BESS Opportunities

Case Studies by DeVilliers Botha

BESS

A Battery Energy Storage System (BESS) is a system that stores energy to be used at a later time. It provides the opportunity for the following applications:

Risk Avoidance Strategies

Fully off-grid system

Energy is stored and supplied from batteries for prolonged periods of time, when no grid supply is available. Batteries are typically charged using solar power during the day, or generators, and discharged at night.

Backup system / UPS

Energy is stored and supplied from batteries when conventional power provision is interrupted, for periods of between 1 – 4 hours typically. Solar power or generators may be used to top up the batteries to extend the running time of the batteries.

Capacity shortage

In this instance a site can not be developed due to insufficient available grid capacity.

Cost Reduction Strategies

Energy arbitrage

Energy is stored (batteries charged) when energy cost is lowest (either from solar, or at night time), and energy is discharged when energy cost is highest (typically morning and evening times). The difference in cost contributes to a cost saving.

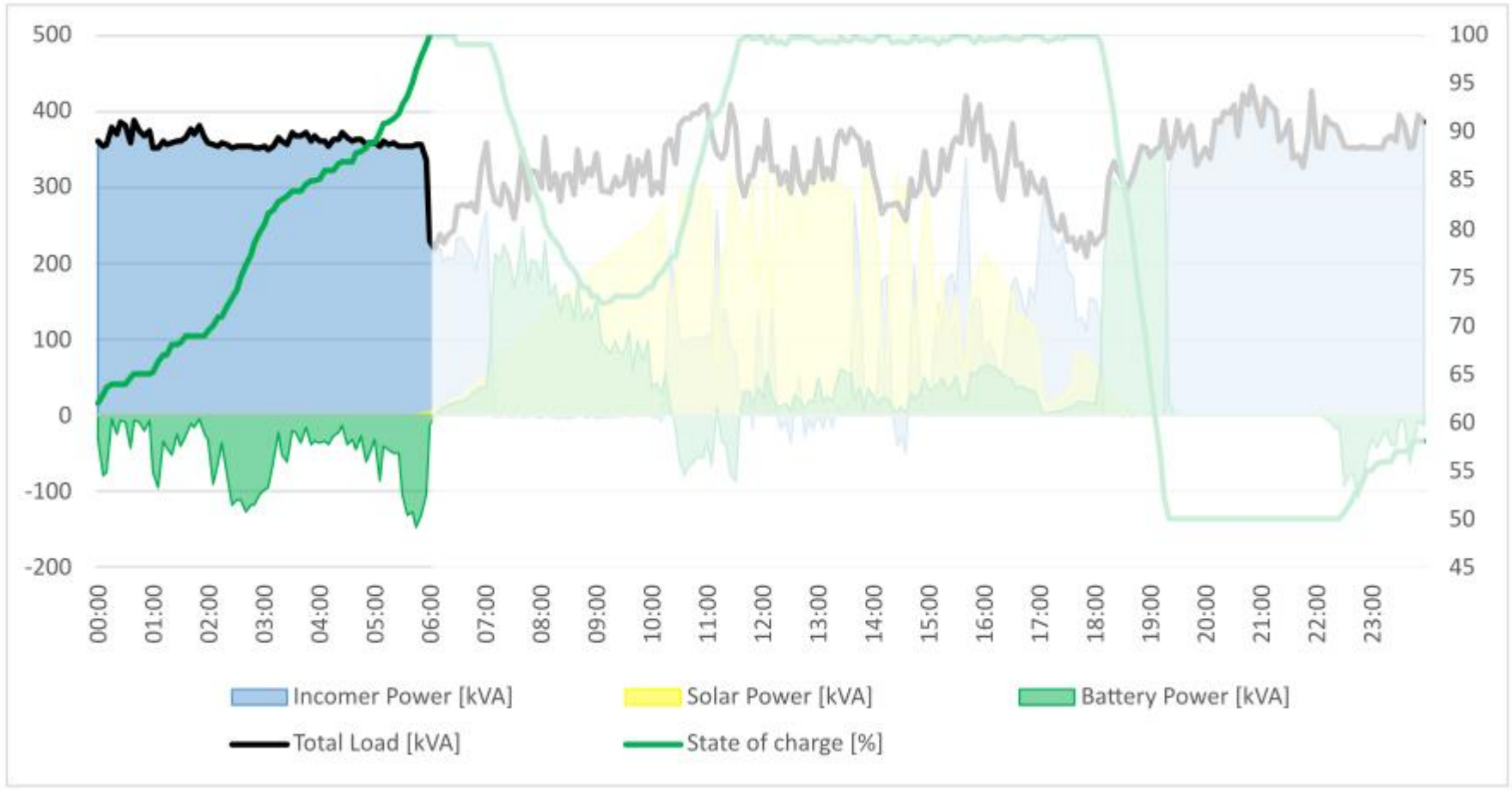
Peak shaving / demand reduction

This method limits energy drawn from energy supplier. Up to a certain level energy will be provided from the grid/council, above the pre-set limit energy will be provided from energy stored. Main application would be to limit / decrease demand charges. Another application would be for limited size connections, to increase behind the meter capacity without upgrading municipal infrastructure.

Globally the energy storage market is growing at a substantial rate as battery technology is highly versatile, scalable, expandable, and can successfully be coupled with renewable energy generation solutions such as Solar PV systems.

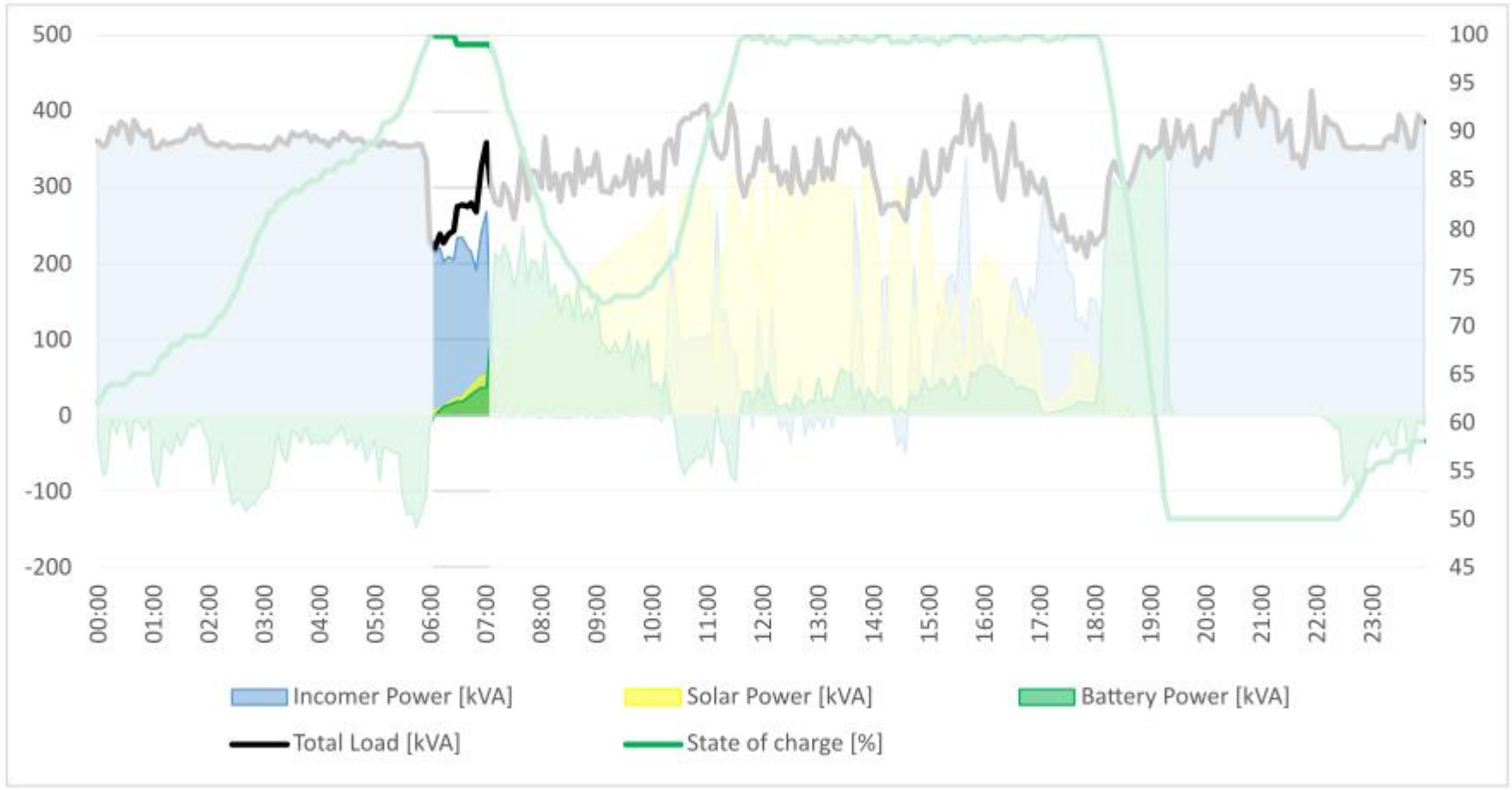
Case Study – Industrial Site - Arbitrage

