



Hybrid power plants may soon be the industry standard

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Providing electricity from solar or other intermittent renewable sources of energy in a grid-serving and consumption-based way is exactly what hybrid power plants can do, provided the source of generation is combined with a battery storage system. This is why, at Intersolar Europe 2025, hybrid power plants were the talk of the event. Both at the Intersolar Forum and the Intersolar Europe Conference, the opportunities offered by hybrid power plants were discussed, particularly concerning innovative business models, though the persistent challenges they face were just as hotly debated.

For the last few years, the speed of the global energy transition has been exceeding all expectations. According to the Global Market Outlook for Solar Power 2024 to 2028 by SolarPower Europe, the cumulated solar power capacity in 2024 was 2.2 terawatts, and think tank Ember's Global Electricity Review 2024 reported that solar energy covered seven percent of the global power mix.

In mature solar markets, the rapid expansion created structural issues in the energy system, including grid congestion and negative electricity spot prices resulting from generation peaks during times of low consumption and a lack of storage.

'In Germany, between noon and 2pm, 20 percent of all hours saw negative electricity prices in 2024, meaning that one in five kilowatt hours (kWh) of electricity was traded at negative prices on the power exchange,' explains Kai Becker, Chief Development Officer at Energy2market, a utility company that exhibited at the Intersolar Europe Conference 2025.

This market development impairs the profitability of solar and wind projects, a financial worry, because cheaply produced renewable electricity is not put to full use. Consequently, the order of the day at Intersolar Europe 2025 was: think systemically, promote integration. One possible way of achieving this is hybrid power plants. After all, the combination of power generation and storage ensures the ideal utilization of solar battery power plants. It

allows storing electricity generated during times of negative electricity spot prices until it can be sold at a profit.

Hybrid projects in Europe: the United Kingdom is forging ahead

Across Europe, hybrid power plants have gained importance over the last few years. In 2015, around 5% of all battery storage systems installed in Europe were combinations of photovoltaics and storage systems (PV+BESS). The UK is leading the way. With 62% of all PV+BESS capacity installed, the UK demonstrates how targeted political measures, favorable market conditions and major ambitious projects can accelerate the growth of hybrid power plants.

Funding instruments, such as the capacity market and the contract for difference (CFD) system, as well as accelerated approval processes and regulatory reforms to improve the integration of battery storage systems, created an environment conducive to innovation.

By comparison, the share of hybrid PV projects within the EU was much lower, with 10% in Sweden, 8% in Italy, 6% in Germany and Bulgaria and 5% in Denmark. The remaining EU-27 and Switzerland combined only reached three percent. These figures, published in SolarPower Europe's Embracing the Benefits of Hybrid PV Systems report, bring home that the potential of hybrid energy systems remains largely untapped in wide parts of Europe.

The million-dollar question: should batteries be allowed to be charged from the grid?

A key reason for the slow development seen in many countries is that regulatory hurdles prevent the full potential of hybrid projects from being realized. A particularly tricky question is whether it should be possible to charge batteries with grid power. This way of using PV+BESS hybrid power plants is still limited in many European countries, unlike stand-alone battery systems. And this affects profitability, because if cheap grid power cannot be stored and sold again later at a profit, key business models, such as arbitrage, remain untapped.

These limitations are due to subsidy rules for feed-in tariffs or investment grants that specify that storage systems may only be charged with renewable electricity. As yet, there is no methodology for distinguishing between gray electricity from the grid and green electricity from a renewable energy system, meaning that grid charging is not permitted for subsidized systems, even though there are tracking systems that would allow this.

Experts, meanwhile, agree: the flexible use of battery storage systems, including the option to charge from the grid, would not only boost the profitability of hybrid systems, it would also help provide the sorely needed flexibility for stabilizing the grid. Some initial solutions to these challenges were presented at Intersolar Europe 2025.





Energy arbitrage: electricity trading as a business model

This is where a promising business model for PV+BESS comes in: energy arbitrage. In this model, a battery storage system can charge renewable electricity from, and discharge it to the grid flexibly, with the change in operating mode allowing profit-oriented electricity trade on the power exchange.

The prices of battery storage systems are dropping and the spreads on the electricity market are widening. Therefore, arbitrage transactions present the most financially promising option.

That being said, the model presents project developers with major challenges because depending on unpredictable market and price dynamics means that robust earnings simulations are difficult to create. This makes banks and other investors reluctant to invest in hybrid power plants, whose earnings are based on direct marketing of electricity through arbitrage transactions.

System services: a new market for hybrid power plants

While fossil fuel power plants are being phased out, renewables, and among them PV, are increasingly called upon to help stabilize the grid. Grid stabilization is done by providing power system inertia and operating reserves, controlling reactive power, voltage and frequency in the grid, and enabling a black start. The variable dispatchable characteristics of batteries allow hybrid power plants consisting of PV+BESS to replace the

systemic inertia that has previously been provided by synchronous machines in fossil fuel power plants.

In European countries such as Germany and Spain, markets for system services, including public tenders, are being created. This is expected to drive the expansion of hybrid power plants because their business case is then based on a predictable, continuous source of revenue. Countries where the creation of a market for system services has driven the construction of hybrid power plants include the US and the UK.

Intersolar Europe 2025 also showcased state-of-the-art software solutions that will enable a financially beneficial switch between direct marketing, energy arbitrage and system services. Novel inverters with grid-forming technology further improve the integration into the grid.

Regulatory challenges stand in the way of progress

Despite their obvious benefits, hybrid power plants are still facing regulatory hurdles. In many countries, there is a lack of targeted support schemes and feed-in tariffs to make the combination of generating and storing electricity profitable. Oftentimes, approval processes are not designed to expand existing systems by adding a storage device or additional generation capacity.

Dual grid charges, fees for charging and discharging a storage device, remain a significant obstacle to profitability in some countries. Another challenge curtailing the

potential of hybrid power plants and that needs to be addressed is the obsolete system for guarantees of origin (GOs). These certificates indicate where electricity was generated.

Hybrid power plants cannot charge their batteries from the grid if the electricity from the integrated renewable generation plant is to be sold with a GO certificate. Precise measurement and balancing solutions may soon ensure that a distinction between gray and green electricity can be made when power is stored.

This, in turn, would allow the introduction of baseload and pay-as-produced PPAs for hybrid power plants, which would constitute an important step towards exploiting additional PV+BESS business models and offering customized, demand-based renewable power supply solutions to industry.

As the world's leading exhibition for the solar industry, Intersolar Europe demonstrates the enormous vitality of the solar market. Under the motto 'Connecting solar business', global market leaders present their latest product developments, as well as trends and business models for hybrid power plants, battery storage systems and solar technology.

These organizations include manufacturers, suppliers, distributors, installers, service providers, project developers, planners and start-ups. The next Intersolar Europe will take place from June 23rd to June 25th 2026 as part of the innovation hub The smarter E Europe, Europe's largest alliance of exhibitions for the energy industry, at Messe München.

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