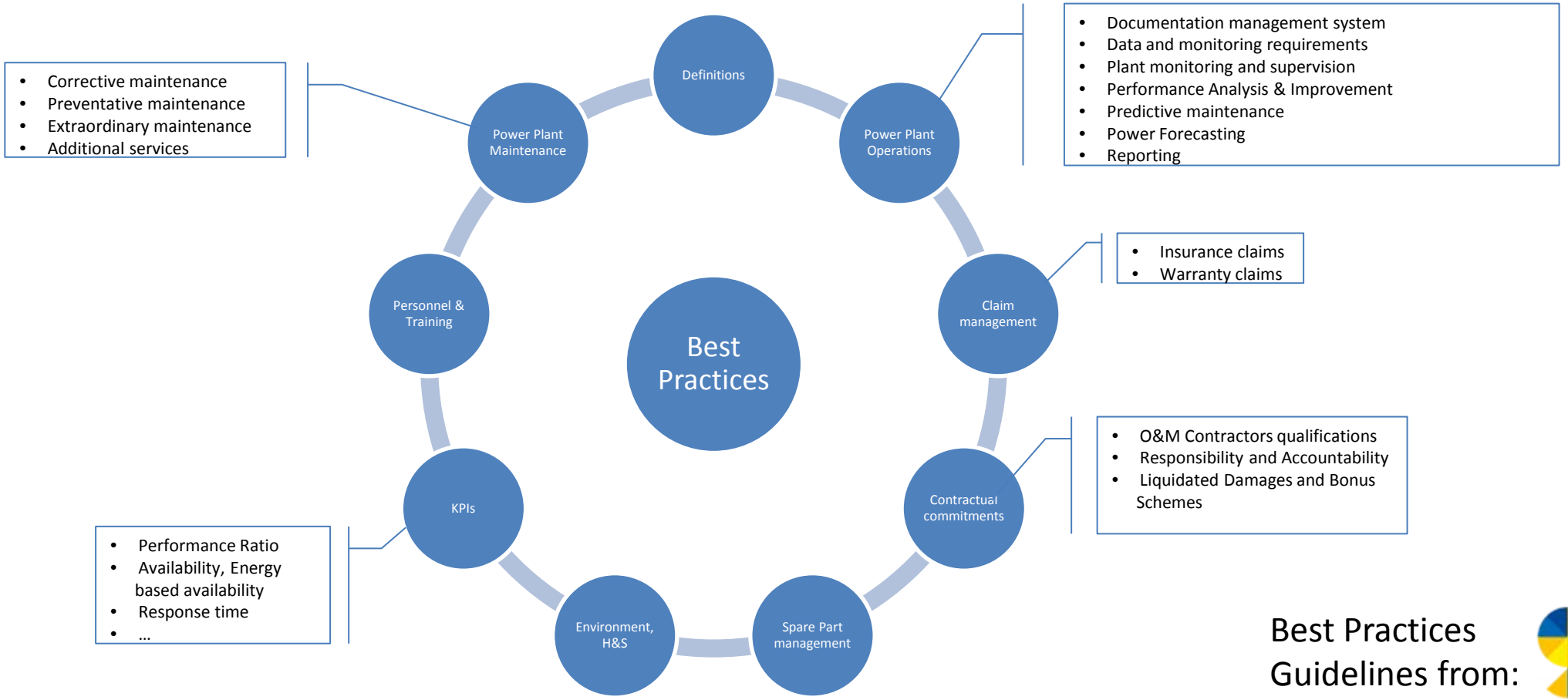
Standardization is a key element for the maturation of the O&M market

- Increases confidence and transparency
- Lowers costs and risks
- Allows for easier entry in the market (new investors)
- Facilitates transactions

Experience has shown: Industries that managed to standardize experienced exponential growth



Best Practices as the foundation of Standardization



Best Practices Guidelines from: SolarPower Europe

The path from SolarPower Europe Best Practices to Standardization

Revision of first draft – incorporate additional comments from new experts

Extend the scope of work – **Lead the work of IRENA/TWI on creating contract template for O&M**