Off-peak period: charging battery using available capacity from grid



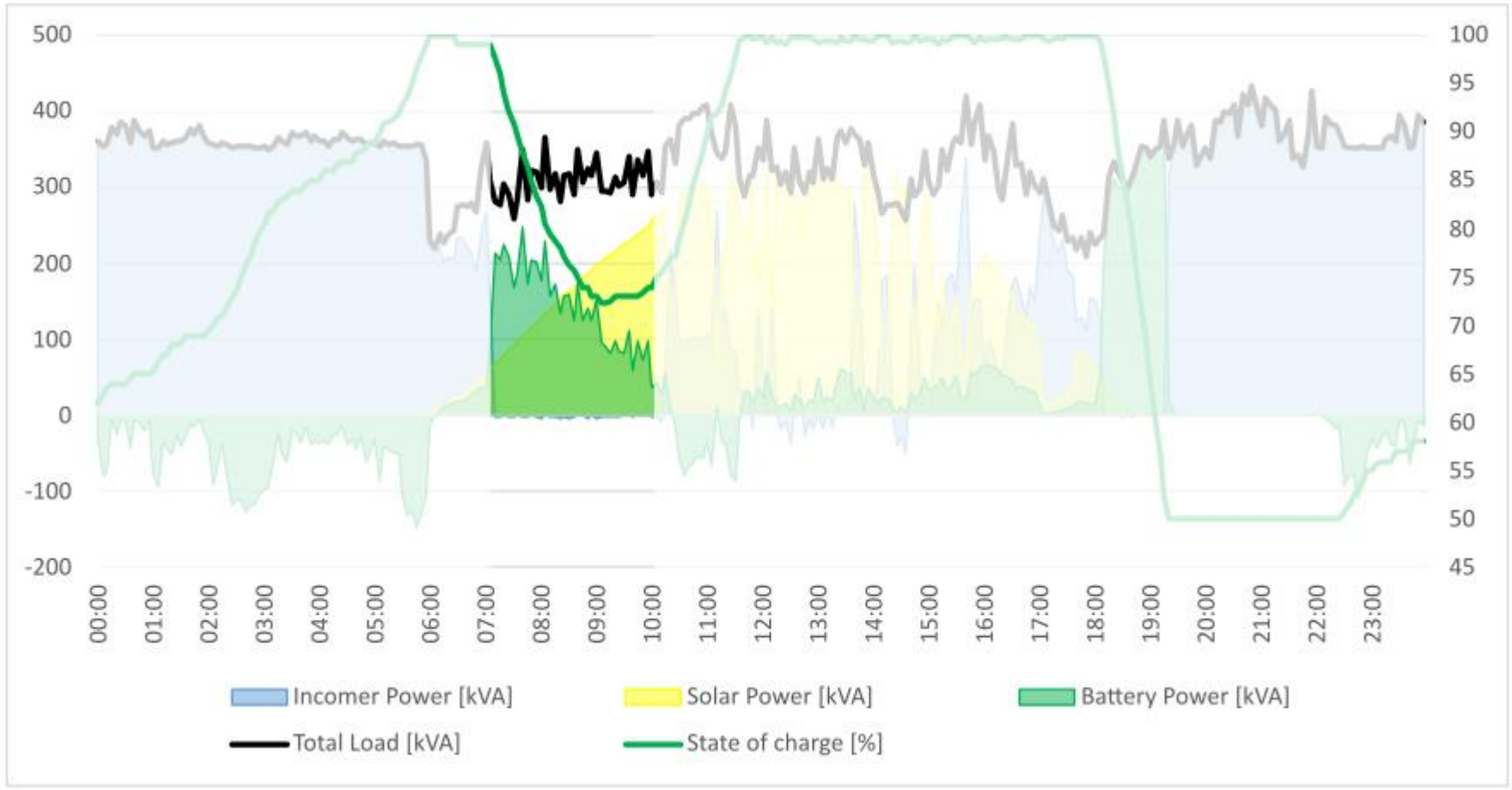
Case Study – Industrial Site - Arbitrage

Standard period: running load from grid, supported by some grid-tied PV



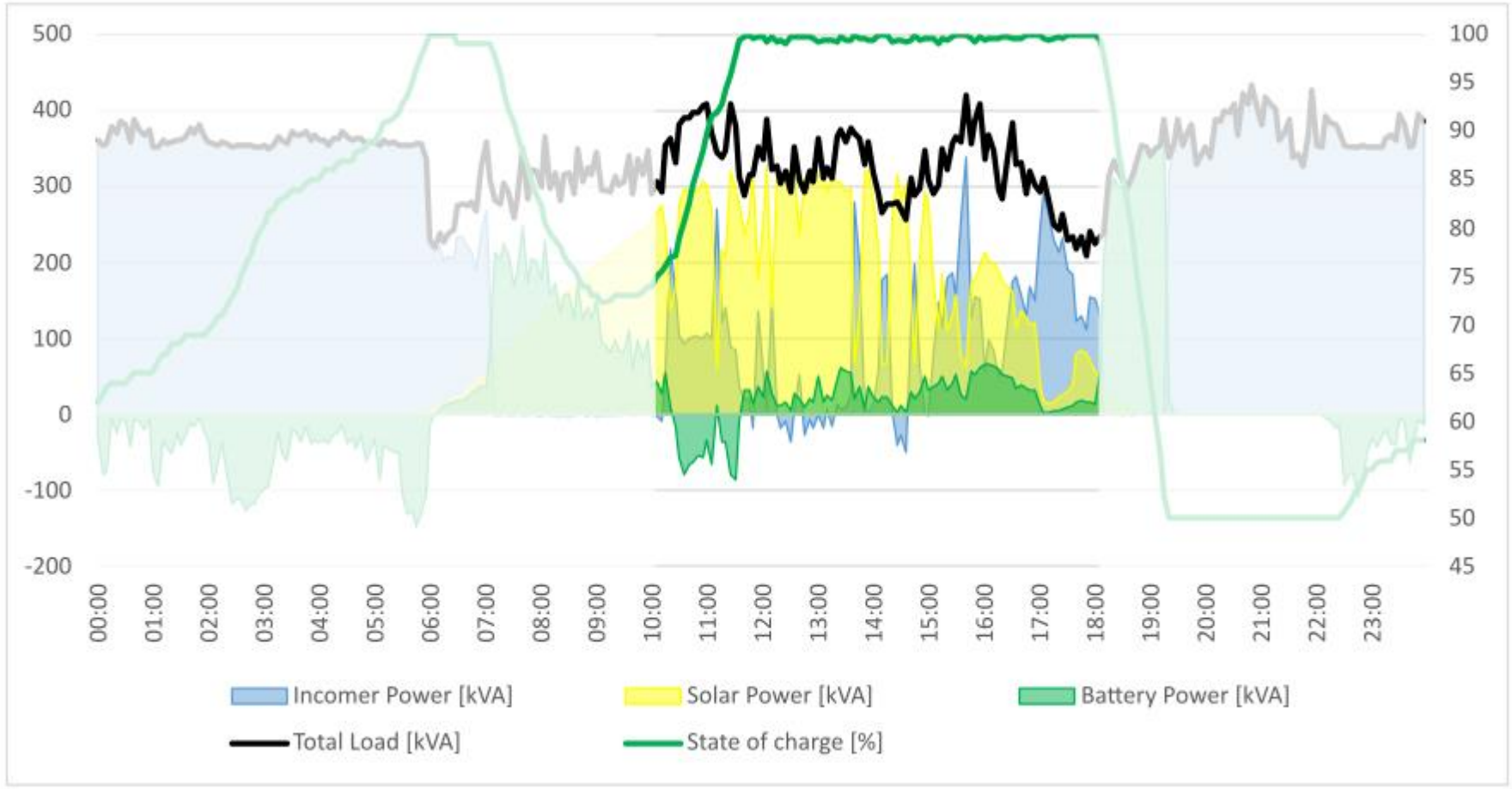
Case Study – Industrial Site - Arbitrage

Morning peak period: running load from battery, supported by grid-tied PV



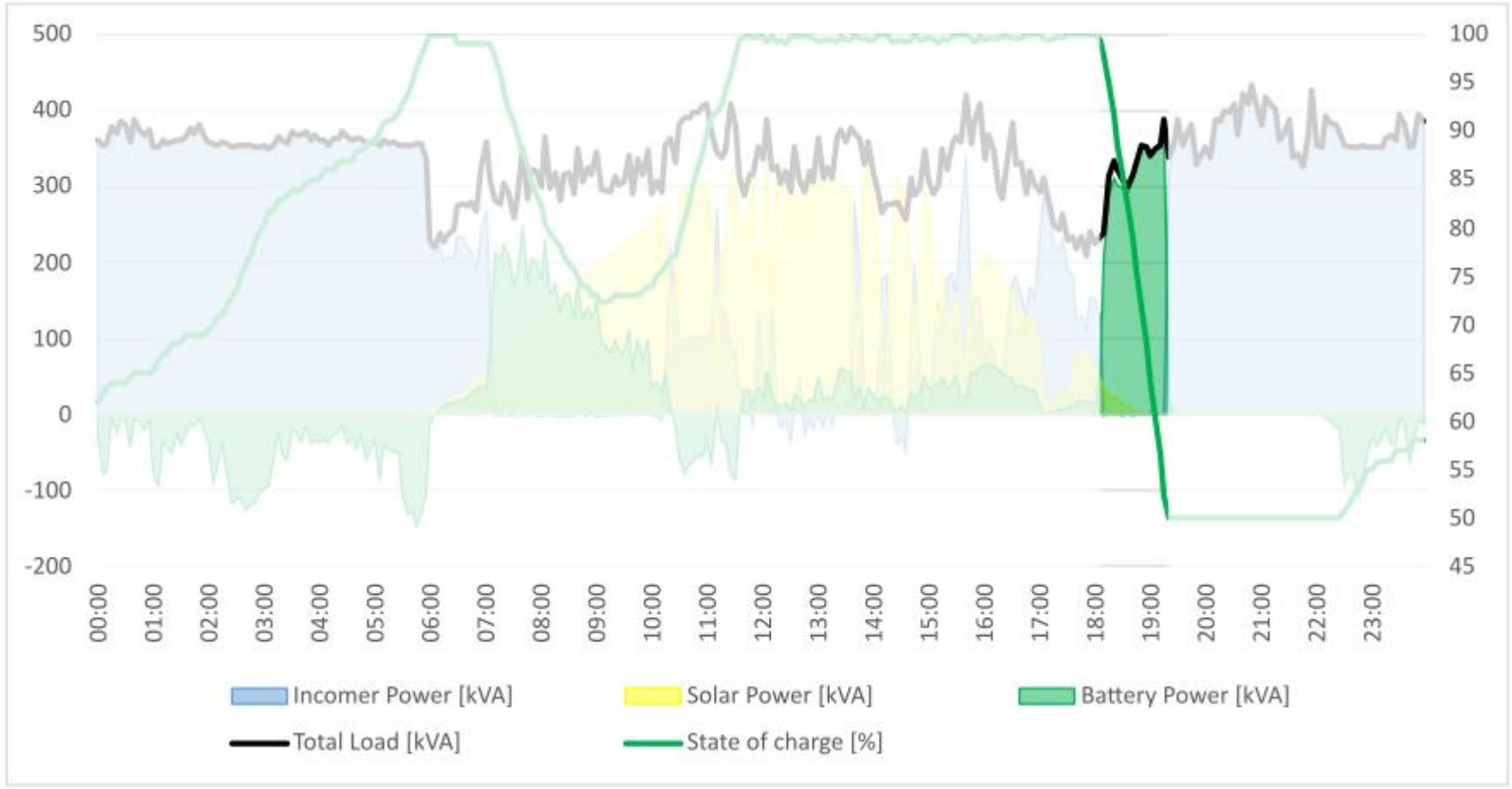
Case Study – Industrial Site - Arbitrage

