Telecontrol systems for renewables: from systems to services

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Abstract

Investments for renewable energy plants are mostly focused on plant realization but operation and maintenance are also a crucial issue. Performance of the plants is strictly related to a well-performing O&M. Now, more than ever, Owners of renewable energy plants need to operate and maintain the plants reducing as much as possible the related operational costs.

This article describes a new approach where the added value to be proposed to plant owners is not a system to monitor & control the plants but a value added service. In this new scenario, plant owner do not need to take care of maintaining the system itself and can get benefits from an Operations & Maintenance (O&M) system without huge investments but just paying for a yearly based service. This approach lets also the owners of small plants to benefit of such service, where a system investment is not justified. In this way companies can propose a new service based approach to the clients and a new portfolio of added value services to the customers.

Introduction

Today, the justification of plant budgets is not only based on engineering criteria related to Operation and Maintenance (O&M), but they have become increasingly more focused on Return on Assets (ROA).

The primary task of asset management is to reduce costs by identifying performance problems, improving predictive maintenance, extending asset lifecycles, and most of all, developing solid business plans for investments. This requires services for lifecycle costing, which implies cost minimization starting with the initial investment, continuing through the lifecycle of the equipment, and ending with recycling or evolution to the next equipment generation. These services typically consist of:

- Monitoring the condition and identifying performance problems of assets.
- Reducing downtime by predictive maintenance
- Optimizing asset lifecycles and evaluating the impact of asset failure.
- Having access to service engineers and product experts.
- Ensuring compliance to safety and security regulations.

Using state-of-art automation, web and cyber security technologies, it is possible to offer and implement such services from remote Service Centers. Such remote services optimize the operation and maintenance activities by providing proactive solutions which avoid production downtime and improve performance. Remote services also

provide significant benefits by making it possible to connect the best (or most familiar) service engineers to the customer quickly and determine the necessary actions efficiently. The benefits of an on-site visit are extended. This paper illustrates basic aspects and advantages of remote Service Centers for renewable energy plants.

Services

This section briefs some of the services that can be offered to the customers.

Remote plant maintenance

Remote monitoring and plant maintenance is an increasing demand, specifically for unattended or remotely located power plants. The Remote Service platform is connected to fleet of remote renewable energy plants and collects real-time process data, handles alarm and failure detection, provides data reporting and ensures that the plants are meeting their performance targets.

In addition to guaranteeing the plant performance ratio, this service has a number of compelling benefits, which explain its rapid impact on the PV market. The PV plants are monitored from dedicated remote PV Service Centers, which use high-speed and secure data transmission connections and are manned solely by accredited technicians. Besides collecting and storing real-time and historic data on all critical plant equipment, the service continuously analyzes the data and monitors the KPI's to ensure the plant is operating at its stipulated performance ratio. If the plant isn't meeting its production target, an engineer at the Service Center is automatically informed, and then performs a detailed diagnosis to identify the cause of the problem. The Service Center can then rectify the problem by remote, or dispatch a service team to the plant if necessary.

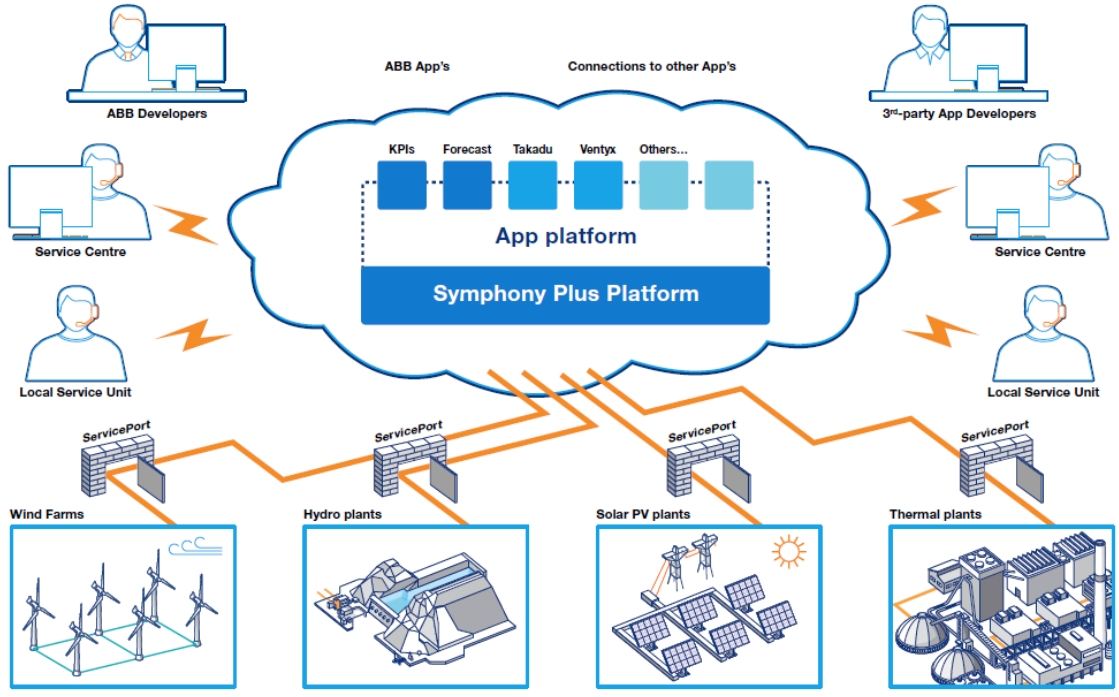

Figure 1 General architecture of the Remote Service Center for Renewable Plants.

