



Effective energy management - the EKTIN system with an EMS (Energy Management System) module

Challenges



Looking to manage your energy production and consumption more efficiently?



Seeking to reduce costs?



Looking to increase earnings from RES energy production?



Looking to extend battery service life?



Discover our solution for your business

The **EKTIN system with an EMS module** is an advanced ICT solution for comprehensive energy management in distributed energy, offering users:

- monitoring, control, and optimisation of energy flows,
- supervision and management of distributed generation sources, including photovoltaic farms, wind power plants, and energy storage systems
- supervision and management of other specified electricity loads (e.g. electric vehicle charging stations and hubs, electrolysers, heat pumps, gas power plants, etc.).



The EKTIN system with an EMS module provides access to detailed information on the operation of a facility or microgrid and enables the management of device operations within isolated microgrids. The system enables the collection of data regarding events, alarms, and measured values, facilitating effective energy management while reducing maintenance costs and ensuring secure operation.

Additionally, you can benefit from reduced energy purchase costs and the optimisation of energy sales revenue through integration with the Polish Power Exchange (TGE).

The EKTIN system with an EMS module provides the following benefits:



Reducing energy costs



Management of multiple energy generation sources and storage systems within a single system.



Stable and secure grid operation



Optimising energy generation and storage



Maximising energy production from RES

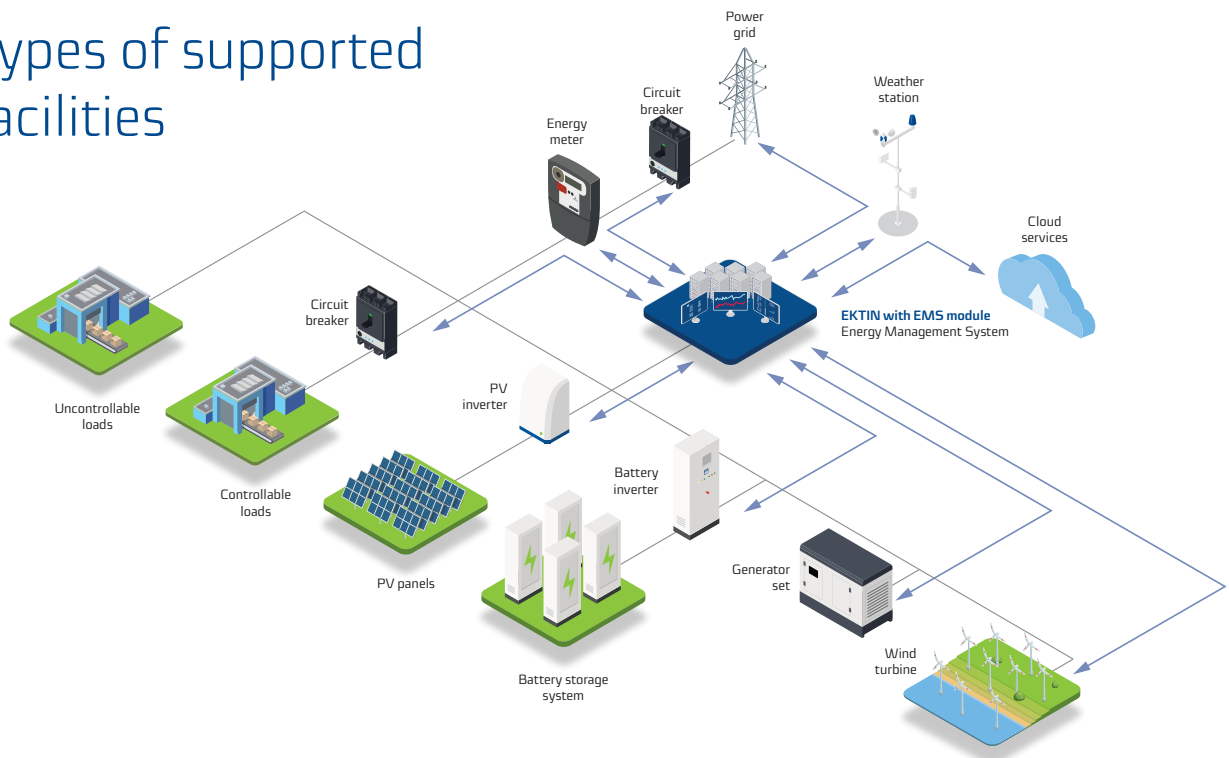


Optimising energy storage system utilisation

The EKTIN system with an EMS module is the ideal ICT solution for managing:

- Distributed infrastructure, e.g. PV systems across the city with a local balancing function.
- Energy flows within energy cooperatives and energy clusters.
- Isolated balancing areas also operating in "on-grid / off-grid" modes.
- Electricity aggregated in energy storage and supplied from distributed generation sources.
- Energy storage systems under various application scenarios and various grid connection methods.
- Other network devices requiring monitoring and control that are essential for grid balancing. Such devices include e.g. electrolyzers or biogas plants.

Types of supported facilities



PHOTOVOLTAIC POWER STATIONS



WIND POWER STATIONS



ENERGY STORAGE SYSTEMS



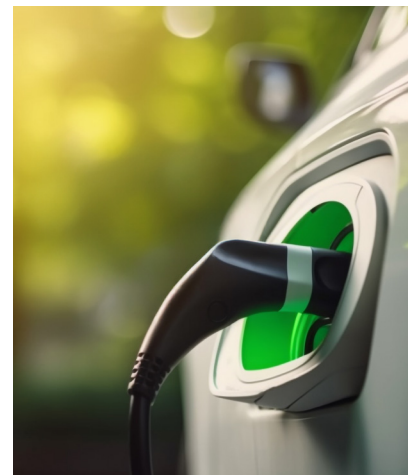
ELECTROLYSERS



BIOGAS PLANTS



ELECTRIC VEHICLE CHARGING STATIONS



and other distributed sources.

Data that works for you

Advanced predictive algorithms enable the utilisation of knowledge about changing weather conditions associated with energy generation from RES, prices, or energy demand. **Preparing energy production and revenue forecasts based on a wealth of data has never been so simple.**

The EKTIN system with an EMS module is a system undergoing continuous development. It is being supplemented with additional functionalities and supported devices.

Tasks performed by the EMS module

The EMS module enables the performance of many tasks related to the enterprise's needs:

- Control of system state changes and real-time automation of system controls.
- Shaping electrical parameters (currents, voltages, power) at the grid connection point.
- Visualisation of electrical measurement data (generation, loads, storage energy).
- Visualisation of financial data (TGE, balancing market, capacity market, applied tariffs) and weather data from preceding and subsequent periods.
- Optimisation of energy generation, storage, and consumption processes within systems: Energy storage – RES generation – Industrial consumer.
- Prediction of microgrid component states and their controls to maximise their efficiency.
- Processing of real-time and historical measurement data in machine learning algorithms.
- Monitoring and reporting of system and energy storage parameters from a technical and economic perspective to assess current efficiency.



EMS module in energy storage systems – tasks performed and benefits for the client

Control automation.

EKTIN with an EMS module manages the operation of the energy storage system in a dedicated configuration based on arbitrary schedules or adaptive charging/discharging algorithms developed from available data.

Technical objectives (regulation of electrical parameters) and economic ones (financial profits) are achieved autonomously for the dominant type of storage operation.

Machine learning and artificial intelligence algorithms support the development of control decisions optimised for a given operating variant according to the current storage state of charge, load status, RES generation, and energy prices.

It is possible to operate with schedules: tariff-based (including integration with the Polish Power Exchange - TGE), production-based (according to the load operation cycle), and weather-based.

Operational automation is implemented taking into account integration with energy prices on the Polish Power Exchange (TGE) and the capacity market, and the data is appropriately secured.

Benefits for the client



management of
RES generation
source operation



energy consumption
optimisation



optimisation and
extension of energy
storage system
service life



intermittent and
uninterruptible
operation in off-
-grid mode



performing ma-
nagement tasks
in isolated areas,
e.g. for an energy
cluster

Scheduling

The **EMS module** creates schedules for energy storage system charging/discharging based on current and historical tariff and weather data (RES generation, loads).