Standard period: running load from grid, supported by grid-tied PV; charging battery using excess PV



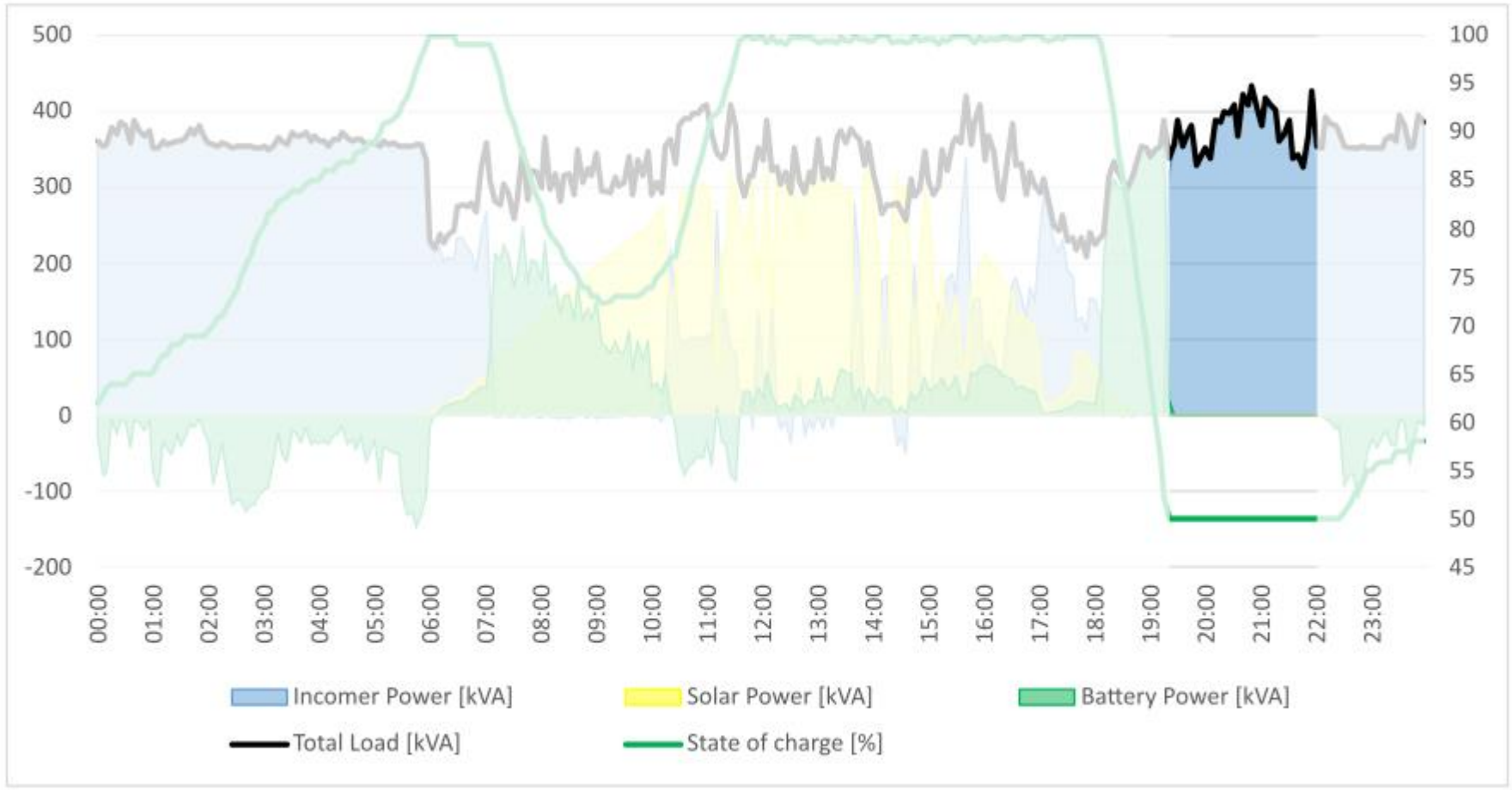
Case Study – Industrial Site - Arbitrage

Evening peak period: running load from battery down to minimum 50% state of charge (to extend life of battery)



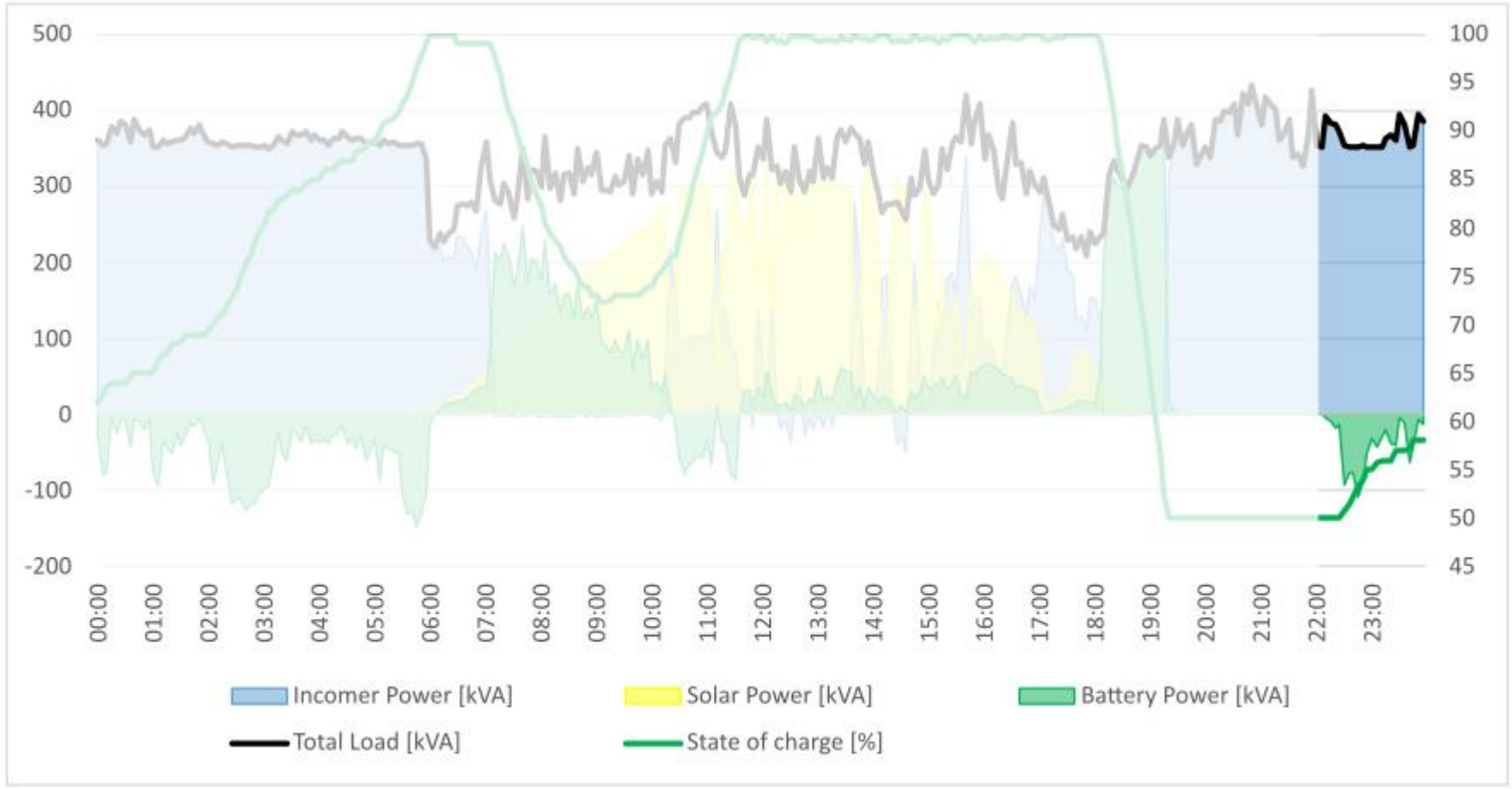
Case Study – Industrial Site - Arbitrage

