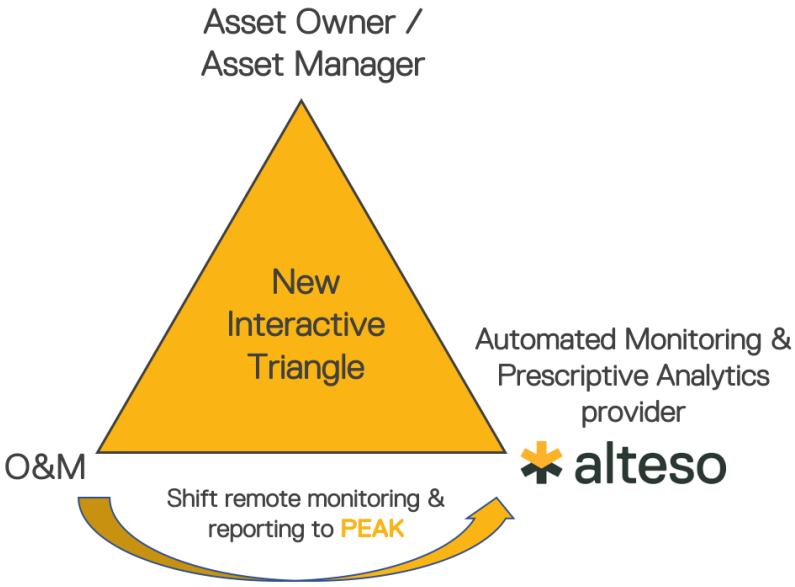

READ TIME: 5 MINS

Automated PV plant monitoring – essential and easily achieved!

Alteso's clients and those familiar with our presentations at international events will recognise our New Interactive Triangle.

This depicts, what we and many of our clients see as being, the essential integration of automated monitoring and advanced data analysis into the traditional asset management structure, alongside O&M.

Based on feedback from our clients and the wider PV market on the subject of monitoring, we have updated our offering and the triangle.

Make it easier and more (cost/time) efficient

A natural and logical development in our client relationships over the past year has resulted in us providing feedback on O&M contracts and negotiations. This has allowed an assessment of overlaps as well as gaps in the operational set-up.

Despite being clearly labelled in many O&M contracts, active monitoring is often not executed to the full extent. On a utility-scale, there is a very real need and desire to automate the monitoring activity.

Due to the way PEAK is set up, it is possible to achieve two goals, automated monitoring and advanced data analysis of monitoring data, through one action. It makes sense for us to offer automated monitoring and for our clients to reap the benefits of this logical extension of the service for plant efficiency optimization at the fundamental level, which includes:

- Data quality improvement, after a process of data cleansing
- Optimum PEAK prescriptive analytics results, due to the aforementioned data cleansing
- All-encompassing reporting: monitoring and data analytics in one and from one provider
- Time-efficient: O&M team freed up from time-consuming manual monitoring tasks
- Further reduced O&M costs: renegotiation of scope

In practice

This section provides two case examples for both on-site and off-site O&M monitoring.

Case 1: 100 MW plant, in-house O&M team on-site

This case is applicable for a number of our clients in India, where plant sizes are larger and in-house and on-site O&M teams are usual.

This 100 MW plant requires:

- 8 technicians working 4.5 months per O&M check cycle
- a total annual O&M cost of 280,000 EUR

The automated monitoring benefit relates, in this case, to the physical monitoring team, consisting of at least 2 technicians for 24/7 monitoring, causing annual costs of approx. 33,000 EUR. This can be reduced by at least -75% down to 8,250 EUR, as a direct result of the automated monitoring.

This has to be seen in addition to the original PEAK analytics offering, which, taking into consideration the benefits of automated monitoring covered under PEAK, as listed previously, enhances the analytics side further, in turn optimizing the benefits already provided:

- the O&M team would focus their time and energy on inspecting and repairing the strings based on cause-related PEAK recommendations and the successful repair is subsequently verified by PEAK
- O&M cost saving of -70% (down to O&M costs of 84,000 EUR)
- swift performance restoration and electricity generation performance improvement of 2-4% in most cases.

The annual PEAK fee amounts to 150,000 EUR (assuming 1,500 EUR/MW and year).