Benefits



Precise energy management taking into account changing conditions



Rational decision-making regarding the purchase, sale, or storage of energy, thanks to the application of prediction using machine learning based on artificial intelligence algorithms

Infrastructure operational flexibility

For a given storage configuration, optimal operating scenarios are developed and/or implemented automatically, **maximising financial profits or maintaining grid parameters**.

In atypical cases, the system allows for manual mode, where the dispatcher decides on the storage charging/discharging process.

The EMS module prioritises functionalities with varying weights within the adopted operating schemes.

Benefits

- **cable pooling**
- **phase voltage balancing**
- **voltage regulation**
- **frequency regulation**
- **reactive power compensation**
- **peak shaving**
- **load shifting**
- **maximisation of self-consumption**
- **off-grid operation**
- **"zero export" mode operation**



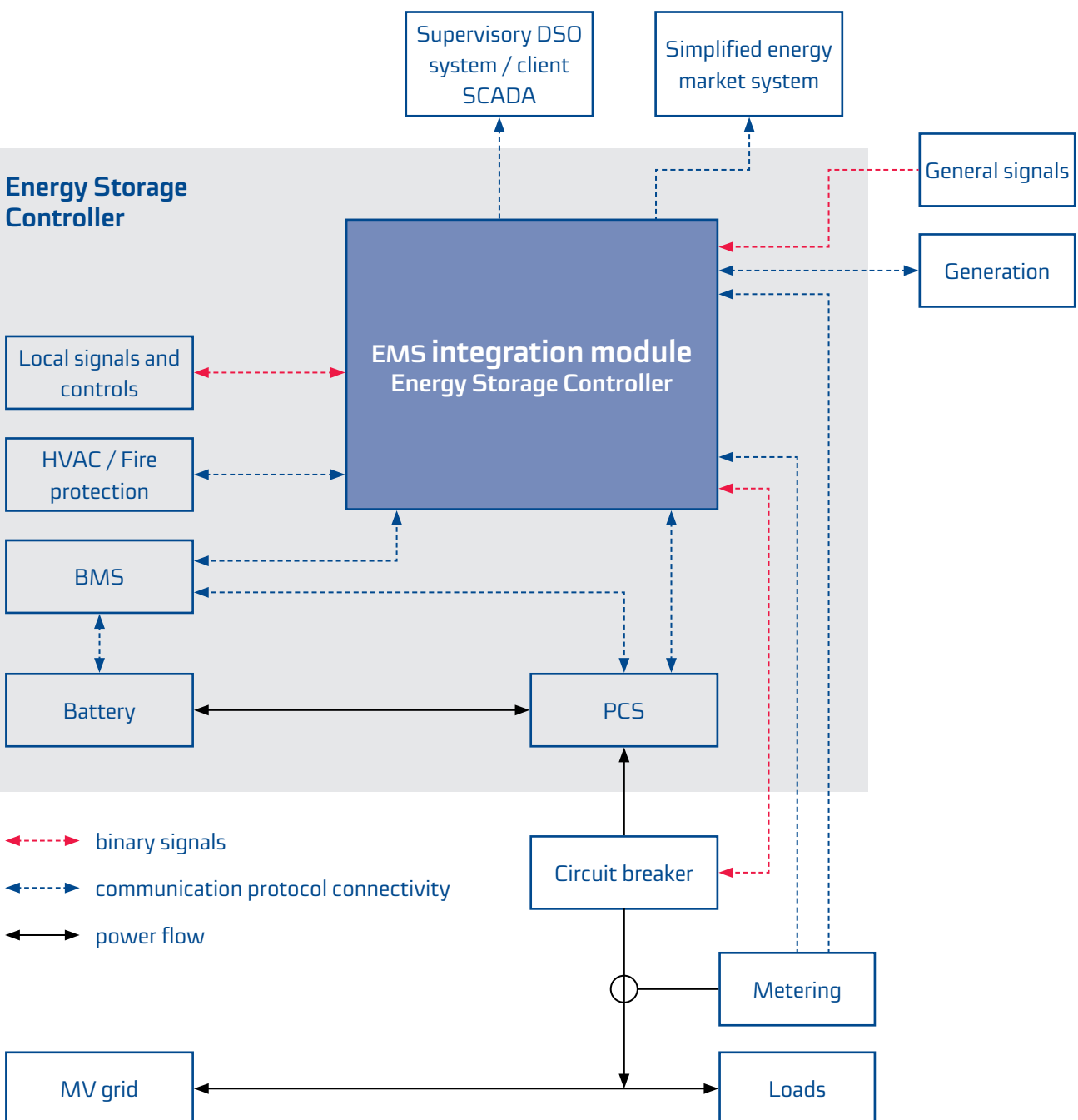
System variants

The EKTIN system with an EMS module is available in four advancement levels designated as packages: BASIC, MEDIUM, ADVANCED, and ADVANCED+.

The BASIC package

is based on an Energy Storage Controller integrated with the energy storage system. It may also include telecontrol elements necessary for communicating the energy storage system with the DSO grid, particularly for integration with the DSO or investor SCADA system. It can operate with energy storage systems from various manufacturers upon defining the rules of cooperation with the energy storage system supplier/manufacturer.

