WHAT IS AN EMS AND WHAT FOR?

OUR BESS REFERENCES

In operation	Contracted / under Construction	In development
1,2 GW	**1,3 GW**	**10,3 GW**
France USA	USA Germany Belgium	USA Germany

We are fully integrated with SAFT and TotalEnergies Power Origination & Sales, BESS & Trading teams.

WHAT IS AN EMS ?

More and more hybrid projects combining various energies, batteries, grid connection and consumption adjustments
=> Necessary to manage all these systems together to optimize capacities and revenues.

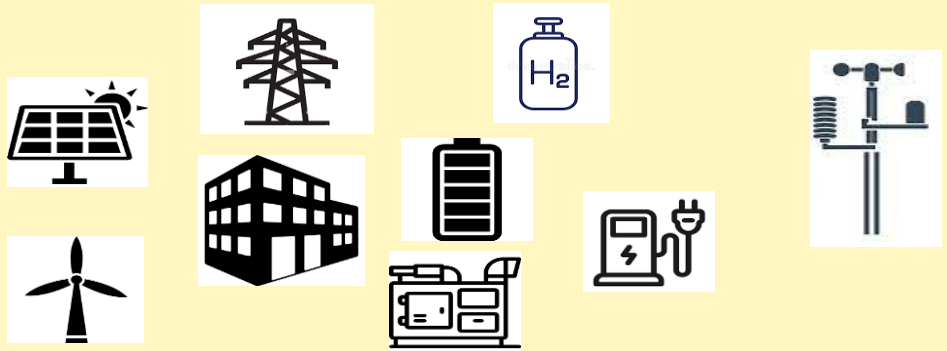
EMS (Energy Management System) for mid-term reaction
and anticipate/optimize production

Predict, Anticipate, Optimize / Forecasts

PMS (Power Management System) for short term
reaction (instantaneous/automatic control)

Reaction, reflex (Voltage/Frequency control)

Devices & Sensors



Analogy with human body

Brain

Spinal cord

Body

AN EMS CONTROLS FLEXIBLE ASSETS

Flexible assets examples (Customer)

Industrial Process
optimizes resources to meet demand efficiently, lower energy costs, and stabilize the grid

Photovoltaic (PV) asset
enables customers to manage energy flexibility through curtailment, cutting costs and enhancing grid stability

Battery Energy Storage Systems
store excess energy produced during low demand for use during peak times, boosting energy independence

Electric Vehicle (EV) Charging Points
enables customers to optimize vehicle charging and discharging for best prices and grid stability

H2
optimizes its production, storage, and usage in alignment with renewable energy availability and grid demands.

Micro Grid aaS
Enhance the flexibility, efficiency, and reliability of Microgrid as a Service, allowing to shift or reduce energy usage during peak times, balancing supply and demand more effectively.

Dispatch groups
enhances the flexibility by optimizing real-time monitoring, demand prediction, and resource allocation.

Tertiary
optimizes energy consumption, integrating renewable sources, and managing demand in real-time.

EMS BENEFITS: REVENUE STACKING TO OPTIMIZE ROI

On-site services for B2B customer

- Optimization of PV self-consumption
- Time-of-use bill optimization
- Demand charge reduction & peak shaving
- Participation to Demand Response
- Balancing cost optimization
- Power backup & power quality

Deliver additional benefits to B2B customers

Grid services

- Frequency regulation & balancing mechanisms
- Capacity reserve (FCR, aFRR, mFRR, RR)
- VPP, wholesale energy arbitrage

