

# ENERGY STORAGE

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# Session 2.6 Stand-alone vs Hybrid ES+RES vs Hybrid ESS+ESS: What to go for?



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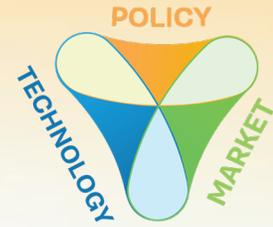
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# Stand-alone vs Hybrid ES+RES vs Hybrid ESS+ESS: What to go for?

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The logo for LCP Delta, featuring a small orange plus sign to the left of the text "LCPDelta" in a blue, sans-serif font.



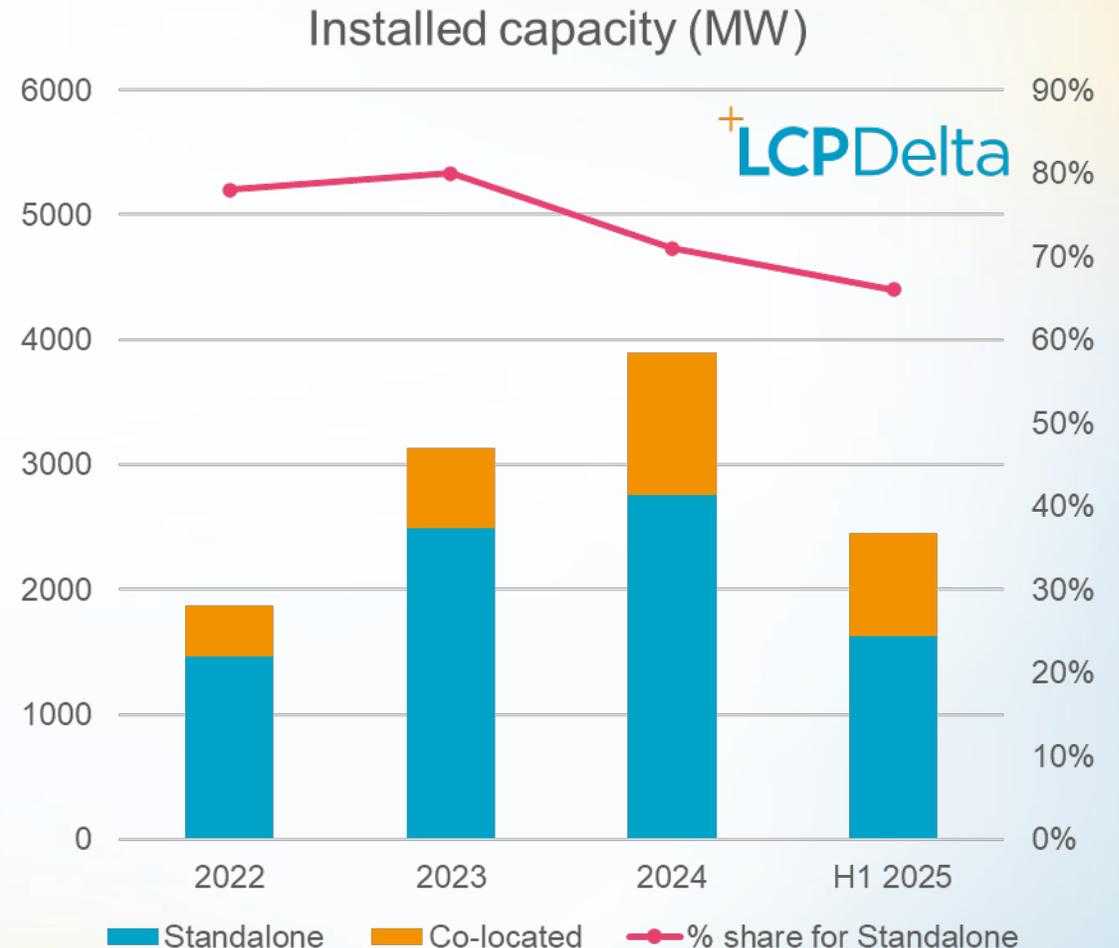
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# Which option is more popular?