Example integration diagram.



The MEDIUM package

is an object-oriented system used to manage various operating modes of the storage system, i.e. phase voltage regulation, frequency regulation, and reactive power compensation. The availability of a given operating mode is strictly dependent on the type and manufacturer of the converter used in the energy storage system. It is possible to create a microgrid consisting of generation sources, one or more energy storage systems, and distributed electricity loads according to PSE requirements (optional module). This level enables integration with other facilities such as PV systems or loads.

The ADVANCED package

is based on the EKTIN digital supervision system with an EMS module, which provides necessary operating schedules, aggregates data, and performs the controls and visualisations required for the cooperation of infrastructure elements (generation sources, loads, energy storage) with source data from external services, e.g. the Polish Power Exchange (TGE) or PSE. The investor decides on the type of data used as the basis for the algorithm's operation. This level of the EKTIN system with an EMS module offers the following storage operating variants:

- profit maximisation,
- zero export – self-consumption,
- ECO option – battery service life optimisation.

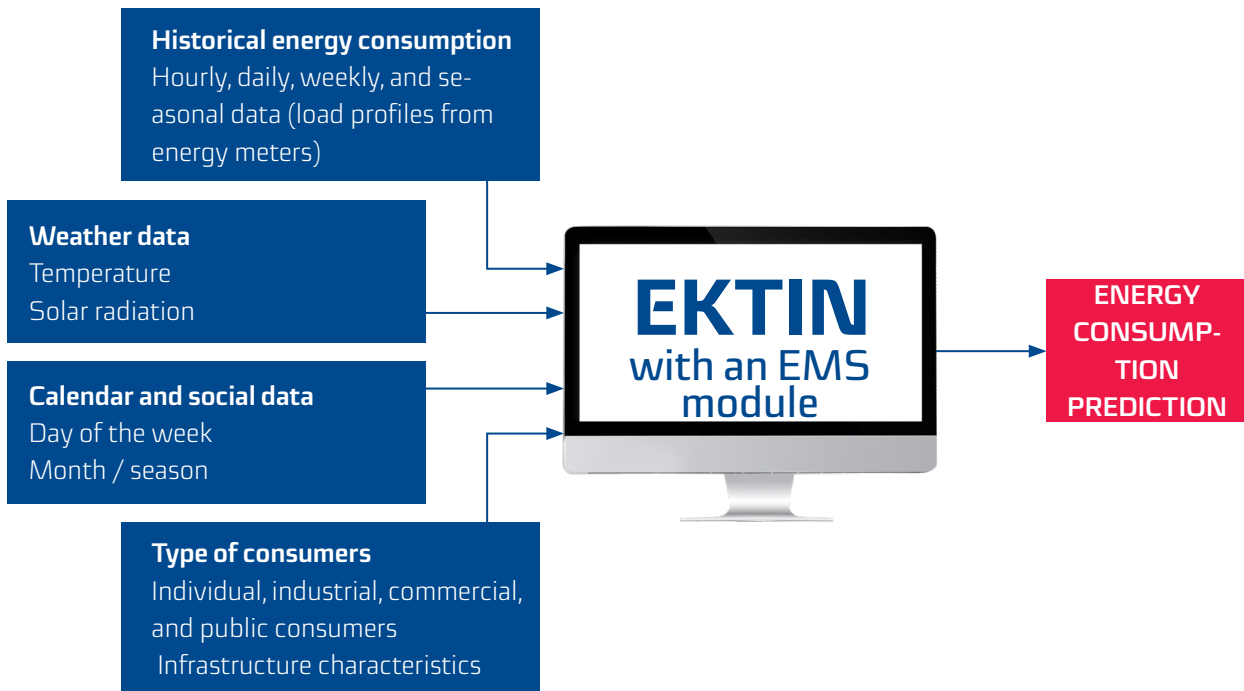
At this level, support for DSR services can be provided (optional module).