Rest of evening peak and standard periods: running load from grid



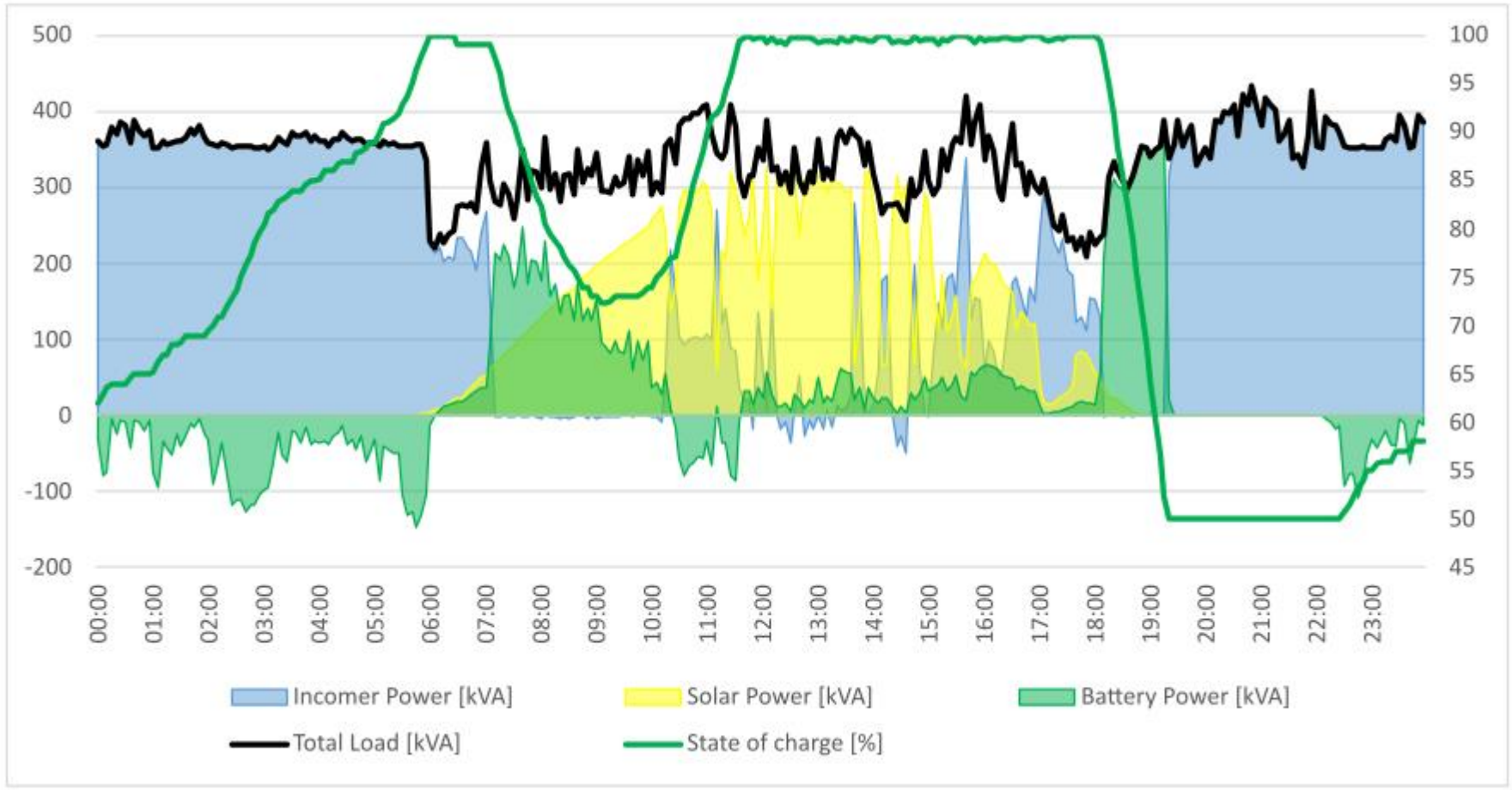
Case Study – Industrial Site - Arbitrage

Off-peak period: charging battery using available capacity from grid



Case Study – Industrial Site - Arbitrage

A day in the life of an Energy Security and Arbitrage system



Case Study – Regional Retail Centre

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Battery during construction

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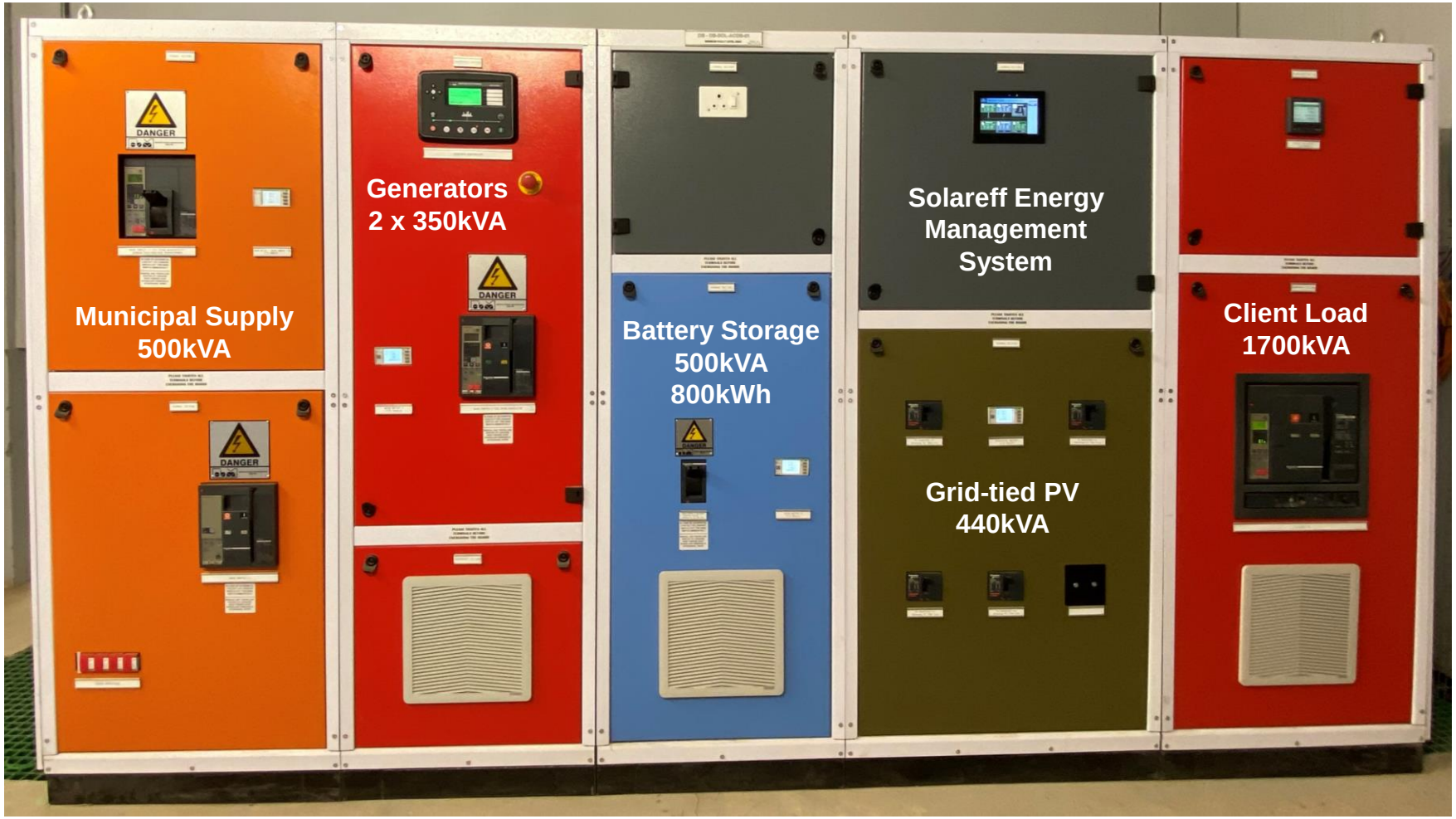