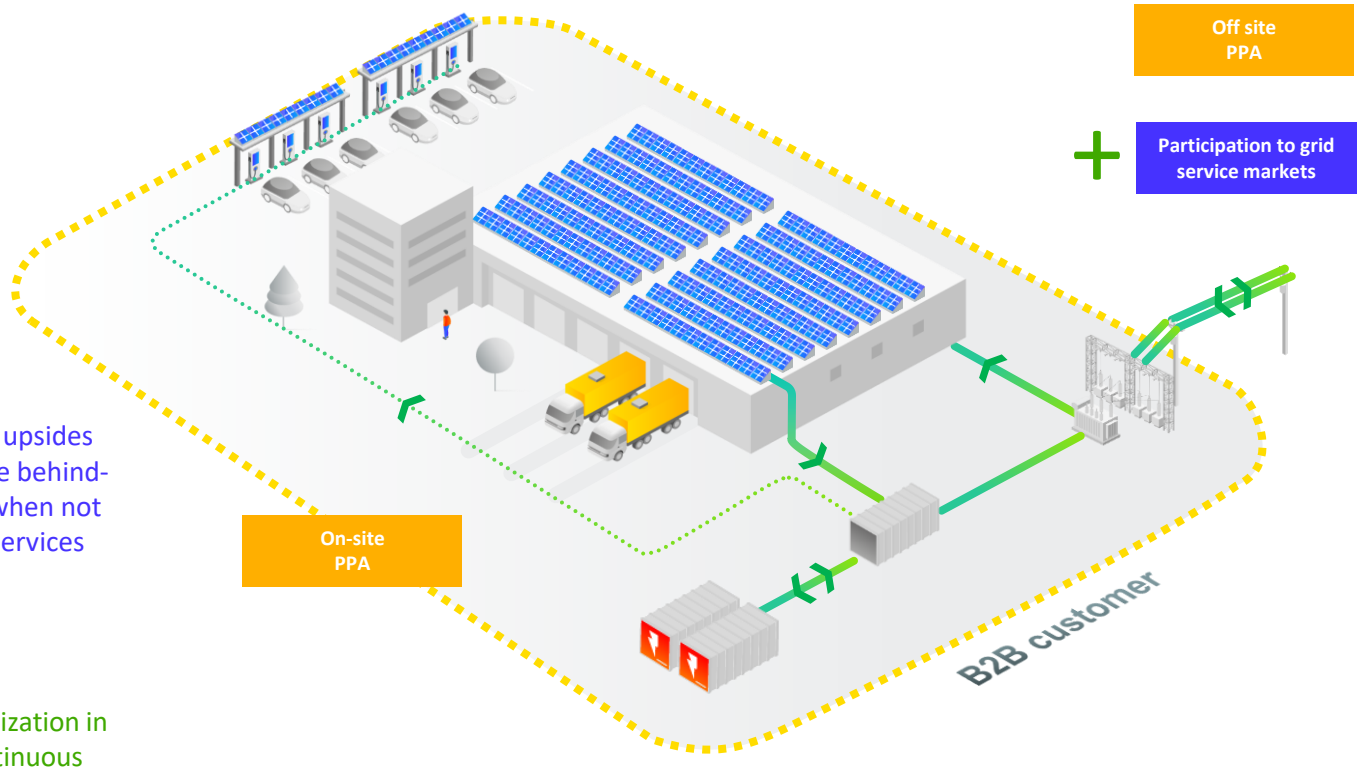
Capture revenue upsides by monetizing the behind-the-meter BESS when not used for on-site services

Market participation

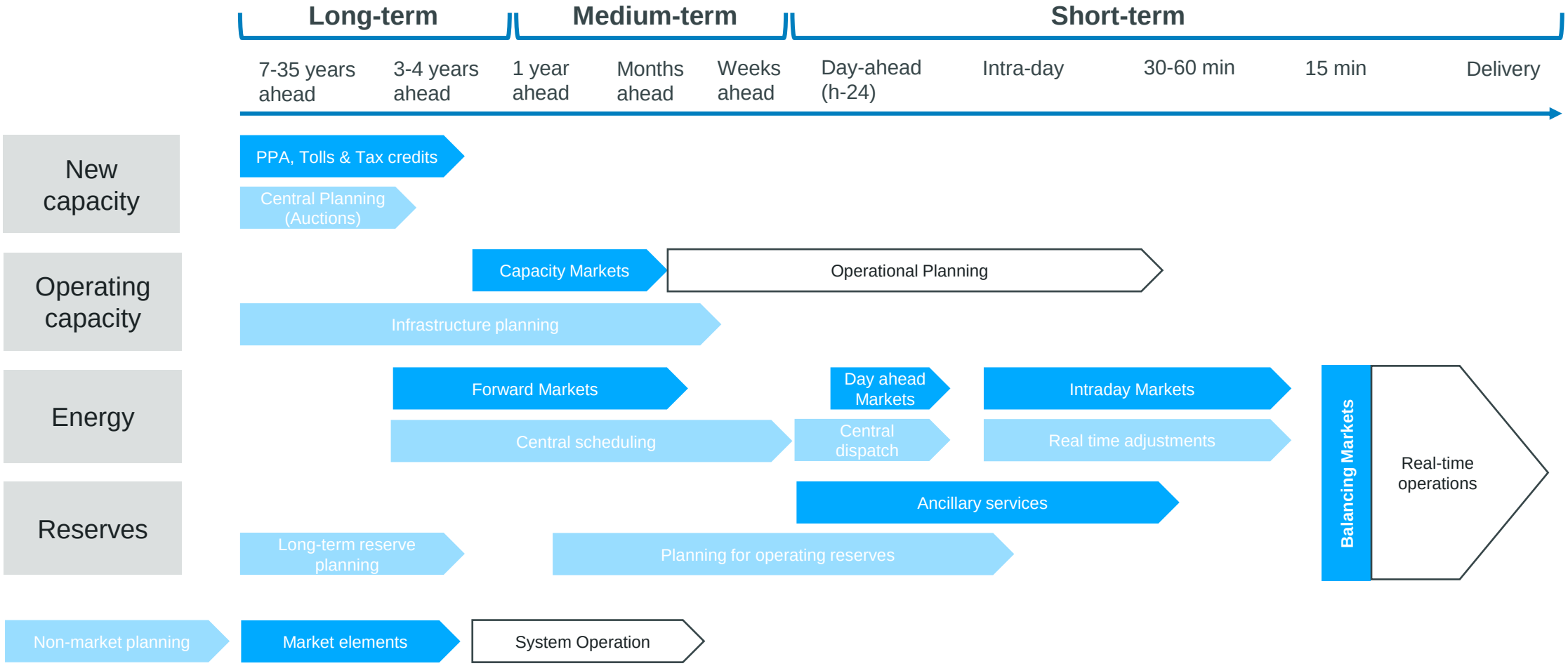
- Day Ahead Market
- Continuous Intraday