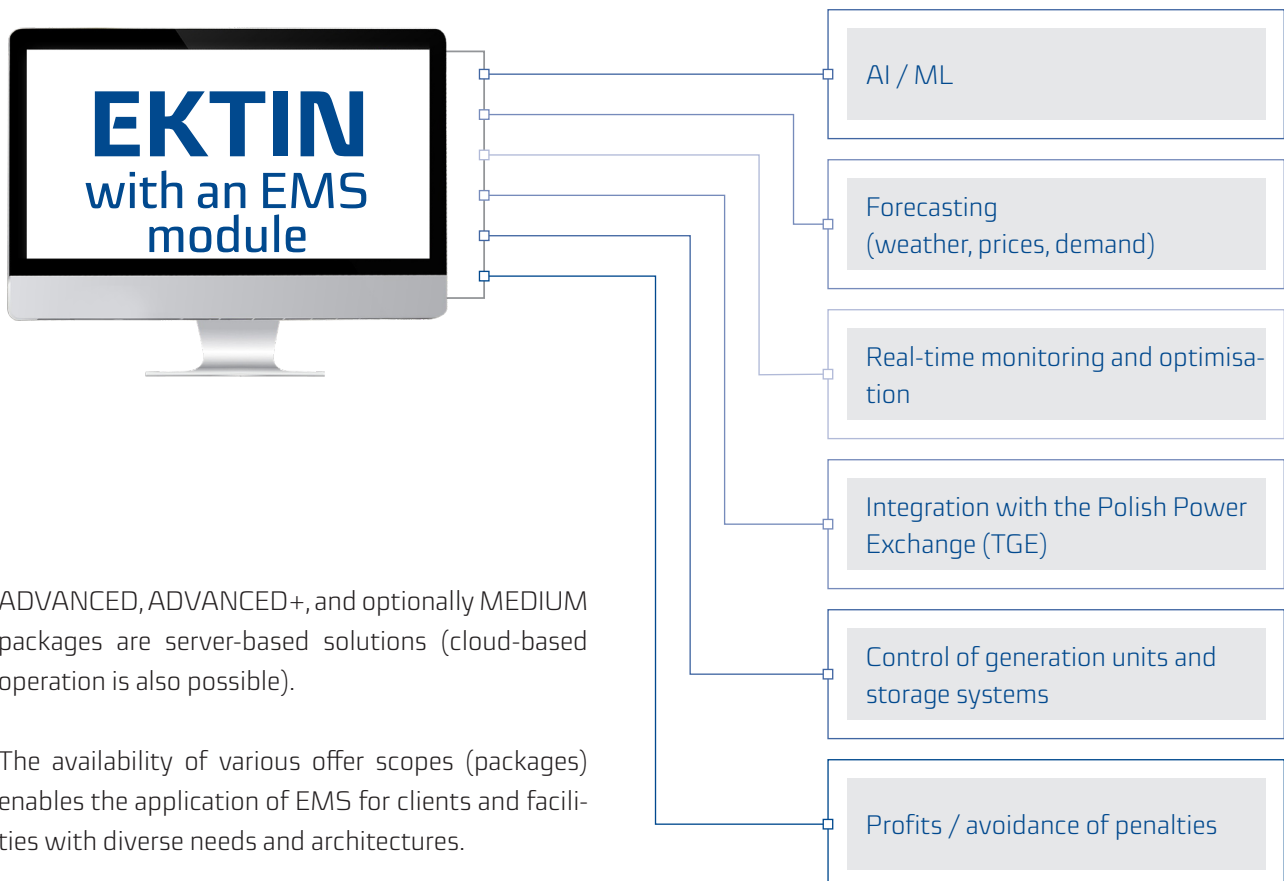
The ADVANCED+ package

utilises AI and ML algorithm modules and supports integration with the capacity market. Use of predictive algorithms based on artificial intelligence, which ensure optimisation and automated operation tailored to a specific operating variant. These are adaptive systems operating based on collected historical data.

What do we consider during prediction?



Functionalities of the EKTIN system with an EMS module



ADVANCED, ADVANCED+, and optionally MEDIUM packages are server-based solutions (cloud-based operation is also possible).

The availability of various offer scopes (packages) enables the application of EMS for clients and facilities with diverse needs and architectures.

Your security is our top priority

Our EMS meets the cybersecurity requirements necessary for operation within critical infrastructure.

Devices comply with the requirements of the standards and the documents mentioned below:

- **ISO / IEC 27001** – Information security management.
- **IEC62351** – security in LV and MV grids, specifically communication security / information exchange between controllers and SCADA systems (IEC62351-5) and communication encryption (IEC62351-3)
- **NERC CIP** – critical infrastructure protection in power systems.
- **EU NIS 2 Directive** – in the context of the security of a specific infrastructure / enterprise.



Scope of available functionalities – choose the ones suitable for your business

The table contains a list of the functions of the EKTIN energy management system with an EMS module used in the available packages.

Item	Module	BASIC	MEDIUM	ADVANCED	ADVANCED+	Notes
Automation and EMS cabinet equipped with a local HMI panel providing information on measurements and states of key energy storage system operating parameters		■	■	■	■	
Automation and EMS cabinet – Central EMS controller		■	■	■	■	
Automation and EMS cabinet – HMI panel (computer)		■	■	■	■	
SCADA EKTIN	WT, PV, Energy storage	■	■	■	■	
Manual storage control (charge / discharge)	Energy storage	■	■	■	■	