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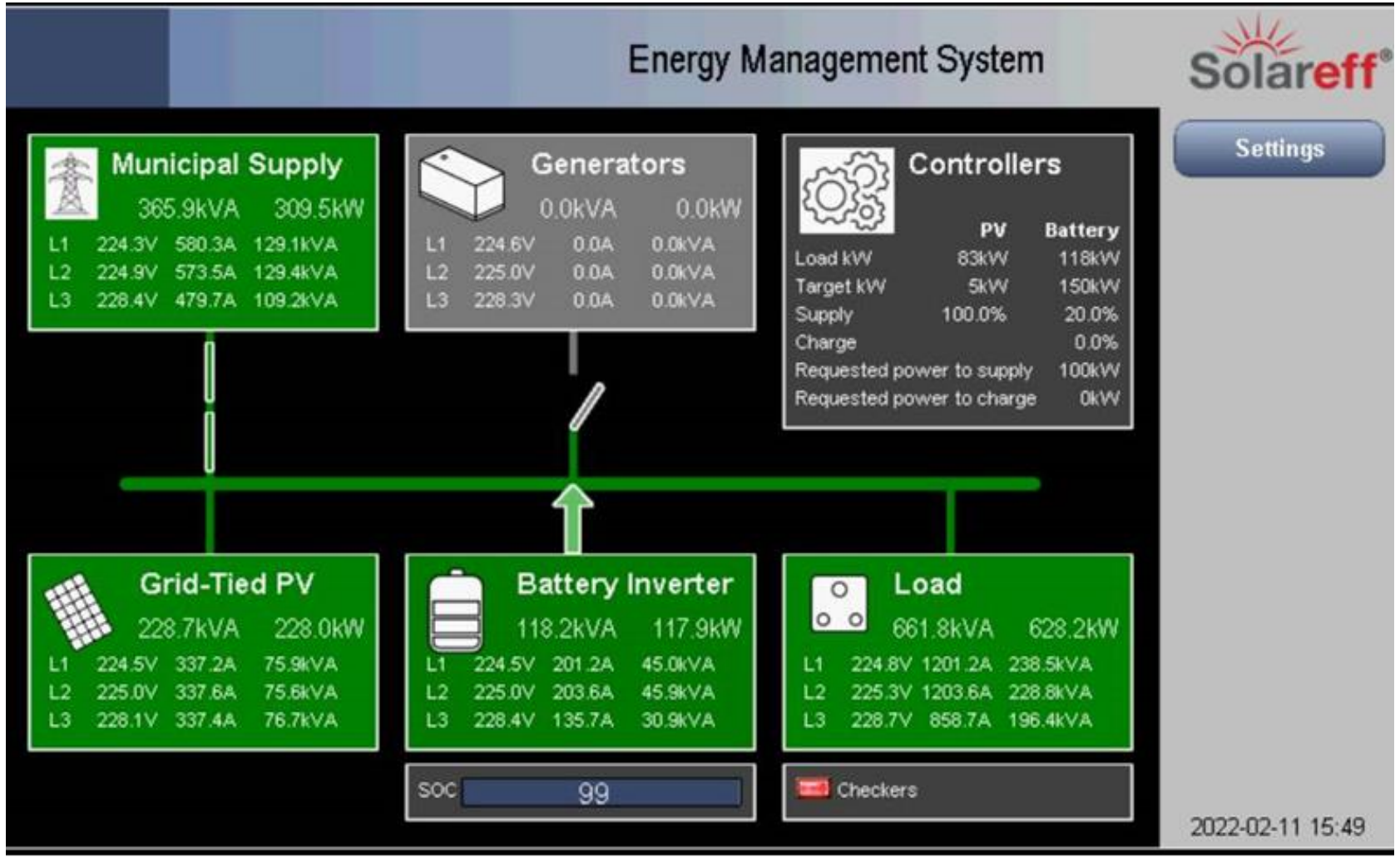

Custom Energy Management System with flexible control and Online Monitoring System

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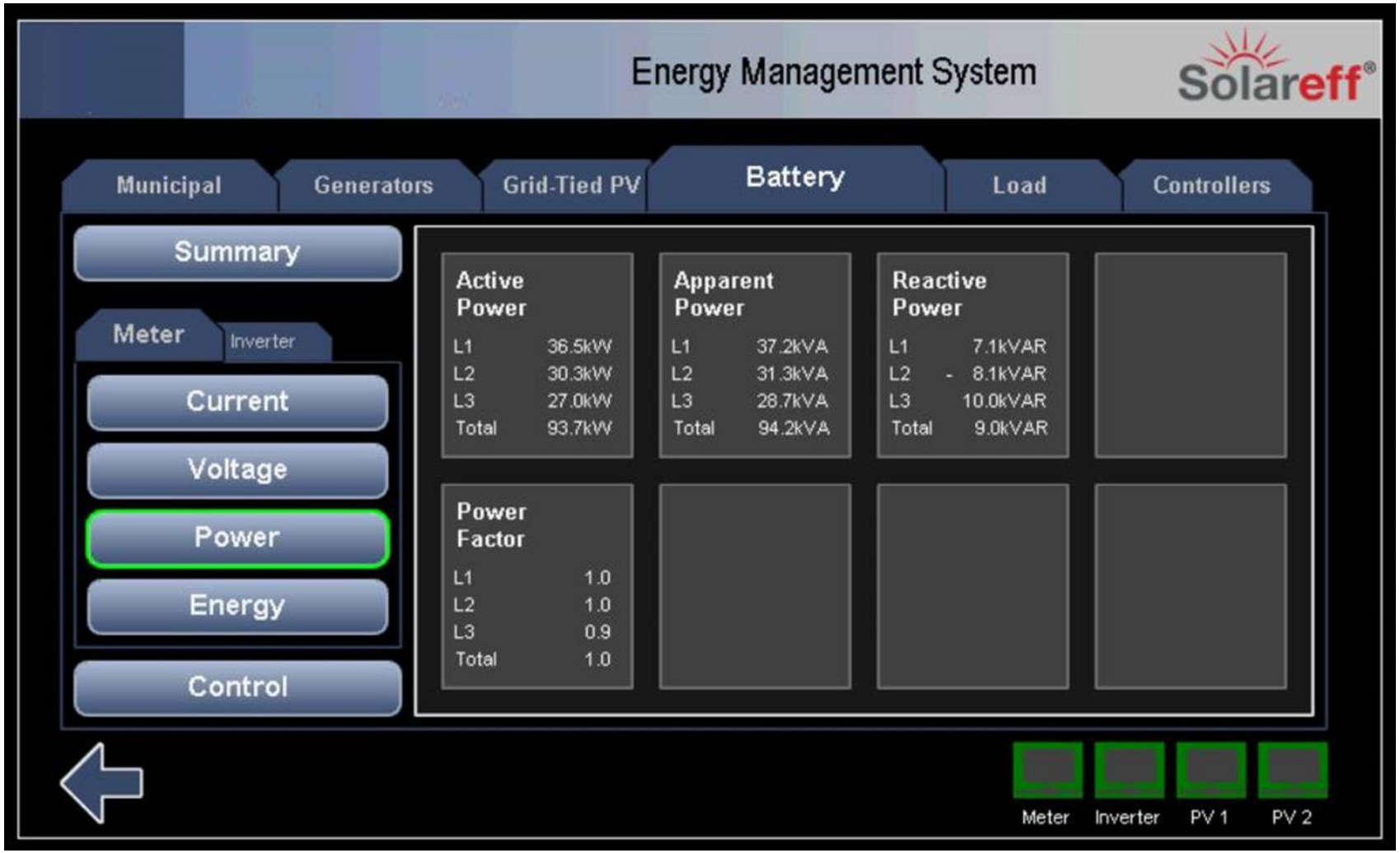
Battery Power Summary



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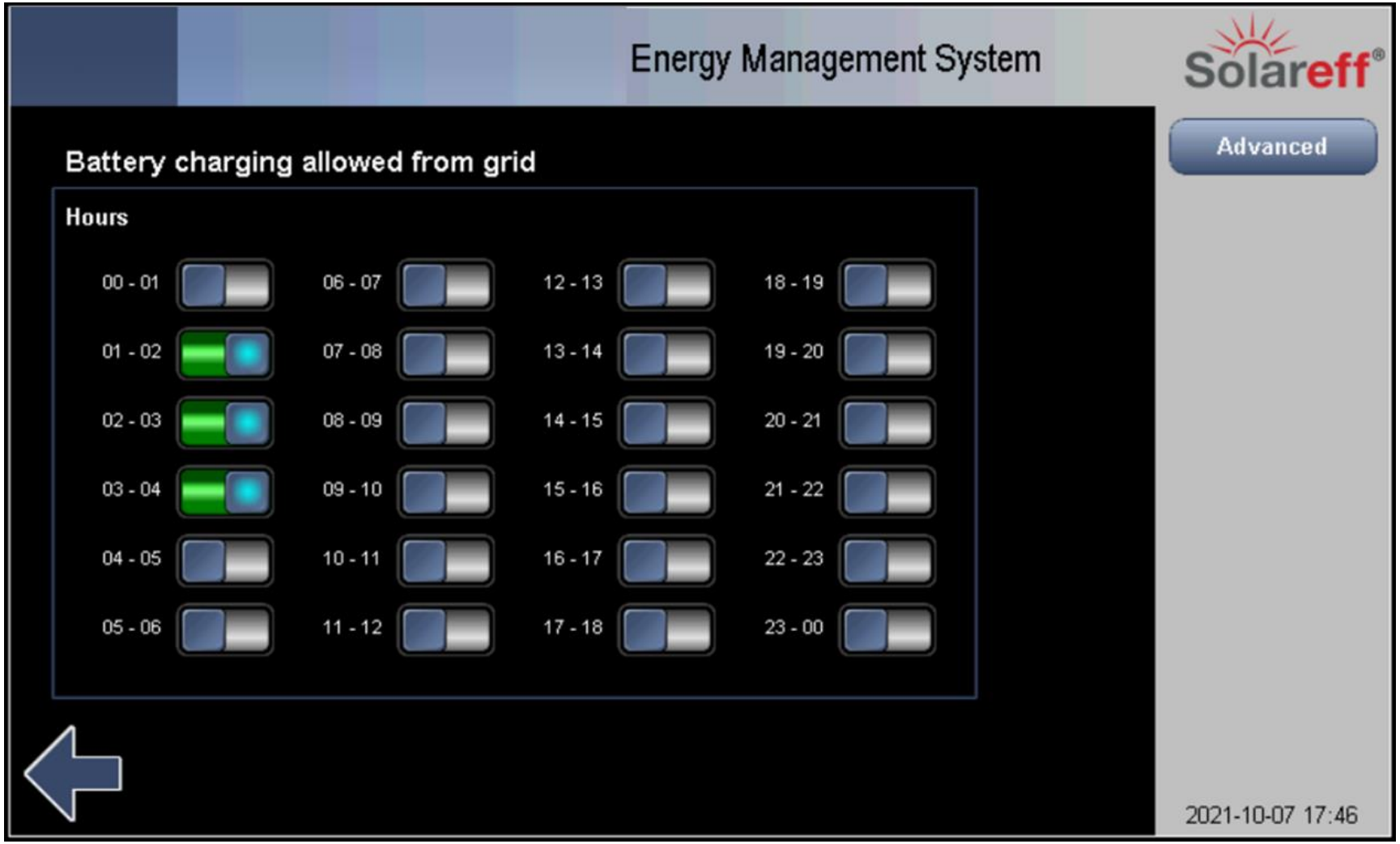
Scheduled Charging of Battery from Grid