Therefore, using PEAK for automated monitoring as well as prescriptive analytics results in the following total benefits:

Cost / Benefit + Payback period

O&M savings	Monitoring savings	Annual savings
O&M cost: 280,000 EUR/yr - PEAK-reduced O&M cost: 84,000 EUR/yr = O&M savings: 196,000 EUR/yr (-70%)	Monitoring cost: 33,000 EUR/yr - PEAK-reduced monitoring cost: 8,250 EUR/yr = Monitoring savings: 24,750 EUR/yr (-75%)	O&M savings: 196,000 EUR/yr + Monitoring savings: 24,750 EUR/yr + Electricity generation improvement (2%)* 342,000 EUR/yr = Annual savings: 562,750 EUR/yr
Payback Period		
= PEAK Fee cost / Annual savings = 150,000 EUR/yr (100 MW x 1,500 EUR/MW/yr) / 562,750 EUR/yr = Payback period of 3.2 months		

Case 2: Plant portfolio > 100 MW (plant sizes 1-10 MW), outsourced O&M team off-site

This case is applicable for a number of our clients in Europe, where plant sizes are smaller and portfolios are made up of large numbers of disparate sites managed by outsourced, off-site O&M teams.

PEAK for automated monitoring and prescriptive analytics provides the benefits described in Example 1 as well as, and more specifically, the following scope items, which can be shifted from the external O&M service provider to PEAK:

- Automated remote monitoring and meter-reading (for PPA accounting) by PEAK (24/7)
- Reporting → one comprehensive report based on client needs instead of separate reports from O&M and PEAK
- Instead of scheduled and preventive maintenance (and carrying out random checks), the external O&M service provider should perform PEAK-focused inspection and repair following the cause-related PEAK recommendations, including a repair success verification by PEAK.
    - Since the external O&M service provider is off-site, the inspection and repair issues are "collected" for site visits. Cost/benefit analyses ensure a timely, as well as cost-effective and efficient working basis (unnecessary additional travel and maintenance costs are kept to a minimum). Preventive maintenance activities are still executed,

* additional revenues assuming electricity generation performance improvement of 2%, specific irradiation of 1,900 kWh/kWp and PPA level of 0.09 EUR/kWh

but reduced in frequency (e.g. every 2-3 years instead of every year) and customized to the individual needs of the plants

- PEAK RADAR service (prescriptive analytics), including also guidance for grass cutting and cleaning
- The external O&M service provider's job is the on-site fault analysis for the root cause and verification of fault cause based on PEAK insights provided by Alteso (in the form of a checklist).
- PEAK Energy Forecasting (if required by the client)

The above would allow a reduction of the O&M contract costs by -45%. Assuming initial O&M contract costs of 6,500 EUR/MW and year, resulting in 650,000 EUR for 100 MW, a reduction of -292,500 EUR is achievable. Similarly to Example 1, the results are swift performance restoration and electricity generation performance improvement of 1-3% in most cases for Europe.

Cost / Benefit + Payback period

O&M savings	Electricity Generation Improvement	Annual savings
O&M cost: 650,000 EUR/yr - PEAK-reduced O&M cost: 292,500 EUR/yr = O&M savings: 357,500 EUR/yr (-45%)	Electricity generation improvement (1%) 180,000 EUR/yr	O&M savings: 357,500 EUR/yr + Electricity generation improvement ** (1%) 180,000 EUR/yr = Annual savings: 472,500 EUR/yr
Payback Period		
= PEAK Fee cost / Annual savings = 150,000 EUR/yr (100 MW x 1,500 EUR/MW/yr) / 472,500 EUR/yr = Payback period of 3.8 months		

Whilst we, as well as our clients, are convinced that monitoring and data analysis should be automated, the approach per plant and client must also be customized – this is Alteso's and PEAK's strength.

Similar cases, on varying scales, geographies and with varying themes are also expanded upon in our recent white paper. At the time our focus was predominantly on the benefits of prescriptive analytics; however, the white paper provides a good introduction to the subject and the concept of reducing OPEX through changing the traditional asset management structure to include data analytics and, in turn, optimize performance.

To find out more about PEAK and what advanced data analysis can do to improve your PV assets visit our website: www.alteso.at

**additional revenues assuming electricity generation performance improvement of 1%, specific irradiation of 1,200 kWh/kWp and PPA level of 0.15 EUR/kWh