The benefits of remote maintenance are:

- Online remote monitoring of plant KPI's improves plant performance.
- Avoiding penalties due to low-performance.
- Fast response when emergency support is needed.
- Automated diagnostic tools and remote experts reduce resolution time.

- Analysis possible across a plant fleet.

Production and performance cockpit(s)

Business applications, such as Performance Ratio Monitoring, Equipment Condition Trending, Fleet Analysis, etc. are shown in dedicated dash boards of the web portal.

These business applications belong to the Business Intelligence (BI) layer implemented in the Service Center and are value added features for the Service Center. One of the key applications for renewable energy plants is the energy production forecast.

Renewable energy is a valuable resource in order to respond effectively to national obligations following the Kyoto protocol and the shortage of domestic sources. In order to reduce the high costs of energy imbalance that is inevitably produced from renewable sources, as non-programmable, to the system of the electric network, an energy production forecasting tool becomes increasingly important. The comparison between the ideal and the real energy production enables continuous improvement of the maintenance strategy and actions.

Production forecasting

The production forecasting tool is based on automatically received data from a high-resolution weather forecast provider. The information is processed by the tool, that focuses its analysis on the most significant parameters of the weather forecast (e.g. for PV, the solar radiation, temperature, etc.) and on the plant configuration. The result is the forecast of energy production within the next 24 hours. The system is based on self-learning algorithms (neural networks and nonlinear/linear system modeling). As the data stored in the database increases day by day, the margin of forecasting error decreases. Furthermore the forecast data (stored in the database) are ready for the transmittal every day to the grid operator.

Health check of equipment

Equipment health check consists of Fingerprint diagnostics. These services identify equipment performance and reliability issues through data collection and analysis. Fingerprints generate both a system benchmark and an improvement plan which can be delivered either on-site or remotely, using the Remote Service platform. Fingerprint tools are available for a variety of plant equipment, for example:

- for the automation system and related software or hardware components;
- for cyber security settings;
- for electrical process equipment;
- for mechanical process equipment.

Based on the fingerprints, improvement recommendations are determined and scheduled for implementation, to start a continuous optimization process. Improvements may be completed all at once or scheduled to be completed incrementally over a period of time. In either case, the implementation ensures that changes can be made and maintained remotely with steady progress toward the performance goal.

Reporting, alarms, and notifications

The Remote Service platform stores data of renewable energy plants and the web portal uses these data to automatically generate specific reports, such as:

- Production reports.
- Interventions and Operators' actions reports
- Operations & Maintenance log book
- Executive level reports with information necessary to manage the plants.
- Business analysis level reports.

- Predefined reports with structured information.

Besides alarms from the plant, the system can also generate new alarms defined by the customer, like “Low KPI Value”, generated by an agent or a calculation on the stored data.

Geographical maps aggregate the information at different zoom levels and provide intuitive monitoring of the entire generation fleet, showing the geographic location of the renewable plants using icons. A list of available plants with dynamic traffic lights and icons summarizing the following information can be configured:

- Contractual KPI's status (e.g. production KPI).
- Presence of open maintenance tickets.
- Status of the connection to the ServiceGate/Port.

Remote and secure access

The customer can access his own plant data through a web browser (Office PC, private Laptop, mobile device, etc.) and he can manage all plants from the same web portal. The login provides different levels of authorization based on roles defined in IEC-62351, for example:

- *Service Manager*: can assign plants for maintenance.
- *Administrator*: can use all functions and tools.
- *Operator*: can operate at plant level (by inserting the O&M activities/actions in charge).
- *Engineer*: can operate the plant and can modify the configuration details of the plant.
- *Intervention Planner*: can plan all O&M interventions, and can read all other functions.

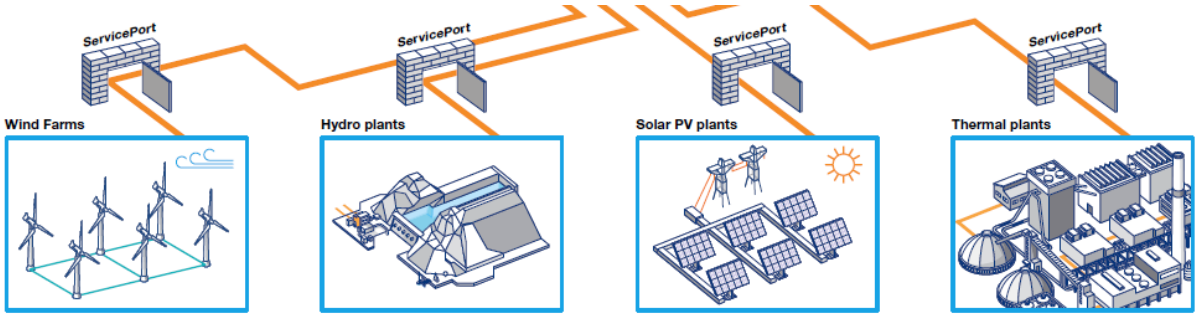

Figure 2 Remote and secure access infrastructure to ensure the protection of data.

The remote site and the Service Center perform two-way authentication prior to initiating communication. To provide end-to-end security, Remote Service utilizes standard secure communication protocols with encryption. The customer can set granular permission on remote activities. Such activities include data collection, desktop sharing and file transfer. Secure data transmission begins at the source, with control over the types of data being collected for transmission. The Remote Service platform is configurable, in that data access can be enabled or disabled based on the asset owner's security policy.