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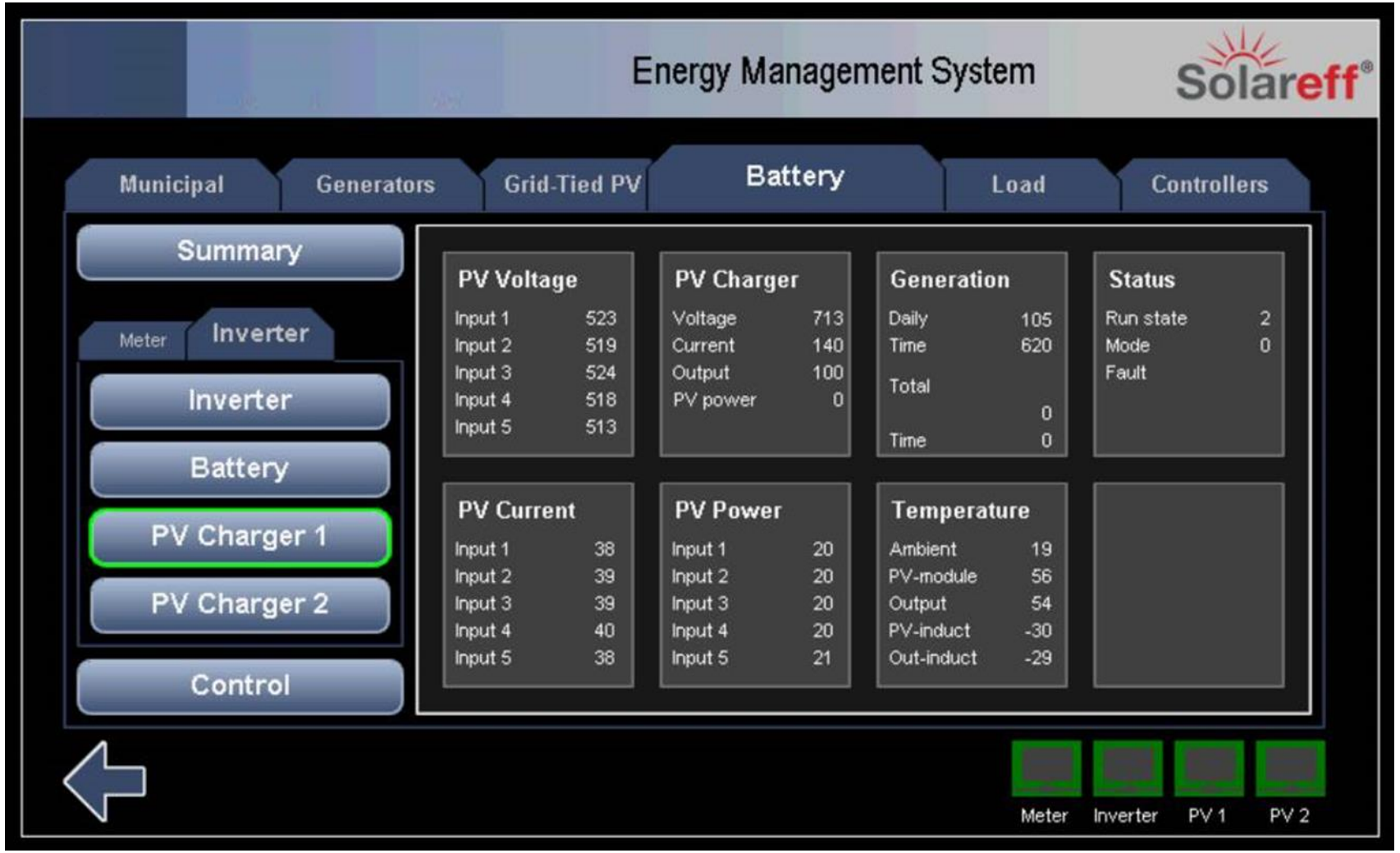
DC-Coupled PV



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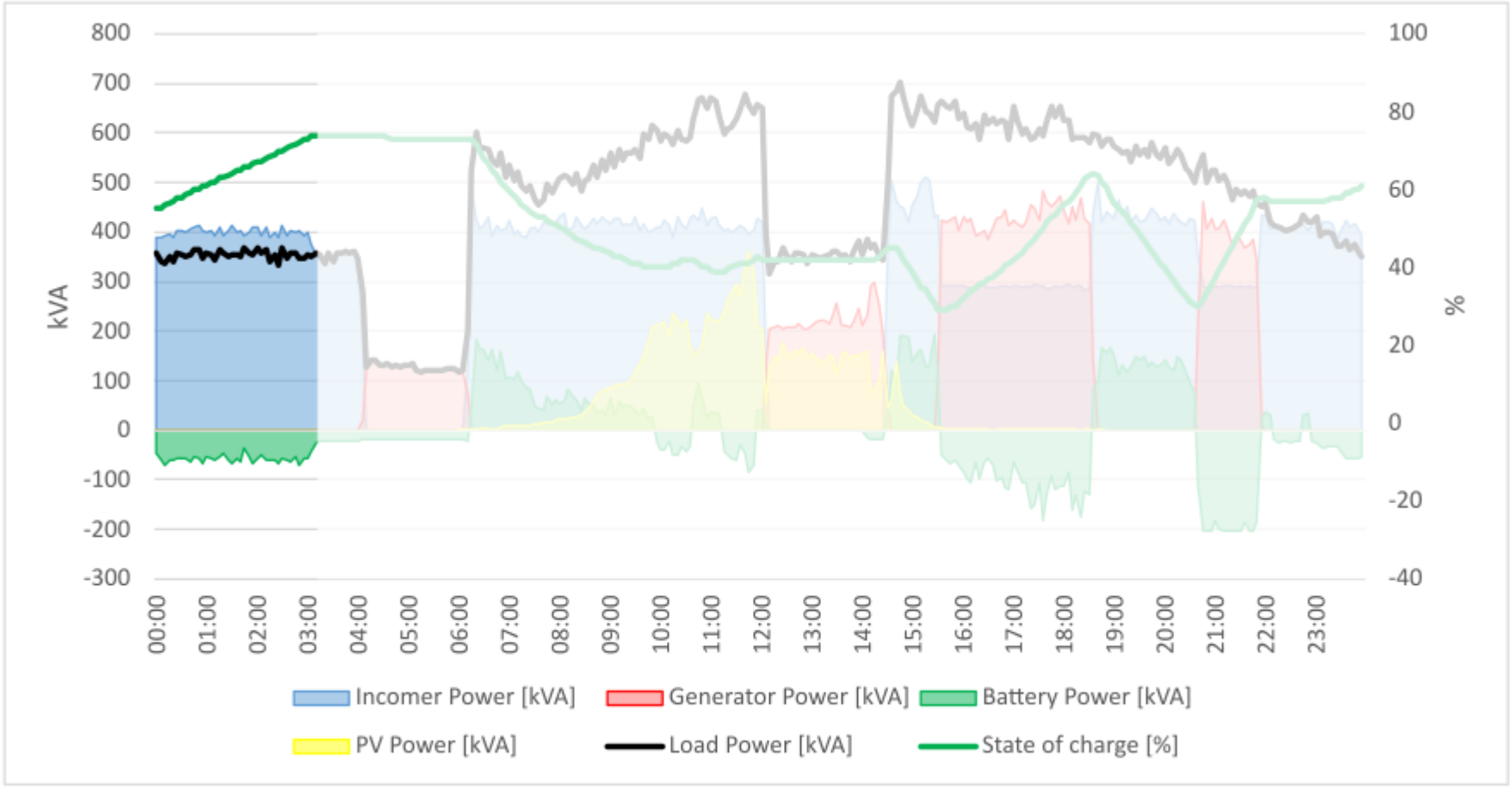
Off-peak period: charging battery using available capacity from grid

