

PV-Hybrid System Data Visualisation Recommendations

A handbook for operators of PV-Hybrid Systems and Mini-Grids

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Executive Summary

PV off-grid systems play an important role in rural electrification, with the capacity to power up applications across a wide power range from several watts up to the megawatt range. The remoteness of off-grid system locations means maintenance is costly. Therefore, data logging is valuable to supervise the system and reduce operation and maintenance costs. Modern power electronic devices often offer a built-in data logging service which can reduce the costs to monitor the system significantly.

This work presents a standardised data visualisation form for battery based PV Hybrid off grid systems. It is applicable for lead-acid and lithium-ion battery based systems. The data visualisation displays the battery data and provides a fast and efficient overview on the system behaviour and battery condition. With the help of a standardised data format and visualisation, it is very easy to compare different systems. It is also possible to compare different years of operation of one system and to identify changes, increases in the load demand or loss of performance. This helps to improve the system, the energy management and to increase the lifetime of the battery. All these aspects can reduce the operating costs of the system. The visualisation summarizes the profile of the battery voltage, current and daily amp-hour usage and the corresponding minimum and maximum values as well as calculating mean values and standard deviations for lead-acid and lithium-ion based battery PV Hybrid off-grid systems.

Battery usage diagrams picture the condition of the battery and provide an in-depth look at the functionality of the state of charge algorithm. All battery data are displayed as raw data so the visualisation can be used for lead-acid and lithium batteries. However it is more difficult to estimate the rest capacity of lithium-ion batteries based on the voltage behaviour compared to lead-acid batteries. Several statistically relevant histogram functions show a detailed picture of the usage of the system. This allows us to evaluate the system status.

Additionally, a detailed visualisation of the temperature data is provided. The temperature has a significant influence on the battery lifetime. In combination with the general data visualisation, a detailed look to the system is available. The standardised visualisation aims to fit on one page to make easy comparison possible.

Highlights:

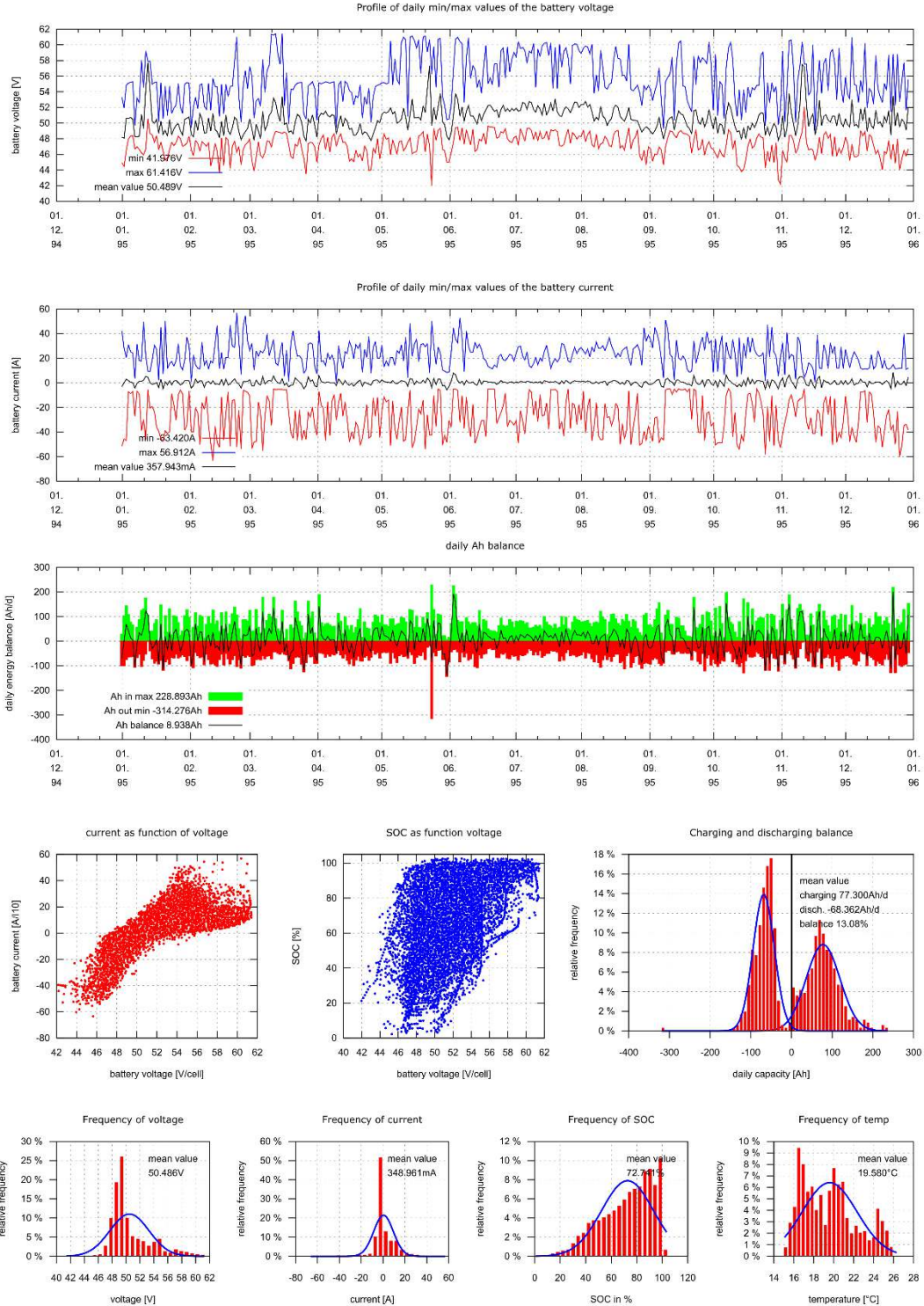
- Standardised data visualisation
- Easy to use
- Fast overview on many system
- Standardised comparison among different systems
- Comparison of different years in the same system

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The following figures show an exemplary sample visualisation:

Energy self-sufficient house, Freiburg Germany



by Micha 2016