Operation according to a PREDEFINED weather / production / tariff schedule	WT, PV, Energy storage	■	■	■	■	
Peak shaving	Energy storage	☒	■	■	■	
Load shifting	Energy storage	☒	■	■	■	
Increasing self-consumption / "zero" export	WT, PV, Energy storage	☒	■	■	■	
Phase voltage balancing	Energy storage	■	■	■	■	
Voltage regulation	Energy storage	☒	■	■	■	The regulation range is dependent on the type of converter used in the energy storage system
Frequency regulation	Energy storage	■	■	■	■	
Reactive power compensation (power factor correction)	PV, Energy storage	☒	■	■	■	
Cable pooling	WT, PV, Energy storage	☒	■	■	■	
Full regulation of generation sources	WT, PV, Energy storage	☒	■	■	■	
Limiting source power – reduction of source power when the storage is full and prices are unfavourable	WT, PV, Energy storage	☒	☒	■	■	
Automatic schedule creation by the EMS module	WT, PV, Energy storage	☒	☒	■	■	
Integration with the energy exchange	WT, PV, Energy storage	☒	☒	■	■	
EMS operation in user setpoint mode without optimisation	WT, PV, Energy storage	☒	☒	■	■	
Utilisation of ML and AI for prediction	WT, PV, Energy storage	☒	☒	☒	■	
Operation in automatic mode according to one of three variants with optimisation	WT, PV, Energy storage	☒	☒	■	■	
Consumption optimisation – load control (if present)	WT, PV, Energy storage	☒	■	■	■	
Operation in off-grid mode (intermittent)	WT, PV, Energy storage	☒	■	■	■	according to investor requirements
Operation in off-grid mode (uninterruptible)	WT, PV, Energy storage	☒	■	■	■	according to investor requirements

■ available

■ option

☒ not available

Glossary of selected terms

System – in this document, it refers to the EKTIN system with an EMS module

Phase voltage balancing – also known as load balancing, it is used to equalise voltages between individual phases in a three-phase system. Charging or discharging the energy storage system leads to changes in power consumption in a given phase of the system, improving its parameters in this regard. This is of particular importance, for example, in situations with an excess of single-phase PV systems in the LV grid area.