Enable bill optimization in day-ahead / continuous intraday arbitrage

➢ ***The EMS facilitates the 'Service Arbitrage' for maximizing the 'Gain'***



DISPATCH TEMPORALITY DECISIONS FOR POWER MARKETS



Source : IEA

MAIN FUNCTIONNALITIES OF AN EMS

Data Management

Collect real-time asset telemetry, archive the information to enhance visibility, enable ongoing monitoring, and provide advanced data analysis features.

Intelligence and Integration with Trading Platforms

The system should support algorithms for forecasting, optimization, and baseline calculations. It must be capable of integrating external models, trading signals, and schedules while enabling the development of hybrid entities. Users should have the ability to customize and adjust models as needed.

Power Management & Dispatch

Facilitate energy programs and provide real-time dispatch directives to local resources, ensuring the integration and oversight of multi-asset systems while suggesting degraded modes when required.

Solution Compatibility & Scalability

Ability to manage various types of assets, adhere to grid codes, utilize metering devices, integrate with third parties, and operate across diverse geographical regions. Facilitate participation in wholesale energy markets, balancing markets, and grid services.

Plans for Maintenance and Unavailability

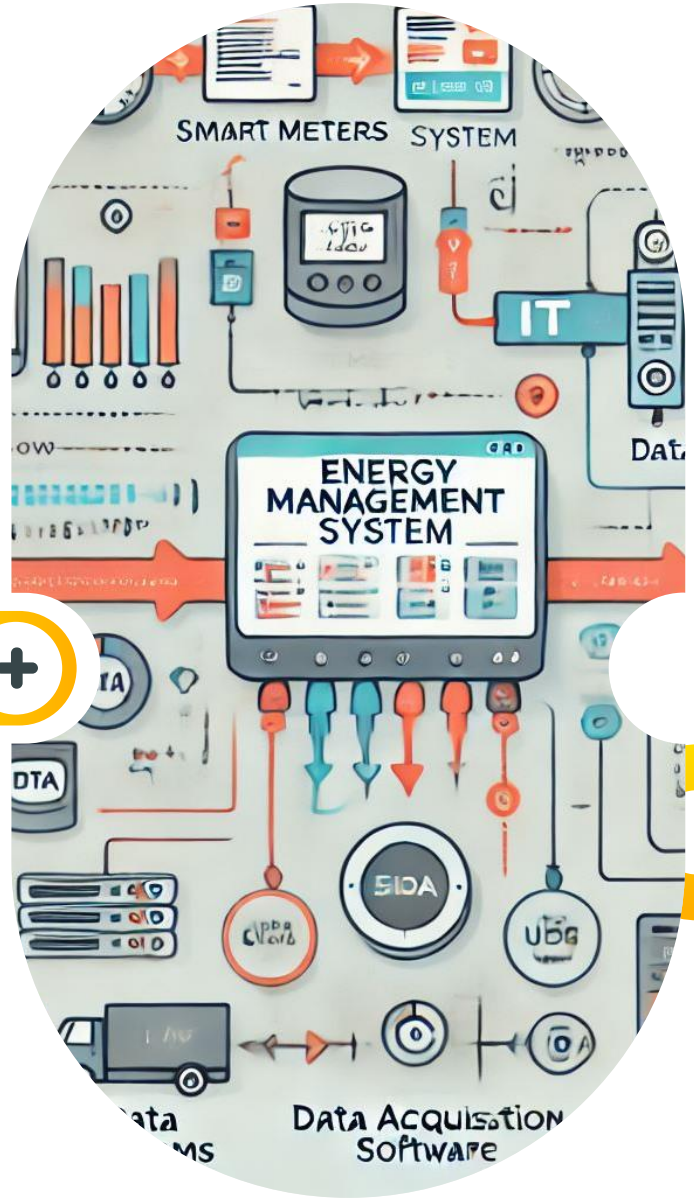
*The capability to arrange maintenance schedules and periods of unavailability, while also documenting these instances (including planned outages), and communicating this information to external entities (**e.g., REMIT**, TSO/RTO/ISO).*