## Standalone dominates the market

- More than 2/3 of the capacity is standalone
- Both market segments are growing
- The % of standalone in the overall market share is dropping. But this doesn't necessarily imply a strong growth in hybrid projects with energy storage

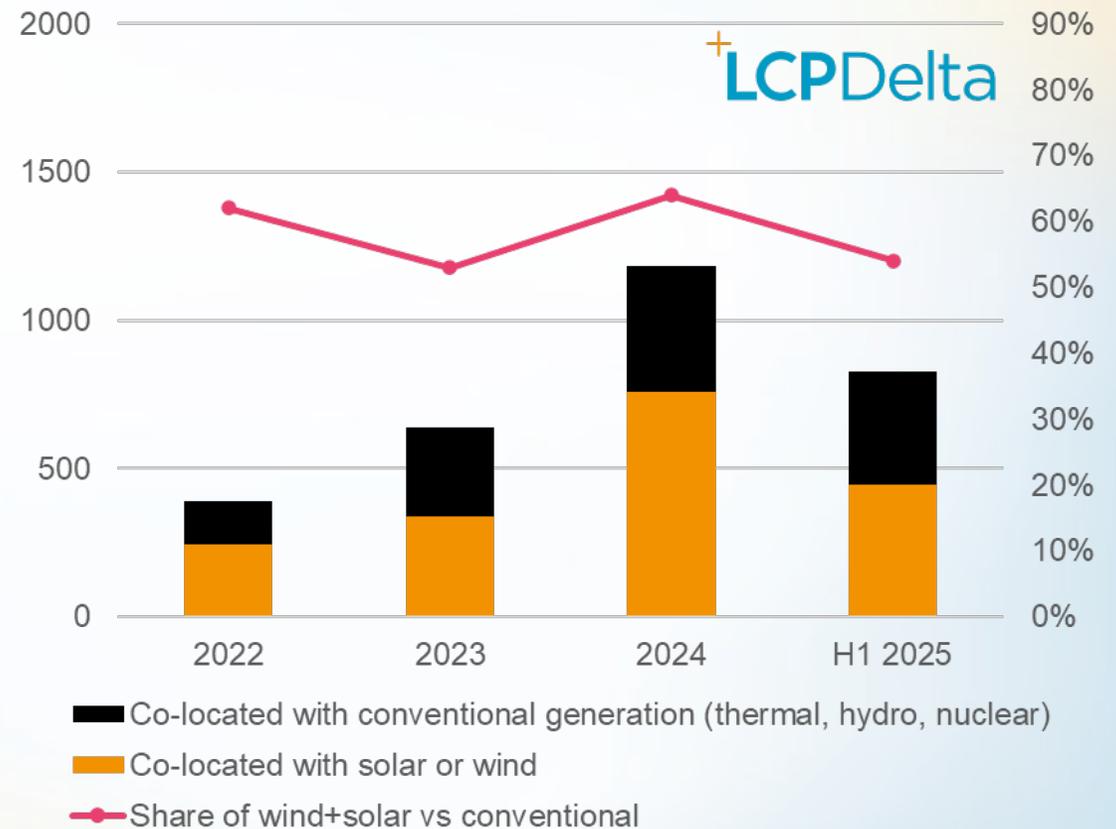


# A closer look at co-located projects

## More projects collocated with wind or solar

- The fact that 35-45% of the co-located projects each year are installed next to a conventional plant hints that there may be other motivations driving this market segment
- Commercially these projects would act just like a standalone project
- Projects co-located with solar and wind aren't necessarily under the same metering point or connected on the same inverter.
- This means the dominance of standalone systems is even bigger than the previous slide suggested

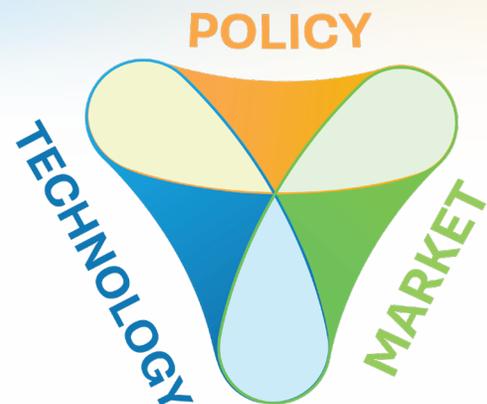
Comparing the different technologies co-located with storage



# What about hybrid ESS + ESS?

## These are rare to find

- Historically this has mainly happened in smaller scale pilot / demonstration projects
- But some projects are being planned combining different storage technologies.
- Currently our data shows some future projects using combinations of BESS with flywheels, LDES storage technologies (like CAES) and hydrogen.