Voltage regulation – maintaining a stable voltage at the power consumption point by regulating the active charging/discharging power of the energy storage system independently for each phase of the supply voltage.

Frequency regulation – maintaining a 50Hz frequency in the power grid through adaptive responses (appropriately fast response modes: FCR, aFRR, mFRR, and RR) to a frequency drop by discharging the energy storage system.

Reactive power compensation (power factor correction) – maintaining the tan phi factor at $-0.4 < \tan \phi < 0.4$ by charging/discharging the storage system relative to the existing conditions.

Peak shaving – in the context of loads, this refers to the reduction of energy demand peaks by using the energy storage system to supply consumers during hours of highest consumption.

Load shifting – emphasizing the role of energy price differences, this refers to moving energy consumption in time, where the storage system is charged during low-price hours and discharged during high-price hours.

Cable pooling – utilising the charging/discharging capabilities of the energy storage system to guarantee power flow through the local power grid infrastructure at a nominal level appropriate for its transmission capacity. It primarily consists of shifting energy in time to and from storage, given the non-linear characteristics of RES generation, to maximise its utilisation. It assumes optimal infrastructure utilisation.

Balancing market integration – the ability to receive control signals, receive operating plans, and transmit information to the central node for monitoring purposes.

Capacity market integration – forms of response to capacity market signals during recall periods for actual or test reduction of real demand or an emergency increase in consumption.

Increasing self-consumption ("zero" export) – in an operating mode that does not permit power outflow from the client's system, the energy storage system is intended to store energy during periods of excess PV generation and shift it for consumption by loads for when this generation is no longer available, thereby reducing the volume of energy purchased from the grid.

PV power limitation – reduction of PV power when the storage is full and prices are unfavourable.

Operation according to a tariff schedule (energy exchange data) – the storage charging/discharging process is controlled by a prepared tariff schedule based on prices from the Polish Power Exchange (TGE).

Manual mode operation – the dispatcher decides which price is favourable.

Tariff schedule creation – the system independently creates a tariff schedule based on available data.

Energy exchange integration – the system has a built-in autonomous module for downloading data directly from the energy exchange.

BMS (battery management system) – a battery management system responsible for its safety, optimal performance, and longer service life. Its key functions include protection against overcharging, over-discharging, and over-heating, as well as balancing (equalising) the charge level of individual cells.

PCS (Power Conversion System) – a bidirectional converter. The converter for energy storage manages the charging process (from AC to DC) and the discharging process (from DC to AC) of the cells.

ENERGY STORAGE SYSTEMS

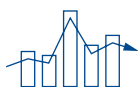
Efficient use of electrical energy



With rising energy prices and changes in the energy generation and distribution model, energy storage systems are becoming increasingly important and widely implemented in power systems. Thanks to the ability to control and manage the processes of energy storage and discharge, they can provide a wide range of functionalities tailored to current user needs and grid parameters.



Efficient use of RES



Peak reduction and lowering of contracted power



Cost savings through maximum use of affordable energy



Stability of energy supply



Flexibility services

We invite you to contact us to learn more about the comprehensive offering of the Apator Group – **a leader in energy, water, and heat solutions.**

Piotr Lewandowski

Distributed Energy Sales Team Leader
tel. +48 452 370 689
piotr.lewandowski@apator.com

Monika Rogowska

Product Manager
tel. +48 512 990 412
monika.rogowska@apator.com



Apator SA
ul. Gdańska 4a unit C4
87-100 Toruń

Correspondence address:
Apator SA Centrum
Ostaszewo 571
87-148 Łysomice
e-mail: apator@apator.com