Interface

Includes a user interface and customer portal that features dashboards and reporting on market outcomes, economic values, asset behaviors, green tracking, and KPIs, all with options for customization. It enables the setting of various types of alerts through multiple methods.

Security

*Capacity to assess the safety of assets, recommends fail-safe mechanisms, and includes a Business Continuity Plan (BCP)**. The solution also adheres to security policies and regulations, ensuring the protection of data and code.*

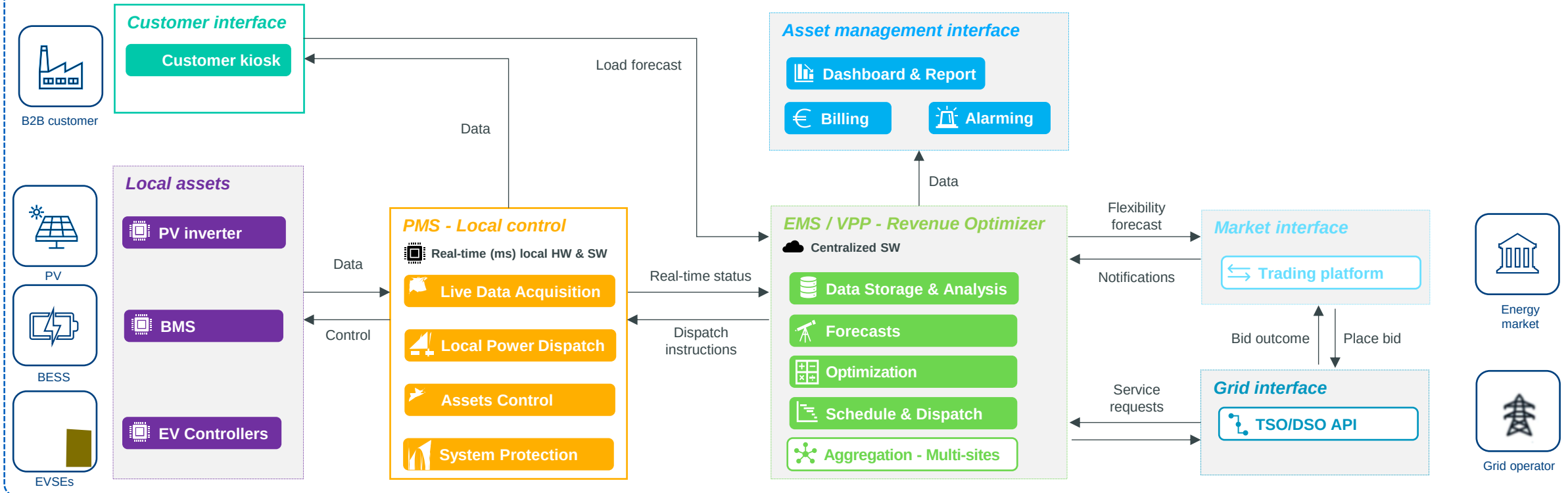


THE EMS ECOSYSTEM ARCHITECTURE

EMS ECOSYSTEM : HIGH LEVEL ARCHITECTURE

TotalEnergies

Functional architecture



Key characteristics

PMS: Local setup

Depending on selected hardware (e.g. BESS/Genset) & tailored to local requirements (cf. regulation, guaranties)