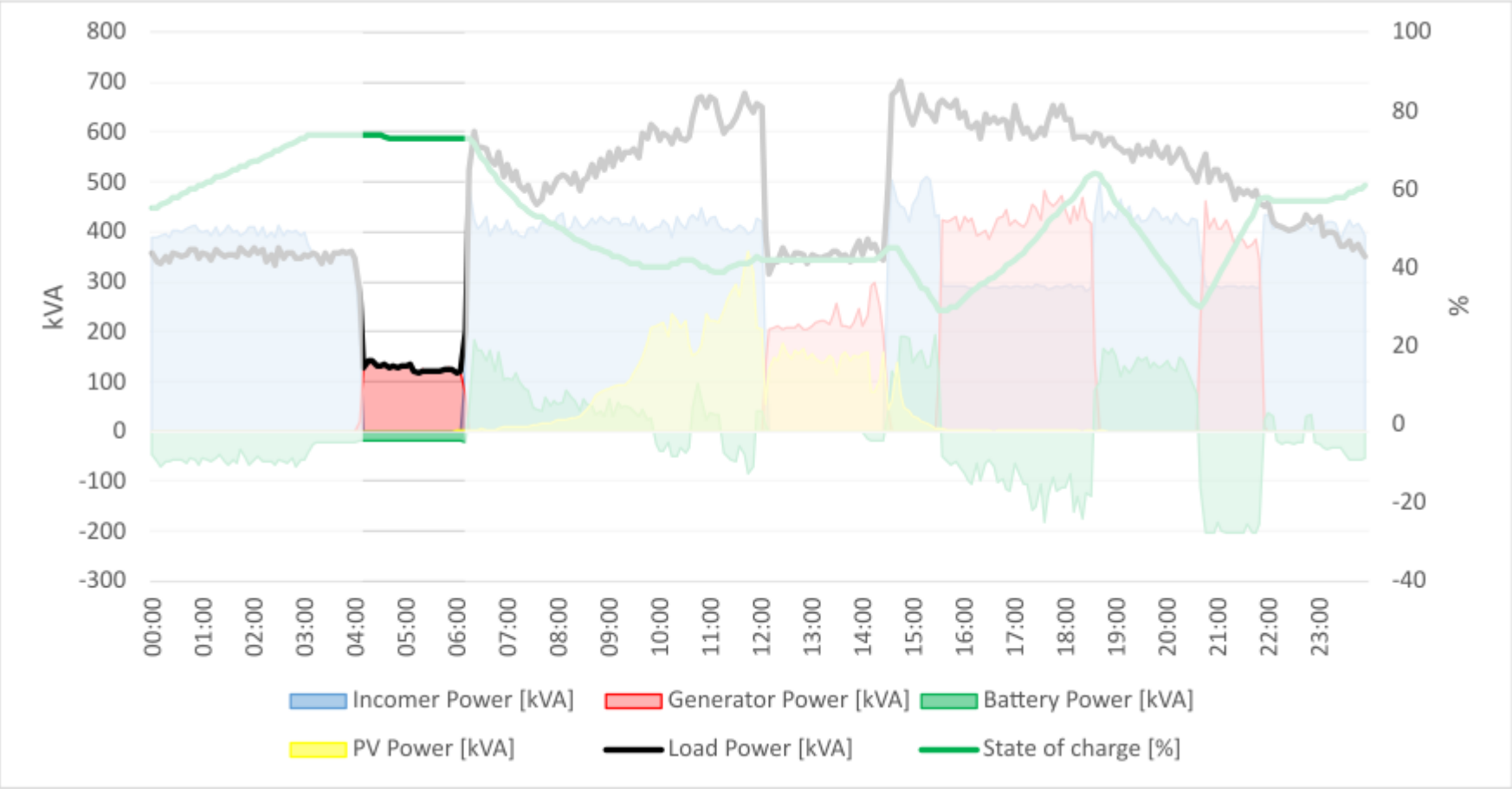


Case Study – Regional Retail Centre

Battery not allowed to charge (settings of EMS)

Case Study – Regional Retail Centre

Load shedding: Grid drops off, EMS switches off Checkers (run on their own generator), Centre's generator starts up



Case Study – Regional Retail Centre

Grid is back, EMS turns on Checkers again; shops start to open and load is higher than the limit of municipal connection. The battery delivers the balance to prevent grid trip.

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Grid-tied PV starts contributing

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Enough grid-time PV to keep load low enough that grid does not trip, as well as to charge the battery slightly

Case Study – Regional Retail Centre

Clouds cause battery to supply power again, but then can charge again a bit later as the clouds move away

Case Study – Regional Retail Centre

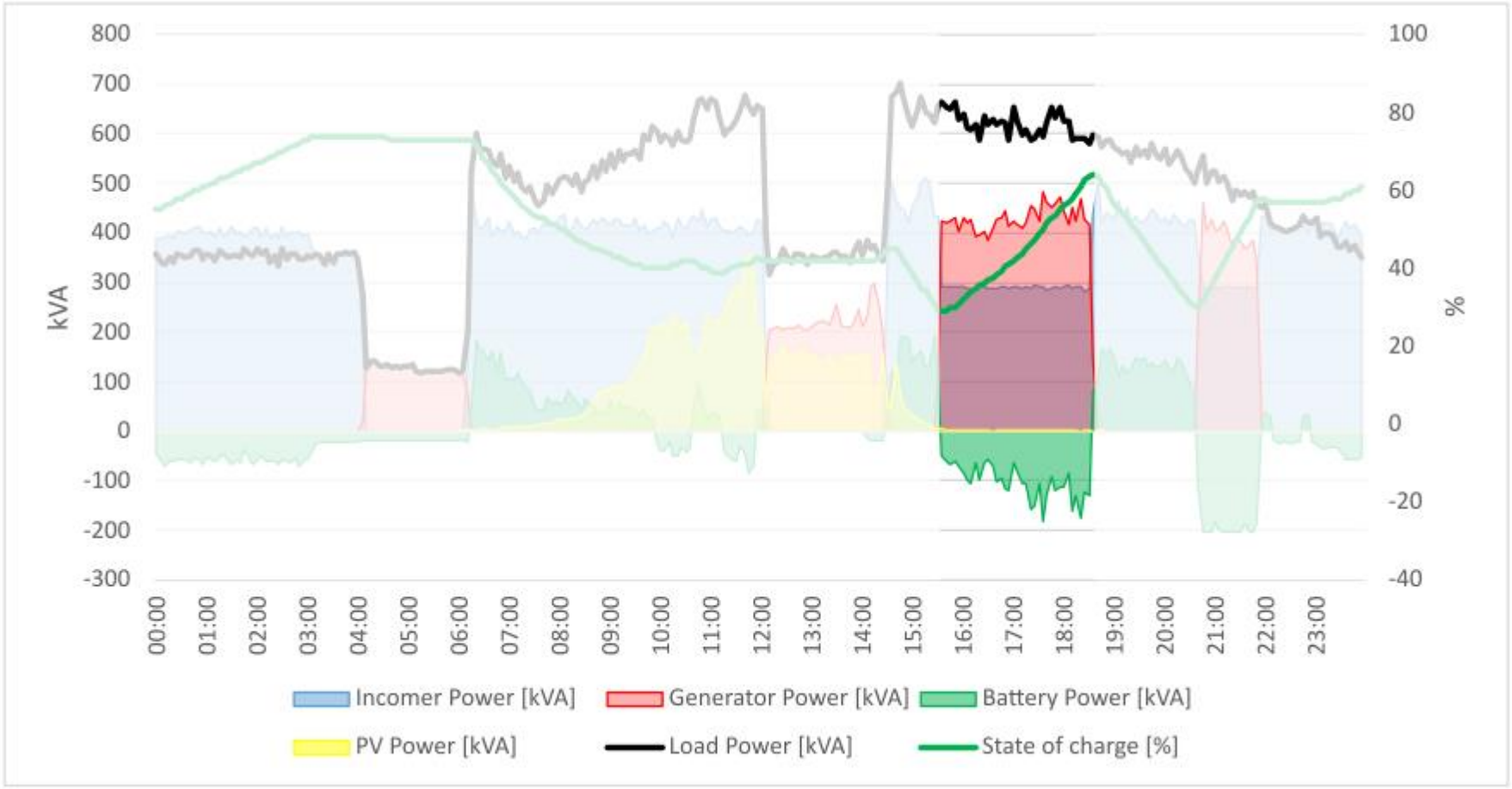
Load shedding (Checkers off again); Grid-tied PV with Generator integration. EMS prevents repulsion in generator but covers as much of the load as possible to prevent second generator from starting.

Case Study – Regional Retail Centre

Grid returns (Checkers turned on again); highveld thunderstorm causes PV to fall and the battery to contribute again

Case Study – Regional Retail Centre

Battery's SOC hits 30% and EMS starts generators synchronized with the grid; battery charge up to 65% SOC



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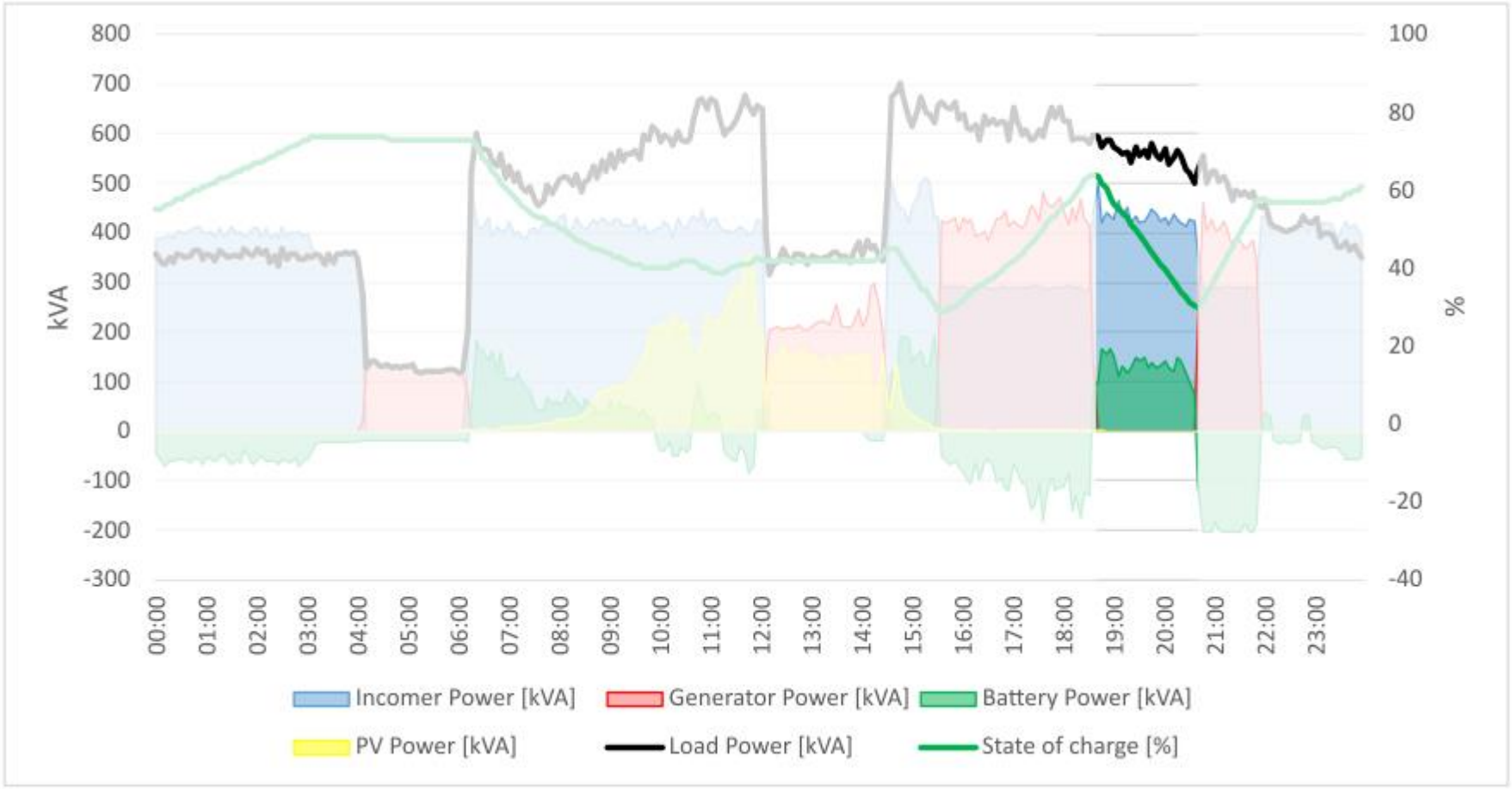
Battery's SOC is 65% and the EMS stops the generators. The load is still high, the sun has set and the battery helps to prevent grid trip.