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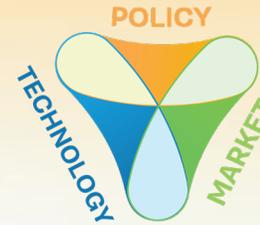
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# Stand-alone vs Hybrid ES+RES vs Hybrid ESS+ESS What to go for?

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# Answering market needs

EV Charging  
Infrastructure  
Support

Data Center Power  
Reliability

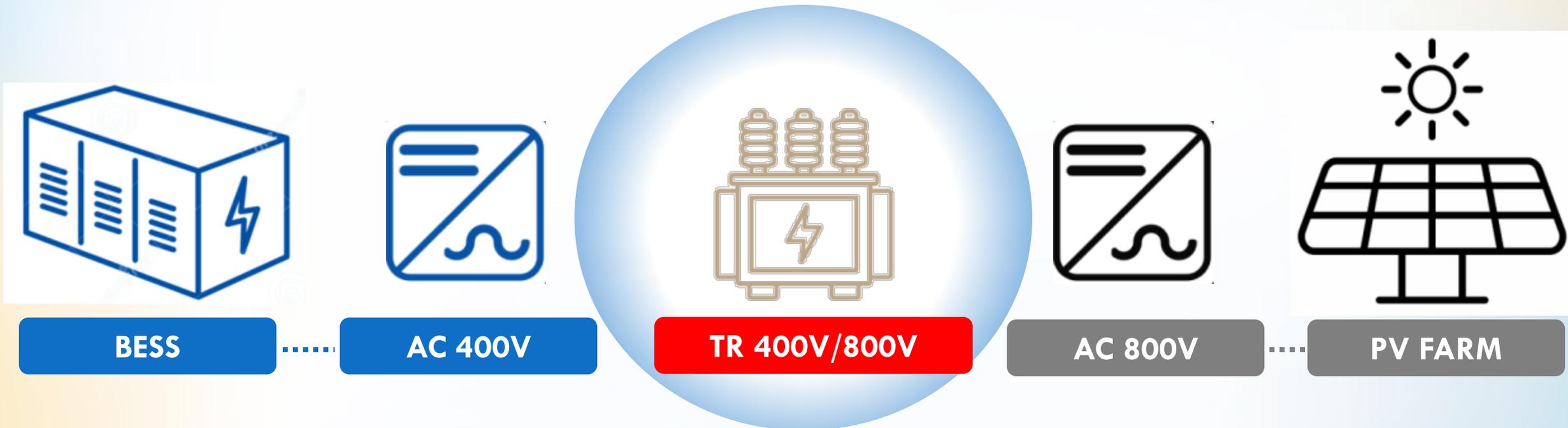
Commercial &  
Industrial (C&I) Peak  
Shaving & Backup



