



## Developing Technologies for Operation and Maintenance Services

# Analytics and Diagnostics Reporting for Storage Systems

The amount of power generated from natural energy sources such as sunlight and wind can fluctuate widely depending on the weather or time of day. Consequently, as large-scale adoption of solar and wind power progresses, this could conceivably impact the stability of the power grid. Utility-scale energy storage systems (ESS), known for their responsiveness and bidirectionality of output, are anticipated to help with averting supply-demand imbalances and providing dispatchable power.

In addition to its offering of stationary lithium-ion storage battery installations (●Fig. 1), GS Yuasa is now offering a new maintenance service —STARELINK. STARELINK, which is a combination of mimamoru, to watch over (STARE) and tsunagaru, to connect (LINK), brings together predictive-preventive maintenance and remote monitoring technologies. This article summarizes the STARELINK service which allows for comprehensive monitoring of the ESS and introduces the technologies therein involved in automatic analytics and diagnostics reporting, for example, for the operation status and deterioration condition of the ESS

### 1. Overview of the STARELINK Service

The STARELINK service (●Fig. 2) collects measurement data on the ESS storage batteries via a network and accumulates the information on a cloud server over time. Thus, detailed status of the storage batteries, e.g., the state of charge (SOC) or the temperature can be monitored remotely via a browser.<sup>1</sup>

Information may be arranged hierarchically in the browser to allow a user to drill down from a map of the entire facility to the cell of a battery module while the status is presented. This allows for prompt identification of a problem area when there is an anomaly in the ESS, including when there is a breakdown or defect.<sup>2</sup>

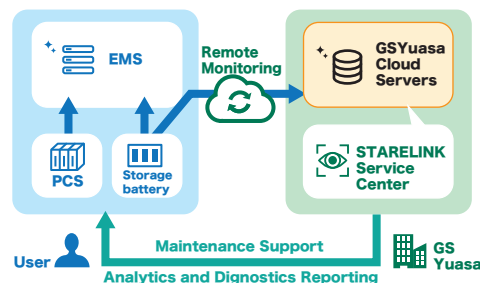
The STARELINK Service Center carries out periodic inspections of the ESS and schedule parts replacement. The STARELINK Service Center also provides maintenance support and repair and restoration when there is a malfunction. Remote monitoring allows for prompt discovery of abnormalities and subsequent repair and restoration, and thereby supports reliable operation of the ESS.

Furthermore, the cloud-based accumulation of data on the cell level creates large volumes of data. This big data becomes the basis for providing operation status analytics reports or deterioration diagnostics reports for the storage batteries at predetermined times.

●Fig.1 Stationary Li-ion Storage Battery Installation



●Fig.2 STARELINK Service



## 2. Battery Operation Status Analytics Reporting

The STARELINK service creates reports that include analytics of the operation status, e.g., charge-discharge power, temperature, and alert status, and provides these reports on a monthly or yearly basis. ●Figure 3 depicts an example of results of analyzing charge-discharge power. Analysis is performed by a computer.

A customer-specific report is then automatically created on the basis of customer information and measurement data accumulated on the cloud server over a prescribed period. The analytics report features assessments of whether the log of measurement data is within a normal range, and messages based on the assessment results.<sup>3</sup>

The analytics report allows for timely understanding of the operation status of the ESS, i.e., charge-discharge power or temperature of the storage batteries. Moreover, the operations of the ESS can be optimized on the basis of the particulars of the report in cases where the log of measurement data is outside the normal range.

## 3. Battery Deterioration Diagnostics Reporting

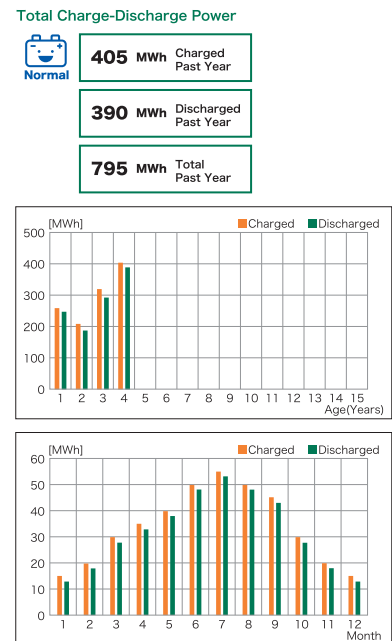
A diagnostics report is a visual representation of the actual value and a future predicted value of the capacity of the storage batteries (●Fig. 4). This report combines the results of a yearly capacity measurement test and the results of estimations and predictions made based on the measurement data captured via remote monitoring.<sup>4</sup>

The capacity of a storage battery degrades as it operates. A computer automatically diagnoses the status of the storage batteries on the basis of the log of measurement data stored on the cloud server and creates the report.<sup>5</sup>

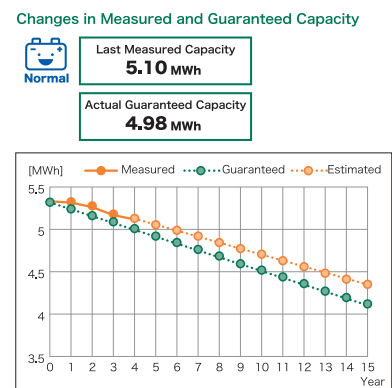
If it is determined from the changes in the future capacity that the capacity may fall below the guaranteed capacity during the warranty period, then the STARELINK Service Center can handle this by exchanging the storage battery, or the like.

This article summarized our new offering —STARELINK— and described the technologies involved in the automatic analytics and diagnostics reporting provided by the STARELINK service. GS Yuasa will continue to pursue additional and high-quality functionality for the safe, secure, and reliable operation of energy storage systems.

●Fig.3 Operation Status Analytics Report



●Fig.4 Deterioration Diagnostics Report



1. [https://www.gs-yuasa.com/en/technology/making\\_history/pdf/no19.pdf](https://www.gs-yuasa.com/en/technology/making_history/pdf/no19.pdf)  
 2. [https://www.gs-yuasa.com/en/technology/making\\_history/pdf/no24.pdf](https://www.gs-yuasa.com/en/technology/making_history/pdf/no24.pdf)  
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 5. Japanese Patent No. 6904380 (Filed in 2019)