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Battery's SOC hits 30% again and EMS launches generators synchronized with the grid; battery charging.

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Load falls below predetermined value (420kVA for at least two minutes in this case) and the EMS stops the generators; battery charging when the load is low enough.

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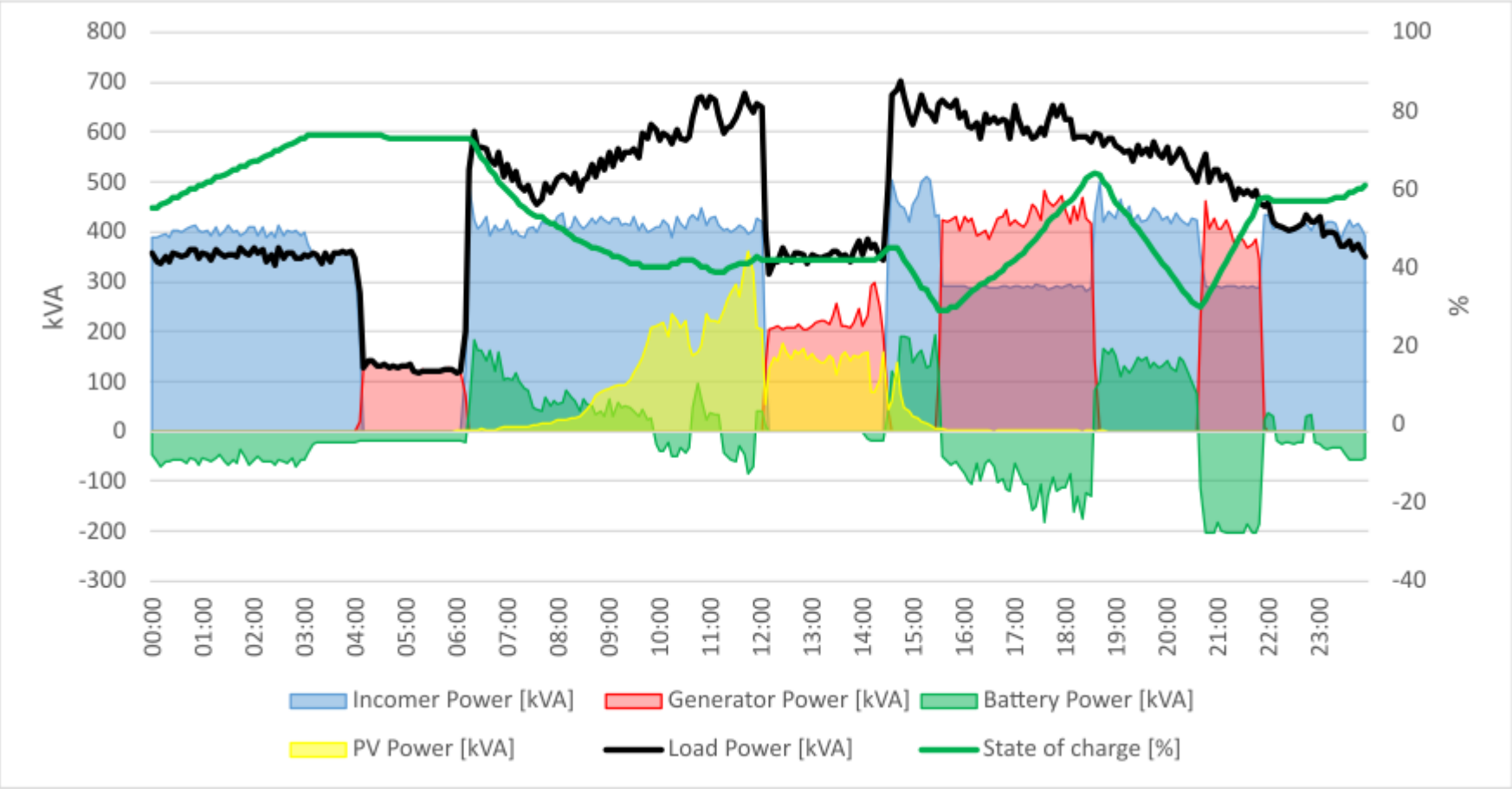
A day with a thunderstorm, load shedding & some clouds



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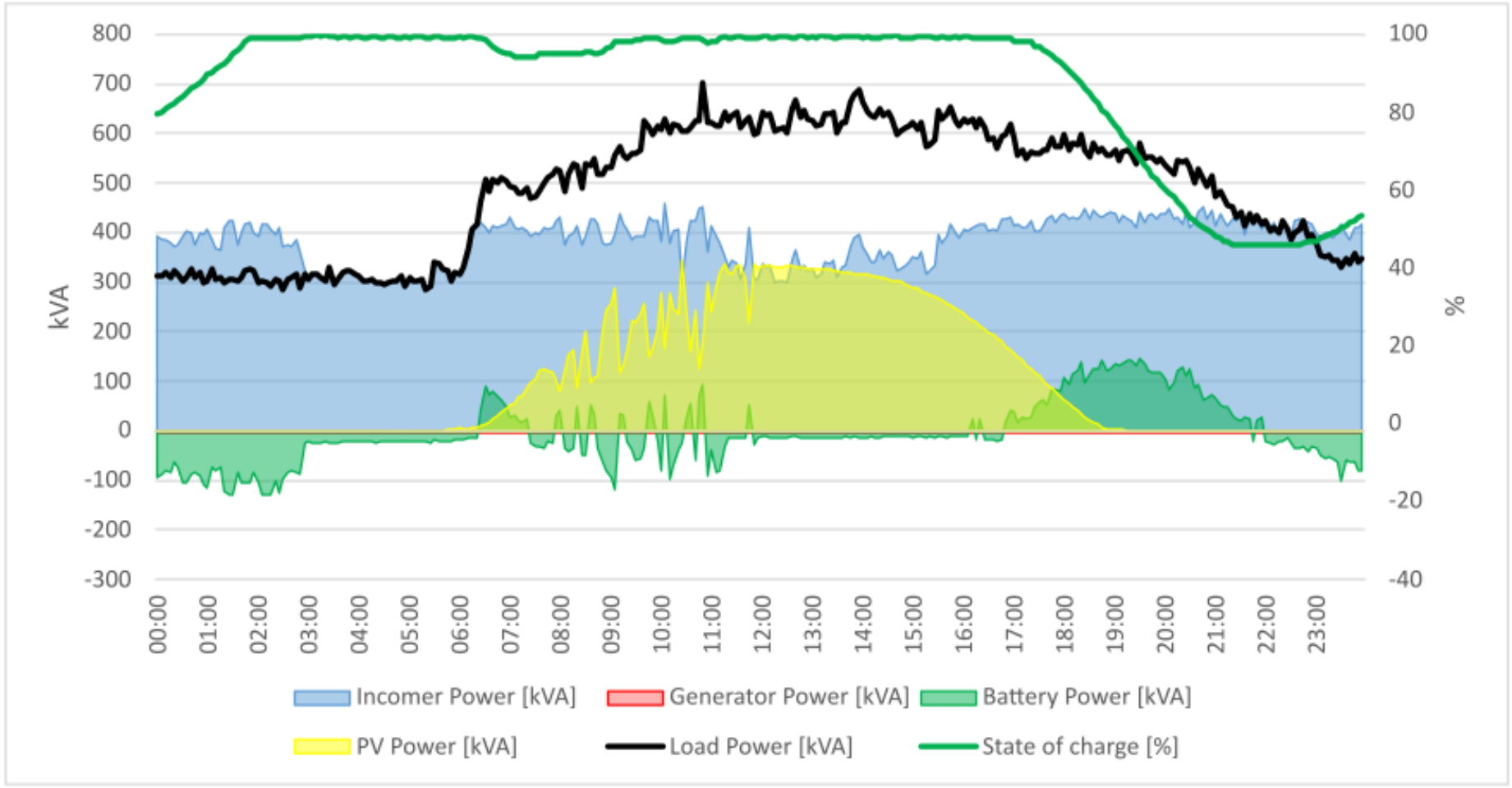
A Perfect Sunny Day



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