Utility-Scale Grid  
Services &  
Renewables  
Integration

# Market Challenge

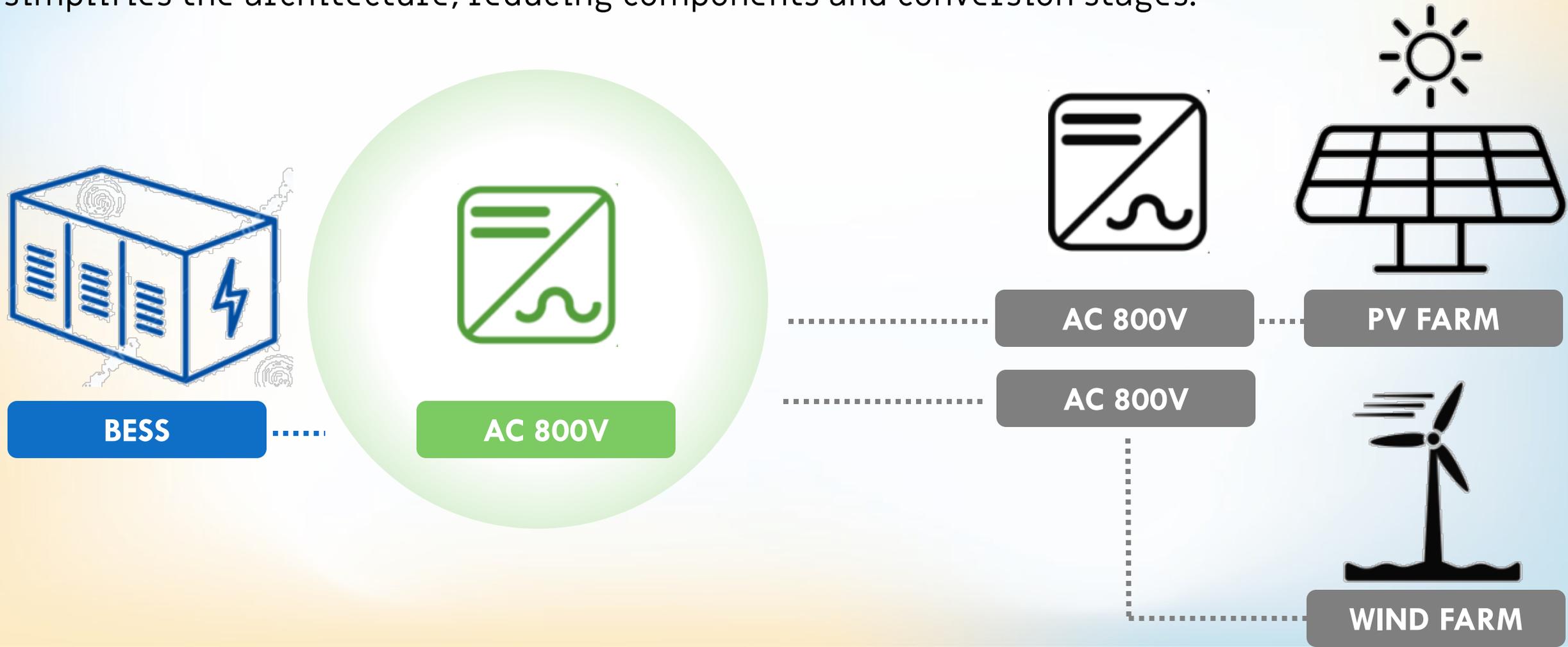
Traditionally, most PV farms in the country operate using transformers at 0.8kV/15kV. Implementing a conventional PCS at 0.4kV (0.69V) requires an additional step-up transformer from 0.4kV (0.69V) to 0.8kV to integrate with these systems.



This extra transformer introduces unnecessary **costs**, including higher **capital expenditures** (CAPEX) for equipment and installation, as well as ongoing **energy losses** during transformation, which reduce overall **system efficiency**.

# Solution made easy

By designing the PCS to output directly at 800V AC, it aligns seamlessly with 800V side of existing transformers in many PV and wind setups. This “plug-and-play” compatibility simplifies the architecture, reducing components and conversion stages.



# key benefits to investors

Investors in renewable energy projects, such as PV farms, wind installations, or hybrid systems, stand to gain substantially from this solution. The benefits are primarily financial and operational:

## CAPEX Savings

- **Elimination of Additional Transformers.** Avoiding the need for a 0.4kV to 0.8kV transformer can reduce upfront costs by 5-15% per installation, depending on project scale. Transformers alone can cost €10,000-€50,000, plus installation and cabling expenses.
- **Simplified System Design.** Fewer components mean lower engineering, procurement, and construction (EPC) costs. This can shorten project timelines by weeks, accelerating revenue generation from energy sales or grid services.
- **Scalability for Large Projects.** For utility-scale farms (e.g., 10-100 MW), these savings compound, making the solution attractive for portfolio investors aiming to deploy multiple sites efficiently.

## OPEX Savings

- **Minimized Energy Losses.** Without the extra transformation, efficiency improves by 1-3%, translating to higher energy output over the system's 20-25 year lifespan. For a 50 MW farm, this revenue is ca. €100,000/yr.
- **Lower Maintenance Needs.** Reduced hardware to service decreases downtime and repair costs. Investors benefit from higher system availability, crucial for meeting PPAs or ancillary service contracts.
- **Less area space required for BESS-related infrastructure.** Transformers and related infrastructure is bulky, so removing them likely saves space.
- **Enhanced Reliability.** Simpler designs lower failure risks, potentially reducing insurance premiums and extending asset life, which boosts long-term asset value for resale or refinancing.

## REVENUE and RISK MITIGATION

- **Improved Energy Yield and Grid Services.** Higher efficiency supports frequency regulation, peak shaving & arbitrage, allowing investors to tap into lucrative markets as balancing services or virtual power plants (VPPs).
- **Regulatory and Environmental Compliance.** Easier integration aligns with EU goals for renewable expansion (e.g., under the REPowerEU plan), potentially qualifying for subsidies or tax incentives. This de-risks investments amid tightening emissions targets.
- **Overall ROI Impact.** Studies on similar high-voltage integrations show ROI improvements of 10-20% due to combined CAPEX/OPEX savings and yield gains, making projects more bankable for debt financing.

