

# Adaptive Battery Control (ABC)

## Quick Start Guide

The EMS is an advanced energy optimization system designed for small business installations combining solar PV, battery storage, and grid connection. It continuously analyzes forecasts, electricity prices, and consumption patterns to operate the system in the most cost-effective and profitable way.

## Main Dashboard Overview

The main dashboard provides a real-time snapshot of system operation. It shows current solar generation, site consumption, grid exchange, battery power, and state of charge (SoC). The system dynamically adjusts these flows based on optimization logic and real-world deviations.

## Schedule Tables

### Left Table – Operational View

This table provides a rolling 6-hour window centered around the current time. It allows operators to quickly understand past behavior and immediate upcoming actions.

### Right Table – Planning View

This table displays the full 48-hour optimization schedule (192 intervals at 15-minute resolution). It combines historical actual data and future planned actions.

- Battery: + charging / – discharging
- Grid: + import (buying) / – export (selling energy)
- Solar: always positive (generation)

# Charts

## Energy Distribution (Pie Charts)

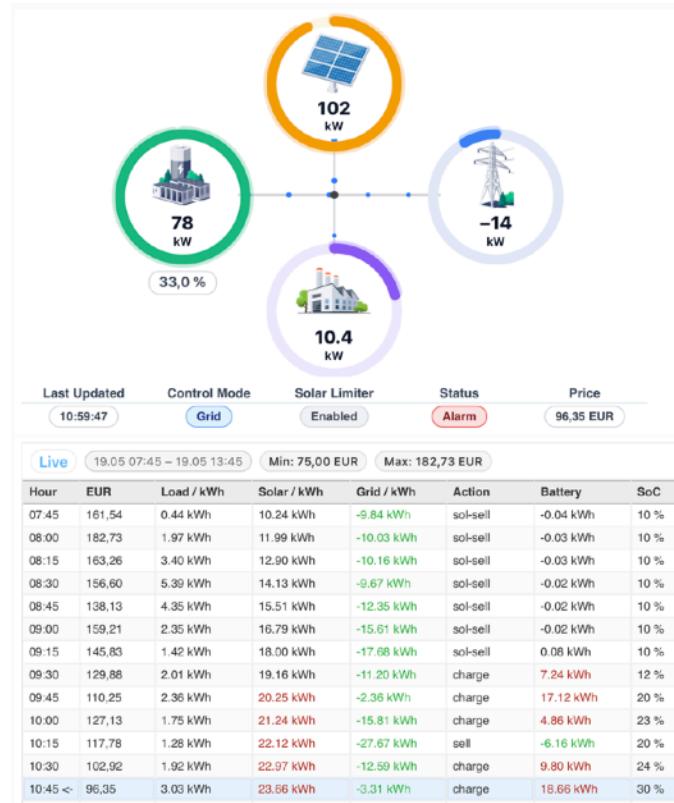
The pie charts provide a quick overview of how energy is generated and consumed within the system.

- The top chart (Generation) shows where energy is coming from (e.g. solar, battery, grid).
- The bottom chart (Consumption) shows how energy is being used.

A set of buttons allows switching between time views:

- Today (past)
- Today / Tomorrow (forecast & plan)
- Monthly view

This enables users to quickly analyze both short-term performance and long-term trends, and verify that the system is operating profitably



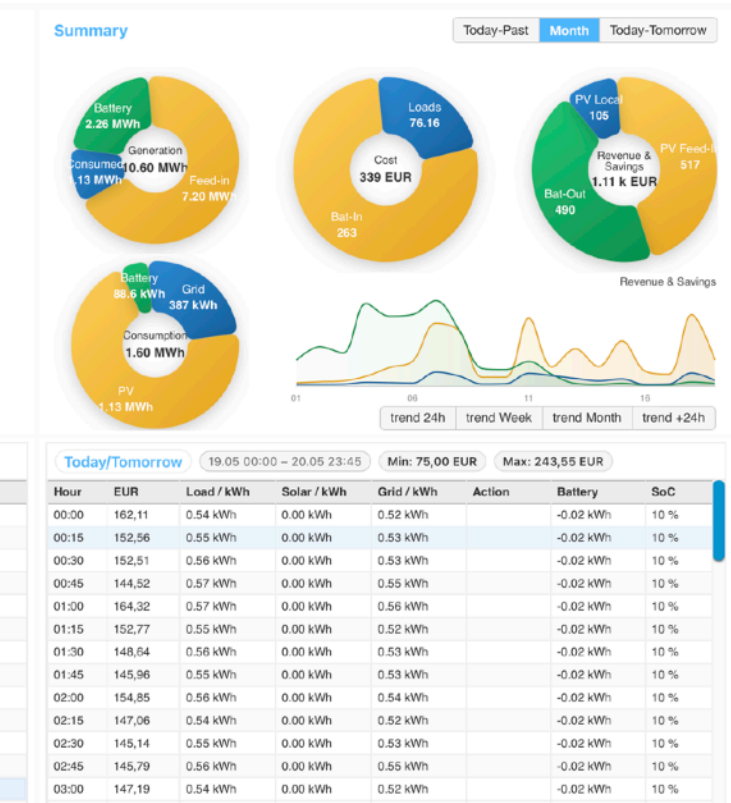
## Cost & Revenue Analysis (Pie Charts)