Potentially create country annexes to touch upon local specifics

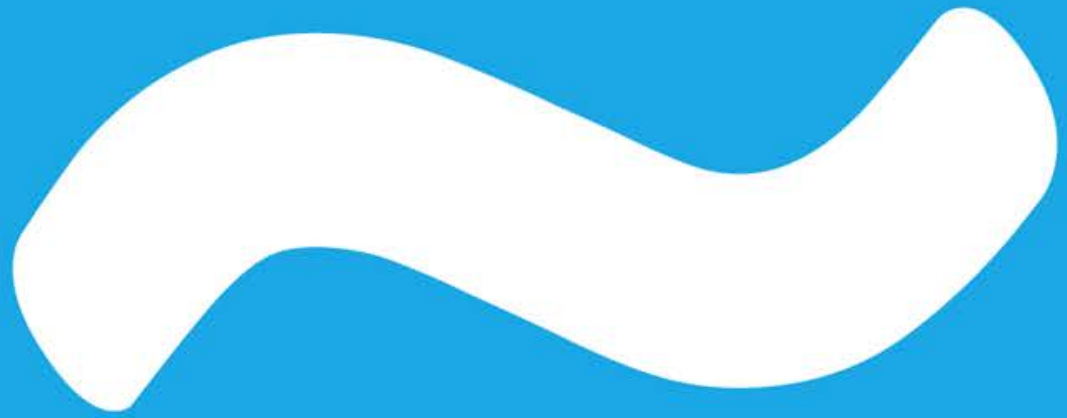
- EU funded project Solar Bankability - reducing the risks associated with investments in PV projects
- TWI/IRENA solar standardization initiative

Stakeholders to endorse and adopt SolarPower Europe Guidelines – create common reference