# How large is the market

European inverter manufacturers commonly use 800V AC outputs, as noted in industry guides, e.g.:

- **Germany, Spain, Italy, and the Netherlands** often employ 600V-800V for solar arrays, with 800V as standard for larger utility-scale projects to optimize efficiency.
- In Eastern Europe (e.g., **Czech Republic, Hungary**), configurations mirror **Poland's** 0.8kV/15kV setup. Western Europe sees variations, but 690V-800V is widespread, especially with EU-harmonized standards like IEC 62109 for inverters.

Overall, 800V is "more common with European inverter manufacturers" compared to lower voltages like 600V in non-EU markets, covering 70-80% of new PV installations across the EU.

## Regional variations and compliance

In some Nordic countries (e.g., **Sweden, Finland**), lower voltages like 400V-690V dominate smaller farms, reducing direct applicability but still allowing adaptations.

Southern Europe (e.g., **Greece, Portugal**) uses similar 800V setups for PV, driven by high solar irradiance and grid integration needs.

EU-wide standards, like EN 50549 as a CENELEC standard for low-voltage connections, **encourage harmonization, making the solution viable in 20+ countries.**

However, it's less relevant in non-EU Europe (e.g., UK post-Brexit variations) or where 400V remains dominant in residential-scale systems.

## Market Readiness:

- **Certified systems** can be deployed across multiple European countries without requiring further technical approvals.

## Enhanced Grid Stability:

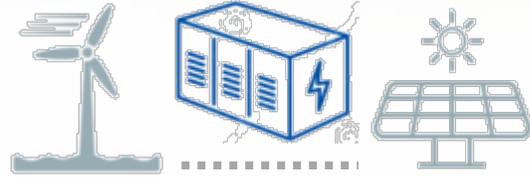
- **Compliance** ensures that the system operates safely and supports overall network reliability.

## Streamlined Project Approval:

- **Quicker integration** of renewable energy solutions makes regulatory hurdles much reduced.

# BESS - co-located or standalone?

## Co-located



BESS integrated at the same site as renewable generators, often sharing a grid connection (e.g., hybrid solar-plus-storage).

## STANDALONE



BESS connected independently to the grid, not paired with a specific renewable source.

### PROS

- **Shares grid infrastructure and connection point**, maximizing underutilized capacity from low load factors in renewables (e.g., 10% for solar, 25% for wind). This reduces costs like cabling, transformers, and network charges.
- **Enables operational flexibility**, revenue stacking (e.g., arbitrage, balancing services), and intermittency management, stabilizing output and enhancing investor appeal.
- **Supports "solar shifting"** (storing daytime excess for evening use) and microgrid formation for resilience.
- **Reduces value deflation** in high-renewable areas by capturing oversupply; can add ca. 10EUR/MWh in market value.

### CONS

- **Export/import constraints:** Assets compete for grid access, leading to curtailed output, shifted dispatch, and revenue losses (e.g., during peak solar and BESS discharge overlap).
- **Requires careful sizing and analysis** to avoid underutilization; market conditions or policies (e.g., PPAs) can complicate viability.
- **May not maximize locational value** if tied to suboptimal renewable sites; incentives like ITC can distort true economics.
- **Higher project-on-project risks** (e.g., delays in one asset affecting the other), though mitigable with independent operations.

- **Allows optimal siting at high-value grid points** (e.g., congestion-prone areas), potentially adding EUR/Mwh in system value over hybrids.
- **Focuses on grid services like energy arbitrage** (charge low, discharge high), **peak shaving, and demand response**, yielding financial incentives and cost savings.
- **Provides independence**, avoiding conflicts with renewable generation profiles; often higher returns in markets like Europe (e.g., 10-year SPBT).
- **Enhances grid resilience and sustainability broadly**, with better energy forecasting via EMS software. - Greater financial viability in some regions without needing renewable synergies.

- **Potentially higher upfront costs** for separate interconnections and no shared infrastructure savings.
- **Misses direct renewable synergies** like excess capture, leading to reliance on grid charging and possible higher emissions if not paired with clean sources.
- **Exposed to merchant risks and market volatility** without renewable hedging; may not qualify for paired incentives. - Less effective for site-specific intermittency management compared to hybrids.