The financial performance section is visualized through dedicated pie charts. The Cost chart shows how purchased energy is utilized, including:

- Energy consumed by site loads
- Energy used for battery charging (Bat-In)

The Revenue & Savings chart shows the financial benefits generated by the system, including:

- Revenue from PV energy exported to the grid (PV Feed-In)
- Savings from locally consumed photovoltaic production (PV Local)
- Battery discharge contribution (Bat-Out), which may represent either locally utilized energy savings or exported energy revenue, depending on operating conditions



# Settings

The Settings page allows configuration of system limits and operational parameters, including:

- Grid maximum power limits
- Battery charge and discharge limits
- Target SoC (minimum battery reserve)
- Battery cycles (daily limit)
- Enable/disable battery control and solar limiting

If it is set higher than the current battery level, the EMS will immediately begin charging, even during less favorable price periods, to ensure the required reserve is met. This is particularly important for backup (UPS) functionality

Solar Limiter enables or disables the system's ability to limit PV production when required (e.g. due to grid constraints or unfavorable market conditions)

### Control Limits

**Grid Max** 0 kW  200 kW **170 kW**

**Bat Charge Power** 0 kW  100 kW **80 kW**

**Bat Discharge Power** 0 kW  100 kW **100 kW**

**Target SoC** 15%  100% **15%**

**Battery Cycles (day)** 0  3 **2.0**

Battery Control  On

Solar Limiter  On

### System Specification

Latitude	43.2181°	Longitude	27.8745°
Grid Max	170 kW	Solar System Efficiency	93 %
Battery Capacity	215 kWh	Battery Efficiency	96%
Bat/Charge Power	80 kW	Bat/Discharge Power	100 kW
Target SoC	15 %		
Transm fee-in	14.32 EUR/MWh	Transm fee-out	2.8 EUR/MWh
Trader fee-in	3.07 EUR/MWh	Trader fee-out	6.14 EUR/MWh
Bat.Charge Cost	10 EUR/MWh		

Solar Array 1

When Battery Control is disabled, all battery charging and discharging actions are stopped, and the battery is no longer actively managed by the EMS.

## System Specification

The System Specification section contains fixed system configuration parameters, such as installed capacities and technical limits.

These values are not user-editable and are used by the EMS as a baseline for all calculations and optimization logic.

## Reports

The Reports section provides a structured overview of system performance, energy usage, and financial results over time.

### Report Types

- Daily → summary of each day
- Monthly → aggregated performance over time
- Hourly (15-minute intervals) → full resolution data for in-depth analysis