Seek synergies with national initiatives – address local requirements

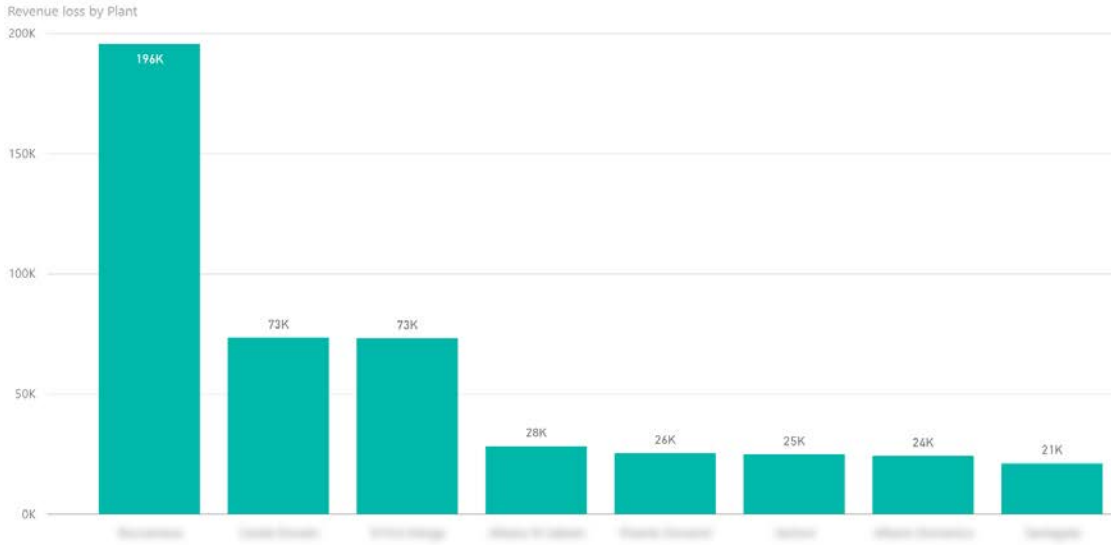
Influence on-going work and projects

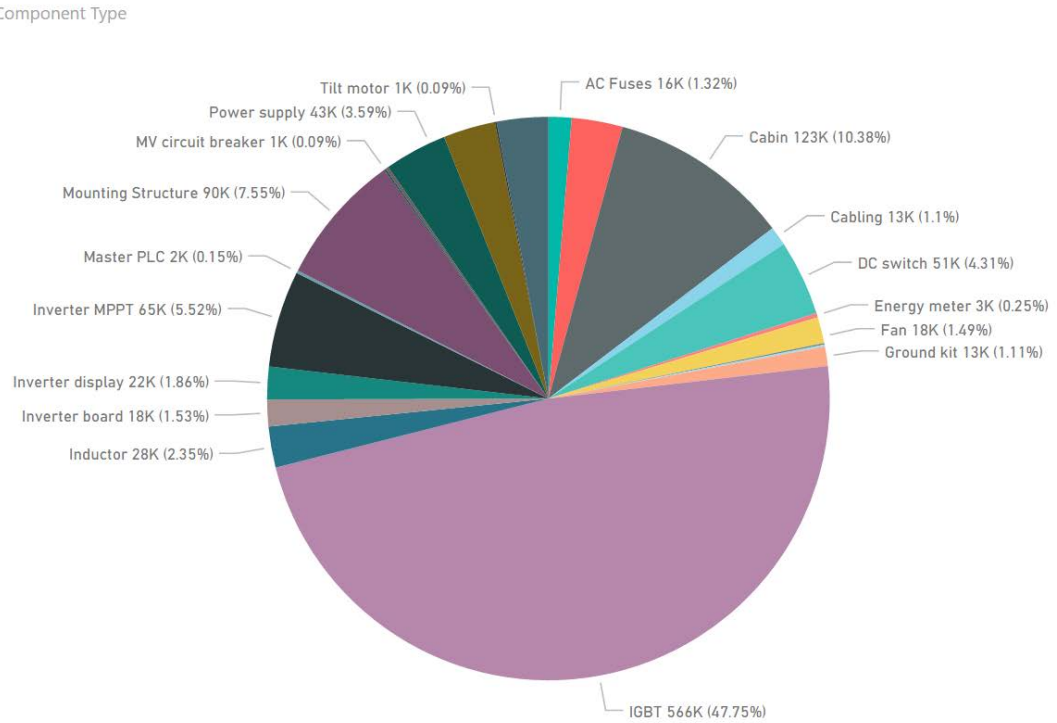
Dissemination – increase outreach and consensus inside and outside of Europe



Case Study

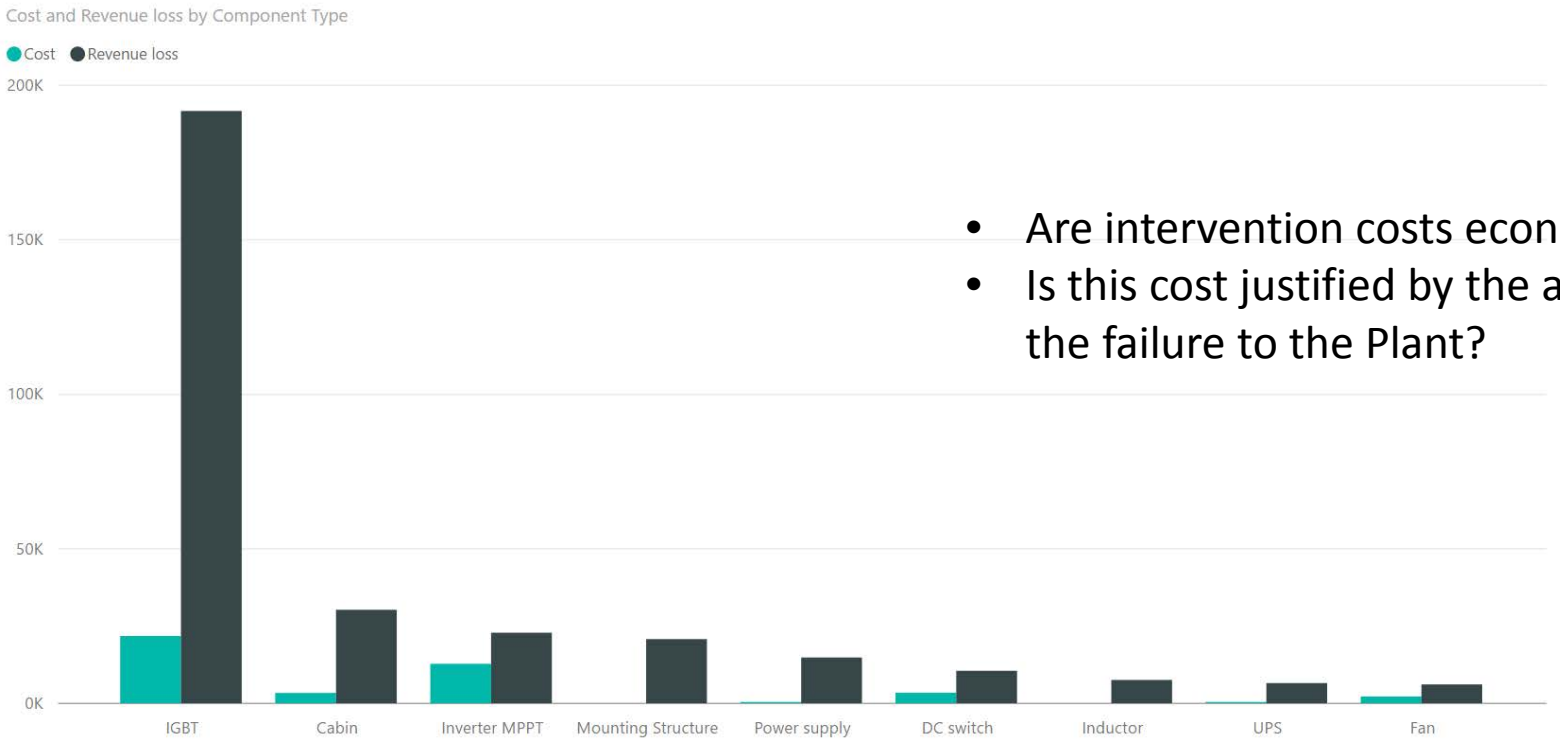
Where to focus?