# Conclusion and follow up

While rooted in Polish market needs, its alignment with European voltage standards — such as 800V for PV and 690V-1kV for wind — extends its value to most EU countries, supporting broader adoption in the transition to renewables.

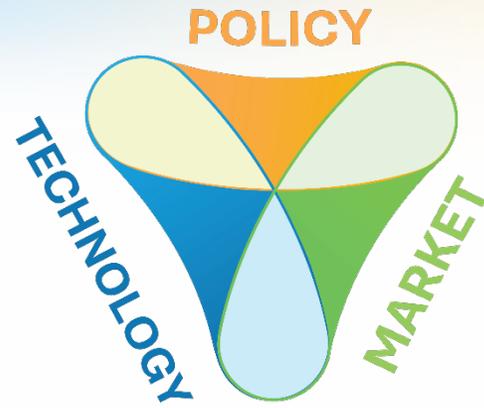
This innovation shifts BESS from a cost center to a value driver, appealing to investors focused on sustainable, high-yield portfolios.

Based on EU renewable trends, this innovation applies to the majority (60-75%) of utility-scale PV and wind projects, especially in Central and Western Europe, where voltage levels overlap with 800V norms.

**RelyEZ integrated 800V AC PCS inverter in BESS is a targeted innovation**

that streamlines integration, cuts costs, and boosts efficiency, directly benefiting investors through enhanced ROI and reduced risks.





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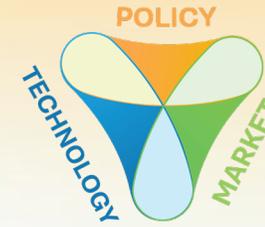


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Head of Project Development Batteries

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# Hybridizing BESS and renewables...

## Many red herrings!

<b>Arbitrage Fallacy</b>	Let's add storage to our wind farm to capture those <b>juicy price spreads</b> between peak and off-peak hours	
<b>PPA myth</b>	Hybrid projects get <b>better PPAs</b> because offtakers want baseload-like products	
<b>Green storage bias</b>	We obviously need to <b>store our clean energy</b> for when the sun doesn't shine	
<b>Capture rate misconception</b>	<b>Capture rates</b> on PV plants are terrible. I will add a BESS to shift my energy to the shoulder hours.	

- BESS are **not the «good samaritan»** to save renewables projects.
- **Renewables need to be profitable** or they will not be built.
- **Portfolio effects, hybrid PPAs, load shifting can all be achieved with standalone BESS** – as long as in the same price zone.

# It's the grid connections, stupid!

## Infra cost sharing

I am already building a substation. Adding BESS will allow to share the cost.



## Local curtailments

I am facing local curtailments on my RES and would like to save the energy.



## Regulatory incentive

My country's tariff regulation incentivizes hybrids.



## Grid connection scarcity

No chance I find grid connection for my standalone asset (without waiting for 5 years)



- In some countries, grid connection is so scarce that hybrids are the **best option to deploy BESS** (fast)
- CAPEX sharing, curtailment reduction and regulatory incentives are valid reasons for hybridizing

# It's the grid connections, stupid!

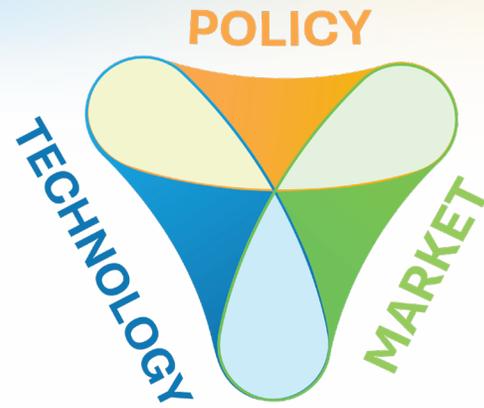
Connection queues are jamming distribution networks

Slow approval times and administrative complexity remain significant barriers

Grid connection delays increase commissioning lead times, slowing down rollout

732 GW grid connection queue choked (UK)

Grid connection requests swell beyond 500 GW (DE)



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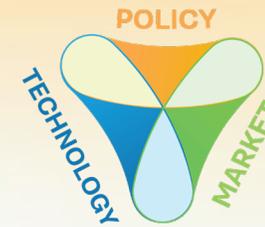
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Simon Sinsel