Reports  Daily  Monthly  Hourly

Year: 2020 Month: 01-01 Apple Export: CSV

Hour	Grid	Solar	Bat	Battery Charging	Battery Discharge	Load (Direct Cost)	Grid Solar/Load Cost	Daily Solar Income	Optimized Cost	Optimized Income	Optimized Cost
2020-01-01	48.71 kWh	131.51 kWh	21.27 kWh	175.32 kWh	39.04 kWh	3.27 EUR	2.84 EUR	-0.94 EUR	1.37 EUR	-4.21 EUR	5.91 EUR
2020-01-02	214.16 kWh	487.34 kWh	-389.71 kWh	243.98 kWh	347.47 kWh	16.42 EUR	7.24 EUR	7.21 EUR	5.74 EUR	32.14 EUR	47.25 EUR
2020-01-03	61.63 kWh	487.79 kWh	-339.26 kWh	249.05 kWh	239.78 kWh	16.38 EUR	6.61 EUR	27.69 EUR	17.54 EUR	17.87 EUR	32.43 EUR
2020-01-04	333.99 kWh	431.31 kWh	-331.32 kWh	421.45 kWh	416.28 kWh	19.38 EUR	8.37 EUR	13.12 EUR	29.94 EUR	58.85 EUR	68.96 EUR
2020-01-05	203.32 kWh	444.81 kWh	-219.21 kWh	512.21 kWh	484.96 kWh	21.36 EUR	16.58 EUR	12.62 EUR	51.98 EUR	51.87 EUR	38.12 EUR
2020-01-06	188.52 kWh	315.23 kWh	-71.55 kWh	522.22 kWh	443.32 kWh	12.44 EUR	8.78 EUR	-0.23 EUR	48.40 EUR	54.79 EUR	24.23 EUR
2020-01-07	61.73 kWh	251.32 kWh	-176.59 kWh	217.62 kWh	202.96 kWh	6.52 EUR	5.12 EUR	3.22 EUR	21.79 EUR	46.47 EUR	28.59 EUR
2020-01-08	58.52 kWh	381.19 kWh	-273.21 kWh	249.85 kWh	276.76 kWh	6.21 EUR	4.42 EUR	6.44 EUR	3.97 EUR	42.79 EUR	31.74 EUR
2020-01-09	213.83 kWh	442.39 kWh	-234.23 kWh	422.42 kWh	423.58 kWh	18.31 EUR	8.11 EUR	6.14 EUR	22.32 EUR	56.49 EUR	48.33 EUR
2020-01-10	239.79 kWh	392.33 kWh	-139.23 kWh	444.62 kWh	434.32 kWh	15.10 EUR	9.45 EUR	3.74 EUR	48.54 EUR	53.33 EUR	43.29 EUR
2020-01-11	231.28 kWh	346.34 kWh	-133.35 kWh	450.27 kWh	470.26 kWh	13.43 EUR	8.74 EUR	2.25 EUR	42.57 EUR	79.38 EUR	42.38 EUR
2020-01-12	153.58 kWh	385.37 kWh	-136.36 kWh	642.71 kWh	537.82 kWh	17.43 EUR	16.89 EUR	6.54 EUR	69.93 EUR	111.20 EUR	43.27 EUR
2020-01-13	122.25 kWh	494.19 kWh	-274.24 kWh	522.92 kWh	510.78 kWh	16.47 EUR	9.48 EUR	6.34 EUR	42.58 EUR	60.33 EUR	37.84 EUR
2020-01-14	58.23 kWh	281.89 kWh	-142.47 kWh	270.52 kWh	262.84 kWh	5.71 EUR	4.05 EUR	-1.21 EUR	16.37 EUR	42.52 EUR	29.58 EUR
2020-01-15	58.27 kWh	285.19 kWh	-139.23 kWh	281.81 kWh	249.27 kWh	5.43 EUR	4.08 EUR	2.89 EUR	12.34 EUR	40.39 EUR	25.44 EUR
2020-01-16	132.59 kWh	436.71 kWh	-333.34 kWh	485.52 kWh	481.58 kWh	13.41 EUR	7.07 EUR	15.94 EUR	35.91 EUR	54.91 EUR	49.33 EUR
2020-01-17	212.79 kWh	574.25 kWh	-337.32 kWh	629.58 kWh	582.26 kWh	9.16 EUR	5.92 EUR	38.02 EUR	56.41 EUR	99.89 EUR	18.71 EUR
2020-01-18	149.53 kWh	483.39 kWh	-296.24 kWh	512.27 kWh	481.17 kWh	13.80 EUR	7.03 EUR	15.48 EUR	38.25 EUR	73.97 EUR	24.94 EUR
2020-01-19	134.32 kWh	346.34 kWh	-119.27 kWh	450.32 kWh	427.24 kWh	16.33 EUR	8.41 EUR	15.45 EUR	44.13 EUR	55.83 EUR	14.39 EUR
2020-01-20	97.39 kWh	322.39 kWh	-113.33 kWh	437.76 kWh	432.36 kWh	19.49 EUR	9.15 EUR	14.44 EUR	49.54 EUR	71.98 EUR	29.59 EUR
2020-01-21	61.24 kWh	126.31 kWh	-121.21 kWh	254.77 kWh	306.56 kWh	7.52 EUR	4.78 EUR	3.69 EUR	17.42 EUR	44.41 EUR	28.93 EUR
2020-01-22	62.34 kWh	116.31 kWh	-125.91 kWh	289.26 kWh	289.27 kWh	6.13 EUR	4.78 EUR	1.29 EUR	21.29 EUR	44.90 EUR	25.73 EUR
2020-01-23	134.32 kWh	99.26 kWh	99.85 kWh	581.45 kWh	552.21 kWh	28.89 EUR	16.43 EUR	6.53 EUR	66.58 EUR	103.35 EUR	25.59 EUR
2020-01-24	139.59 kWh	181.13 kWh	-42.81 kWh	479.28 kWh	437.46 kWh	17.01 EUR	8.33 EUR	1.82 EUR	56.37 EUR	69.89 EUR	22.13 EUR
2020-01-25	139.79 kWh	346.21 kWh	-246.59 kWh	328.74 kWh	286.78 kWh	9.29 EUR	6.23 EUR	5.63 EUR	32.12 EUR	61.82 EUR	32.13 EUR
2020-01-26	148.89 kWh	346.32 kWh	-175.23 kWh	470.22 kWh	368.81 kWh	16.40 EUR	8.12 EUR	7.89 EUR	31.32 EUR	61.93 EUR	36.13 EUR

# Trends

The Trends view provides a detailed visualization of how the system operates over time, combining energy flows, battery behavior, and electricity prices in a single chart.

### Time Ranges

Users can select different time ranges:

- Last 24 hours → historical performance (first chart)
- Custom time window → detailed analysis (first chart)
- +24 hours view → planned future schedule (second chart)

The first chart displays actual historical data, while the second chart shows the planned system behavior for the upcoming period.