EMS: Revenue engine

EMS as the critical capability for service value creation and for revenue capture

Integrating 3rd party solutions

Open architecture to connect to external platforms (e.g. grid operators, external aggregators)

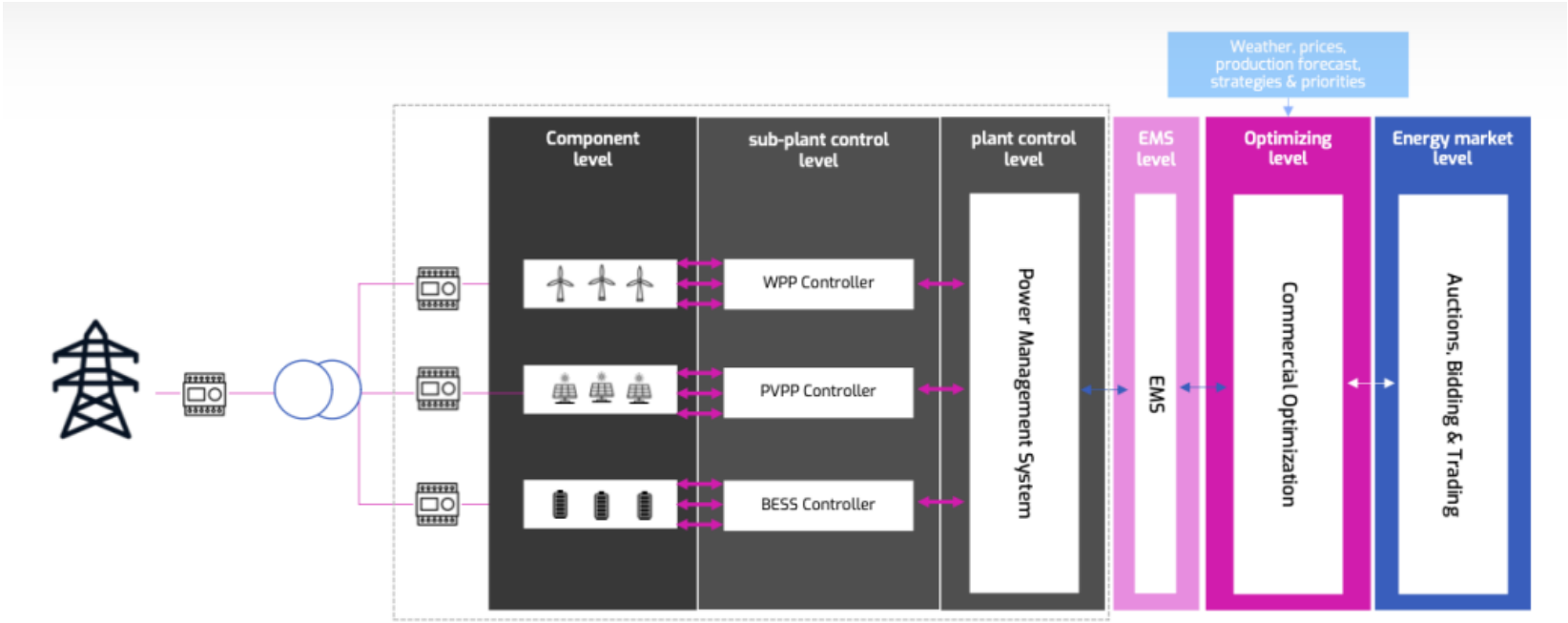
Modular platform

Flexible architecture to adapt to various project typologies and to ease insourcing/outsourcing of modules

Upgradable

Designed to enable replacement/ upgrade of modules with new solutions, to introduce new services, or to adapt to new regulations throughout PPA duration

THE DIFFERENCES BETWEEN CONTROLLERS, PMS AND EMS



In a co-located or hybrid power plant, these systems usually work together to ensure that the batteries operate properly, that energy production is optimized, and that the power distribution meets demand and efficiency requirements. We can see them as different layers in the control part of the asset and with every level one can add more and more intelligence to the plant. **Why?**

→ While the BMS focuses on the batteries, the PMS focuses on the performance of the entire power plant, and the EMS optimizes the overall energy flow and efficiency under the premise of achieving the economically optimized result by considering forecasting, prices, and costs.