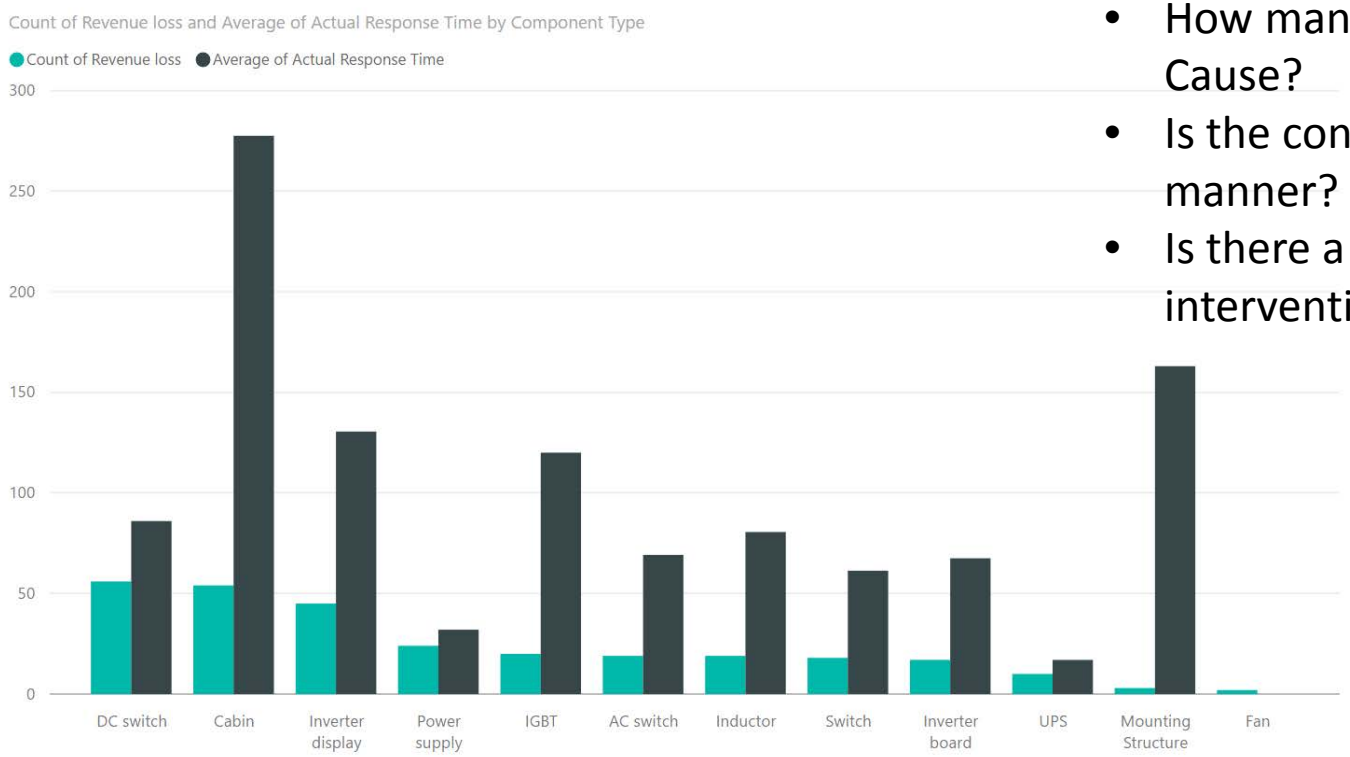
- Which plant has the biggest loss of revenues?
- Which Root Cause is mostly responsible for energy losses?

Intervention costs vs Revenue Loss



- Are intervention costs economical?
- Is this cost justified by the actual impact of the failure to the Plant?

Response time and number of incidents



- How many occurrences are there per Root Cause?
- Is the contractor responding in a timely manner?
- Is there a point of focus for faster interventions?

Questions & Answers

Thanks very much