Global Head of BESS Sales

Siemens Energy

**SIEMENS**  
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# Hybrid Project Overview



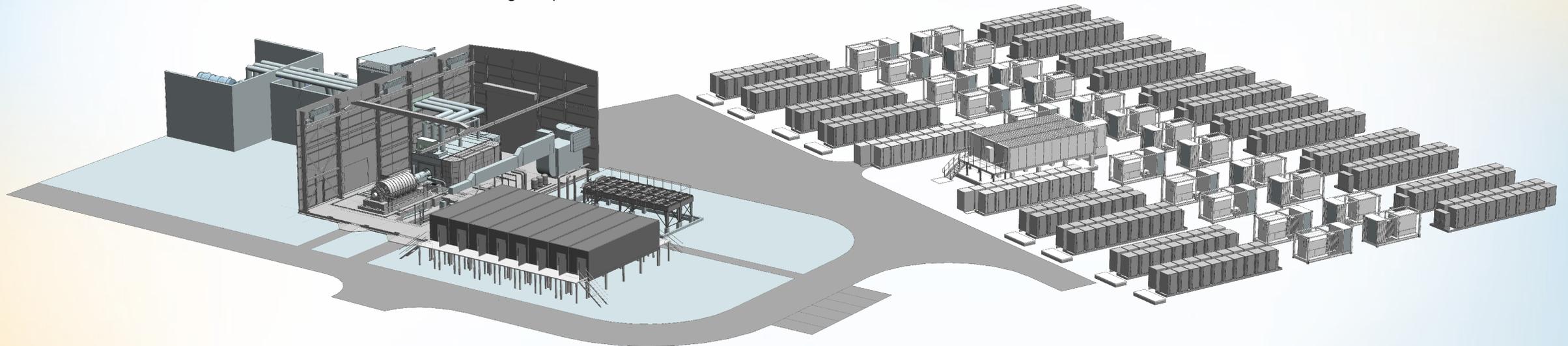
## Synchronous Condenser & Flywheel

- Proven design for max. provision of short circuit power and kinetic energy to the power grid
- Prefabricated, modular control building for quick reduced installation times on site



## Outdoor Battery units

- Durable design suitable for outdoor installation



## Var controller

- Common control system between SynCon and BESS for reactive power contribution



## Hybrid Control Unit

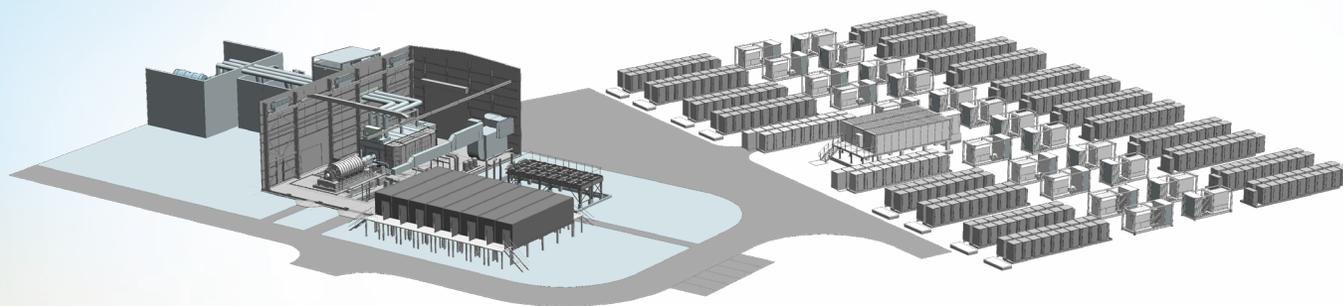


## PCS skids

- Cutting-edge technology for maximum efficiency
- Consisting of MV switchgears, inverters, transformers and communication device



# SynCon+BESS – A powerful combination for Grid Stabilization



## Project name & location

Shannonbridge B, Ireland

## Use case

Provision of inertia, voltage regulation, fast frequency response to stabilize the Irish transmission grid



## Scope

- SynCon incl. Flywheel (4000MWs)
- BESS system (63 MW / 158 MWh)
- HV Grid connection
- Common reactive power controller
- Supervision of installation
- Commissioning



## Value-add

Delivery out of one hand with a common reactive power controller between BESS & SynCon



## Status

In commissioning

## Key take aways

1. Hybrid BESS solutions serve key technical requirements of evolving, renewable-based power systems
2. Limited grid connections accelerate the need for innovative hybrid approaches
3. Evolving revenue models and business cases will shape market growth

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