ADON RENEWABLES

Adon EMS

(Energy Management System)

Our team at Adon Renewables has developed our own in-house Energy Management System software. When you purchase an **Adon PowerBox** battery, you will have peace-of-mind knowing your system is running at top efficiency.

Adon EMS saves you time and money by notifying you when issues arise, and it smooths out demand spikes through peak shaving.

Cloud Accessible

Respond Quickly to Emergencies

Mobile Notifications

Significant Energy Savings

Net Metering Revenue Capability

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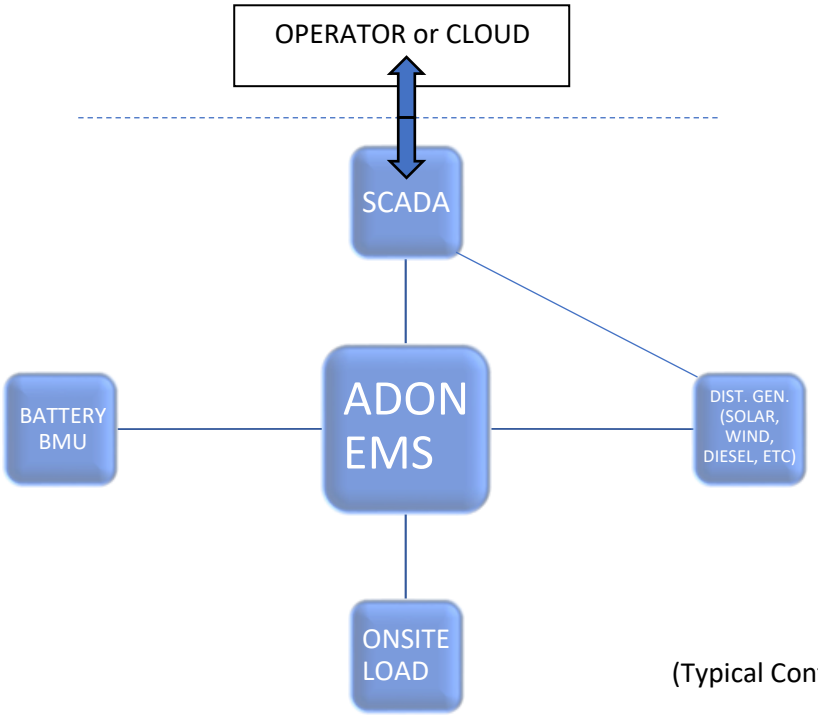
General Overview

Our Adon energy management system (EMS) provides monitoring and control of battery energy storage systems (BESS). The EMS pushes data from the battery system to either the onsite SCADA system or the cloud. Adon EMS provides the Operator real-time status information operation and state of the battery Operators need to make informed decisions. Additionally, the EMS can receive instructions from the Operator for various dispatchable and remotely configurable advanced grid support functions. Communications can be either RS485 or TCP/IP. EMS data is crucial in helping quickly diagnose system maintenance issues as well as evidence for any equipment warranty claims.

The EMS also may be additionally configured to:

- Dynamically operate or curtail other onsite generators
- Act as the Operator in the event communication with the Operator is lost
- Operate the site in a stand-alone mode
- Provide demand response, provide time of use controls, manage power flow to prioritize energy use from a particular source
- Provide four-quadrant Utility grid-services or supplemental services to offsite systems (both DC and AC services)



(Typical Configuration)

Monitoring Functions

The EMS will obtain the cell and rack operation data from the BMS, and the operation parameters from the solar inverters, PCS, DC-DC converter, and energy meter. It also provides a user interface and graphical plots of the battery power, load, and net-load. A sample graphical plot and system parameters are provided below. The followings are the parameters that EMS monitors.

PCS:

- L1 AC Voltage (V)
- L2 AC Voltage (V)
- L3 AC Voltage (V)
- L1 Current (A)
- L2 Current (A)
- L3 Current (A)
- L1 AC Power (KW)
- L2 AC Power (KW)
- L3 AC Power (KW)
- Total AC Power (KW)
- Reactive Power (KVAR)
- PCS Potential Power (KW)
- Active Power Control Status
- Current Frequency Response Mode
- DC Voltage (V)
- DC String Current (A)
- DC String Power (KW)

Battery:

- Battery SOC (%)
- Battery SOH (%)
- Battery Max Charge Current (A)
- Battery Max Charge Voltage (V)
- Battery Max Discharge Current (A)
- Battery Min Discharge Voltage (V)
- Battery DC Voltage (V)
- Battery DC Current (A)
- Battery Alarm Status
- Basic Status
- Battery DC Power (KW)
- Battery Request Balance Charge Mark
- Battery Charge Forbidden Mark
- Battery Discharge Forbidden Mark
- Battery Request Force Charge Mark
- Battery Switch Value Indicate
- Battery Sleep Status
- Battery IDLE Status
- Battery Charge/Discharge Status
- Battery Cell Max Temperature
- Battery Cell Min Temperature
- Battery Cell Max Voltage
- Battery Cell Min Voltage
- Battery Cell Max Temp. Addr.
- Battery Cell Min Temp. Addr.
- Battery Cell Max Voltage Addr.
- Battery Cell Min Voltage Addr.
- Battery Module Max Temp.
- Battery Module Min Temp.
- Battery Module Max Voltage
- Battery Module Min Voltage
- Battery Module Max Temp. Addr.
- Battery Module Min Temp. Addr.
- Battery Module Max Voltage Addr.
- Battery Module Min Voltage Addr.
- Container Temp.
- Battery Cycle Times

Other Distributed Generators (PV, wind, diesel, etc):

- DG Source Power (KW)
- DG Source Status

Total Site (optional):

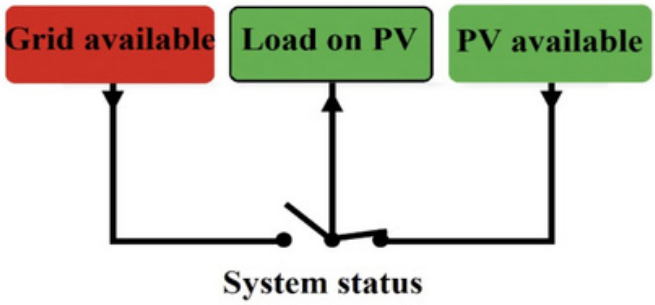
- Individal Load (KW)
- Net Load (KW)
- Net Reactive Power (KVAR)

Control Functions

Adon EMS can be custom configured to align with variety of desired client outcomes. The following are some available EMS software applications:

Off-grid Application:

The EMS can operate as a “micro-grid” in an “stand-alone” mode either as a backup to another energy source (such as a utility grid) or completely “off-grid” where the Adon EMS acts as the primary energy service provider. A graphical user interface as shown in the example below gives operators a quick indication of the status of their particular site.



System status

The EMS can be configured to dynamically control both loads and other generators to prioritize certain client outcomes in complex micro-grid scenarios, such as:

• Minimize site operation disruptions due to loss of a primary energy source (e.g. utility or primary generator outage)

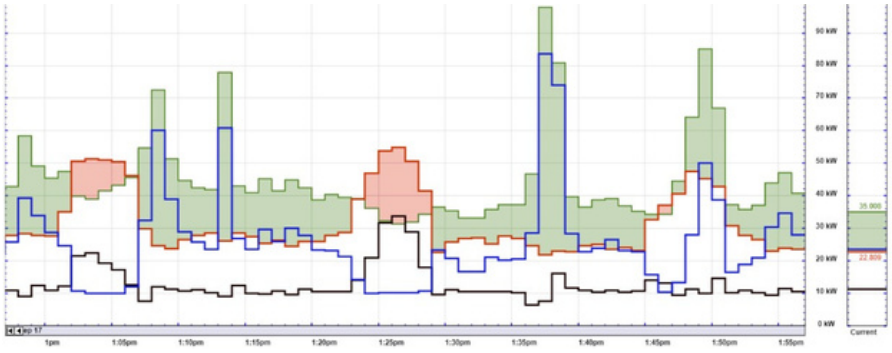
• Maximize resiliency by shedding load, coordinating other distributed generation, and using weather look-ahead/load forecasting to maximize system uptime during potentially long disruptions in primary services.

• Maximize efficiency of traditional backup generators with constant loading

• Maximize energy cost savings while keeping a set energy reserve for emergency backup.

Self-Consumption Application:

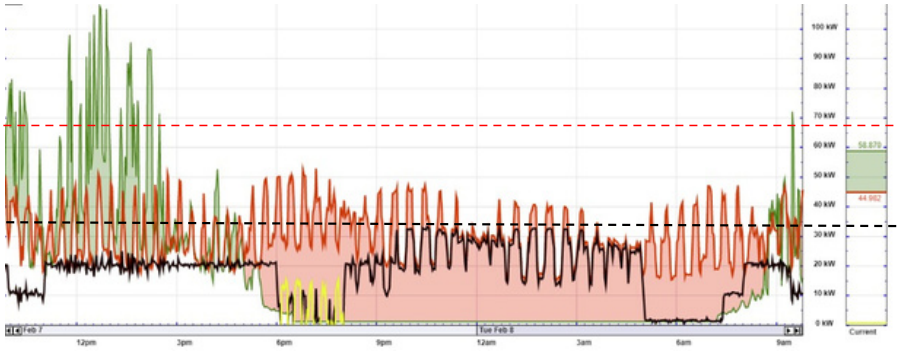
With renewables connected in parallel to the grid, **Adon EMS** manages the State of Charge (SOC) of the battery to ensure that the SOC of the battery is large enough to meet the commitment to the local utility while attempting to avoid exporting excess power to the grid. Some of the parameters of the solar systems are given below:



Load (red), net-load (black), battery charging power (blue), and solar generation (green)

Demand Response Application:

Adon EMS estimates potential load and generation to reduce peak demand and flatten both load and renewable energy impacts to the grid at the point of interconnection. The chart below is from an Adon project on Oahu demonstrating a 40% reduction in kW demand:

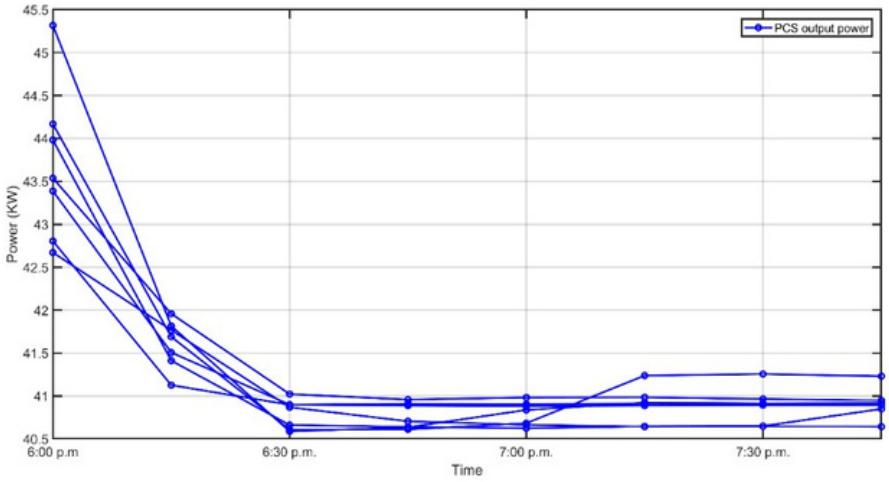


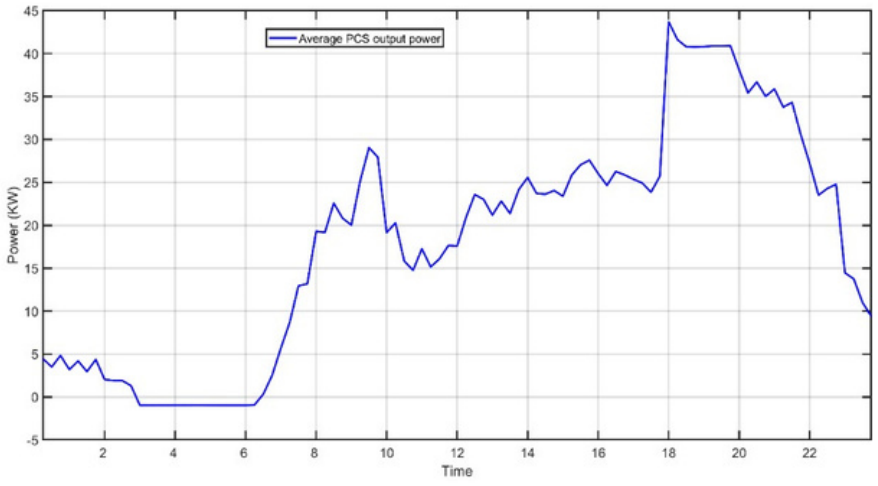
Load (red), net-load (black), solar generation (green)

Demand w/o Adon (red dashed), Demand w/ Adon (black dashed)

Active Power Grid Support Application:

Adon's EMS currently plays a vital role in supporting the local utility during peak demand hours from 6:00 p.m. to 8:00 p.m on Oahu. In exchange, the HECO battery bonus program pays the Operator per KW for guaranteed dispatch during these peak hours. Adon's EMS ramps output according to HECO rules just prior to the scheduled time and holds output steadily above the required committed kW delivery continuously for the two hour duration each day:





Other Applications:

Fixed PF / Fixed Q / Volt-Var / Volt-Watt / Freq-Watt / V-Watt / F-Watt