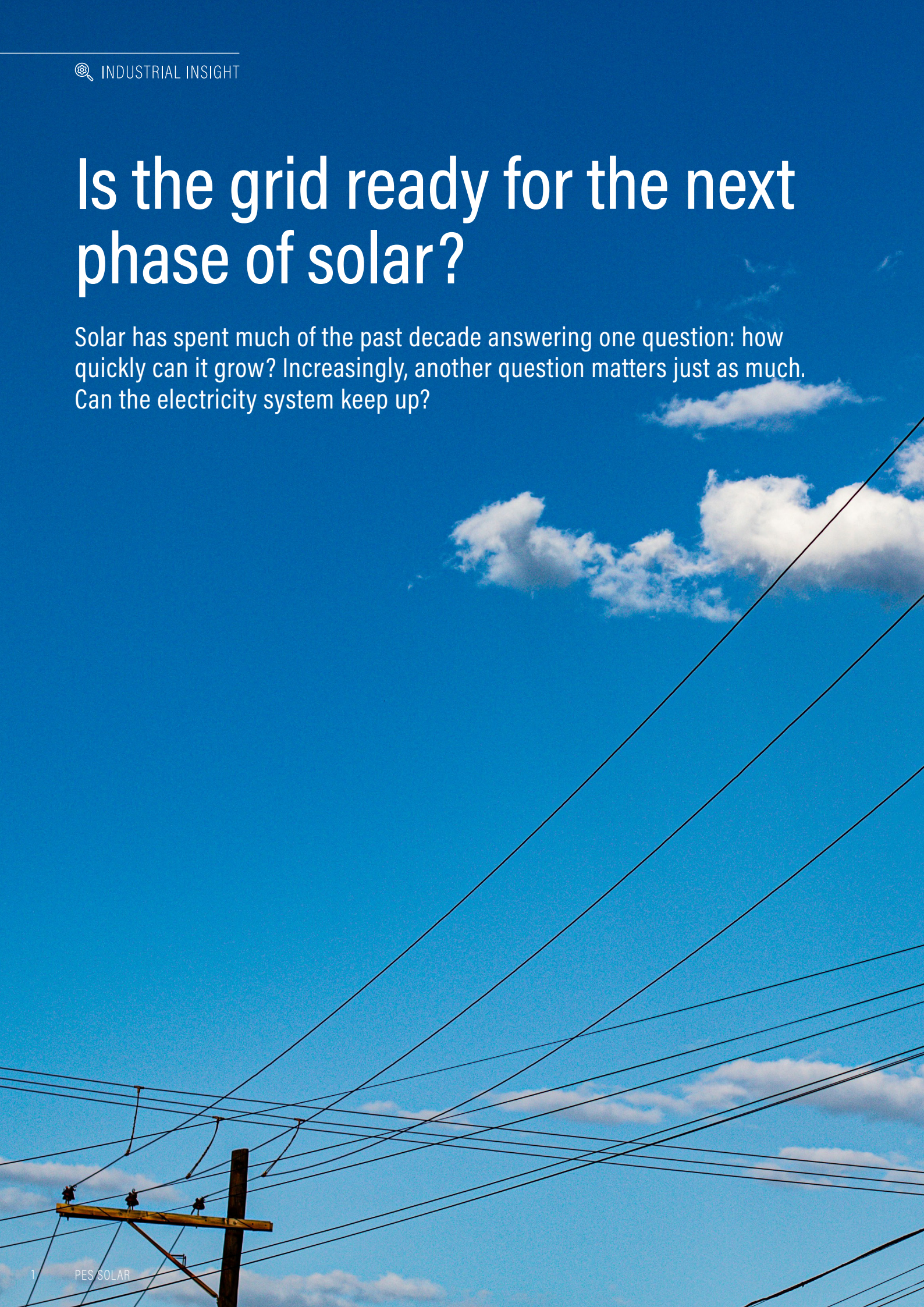
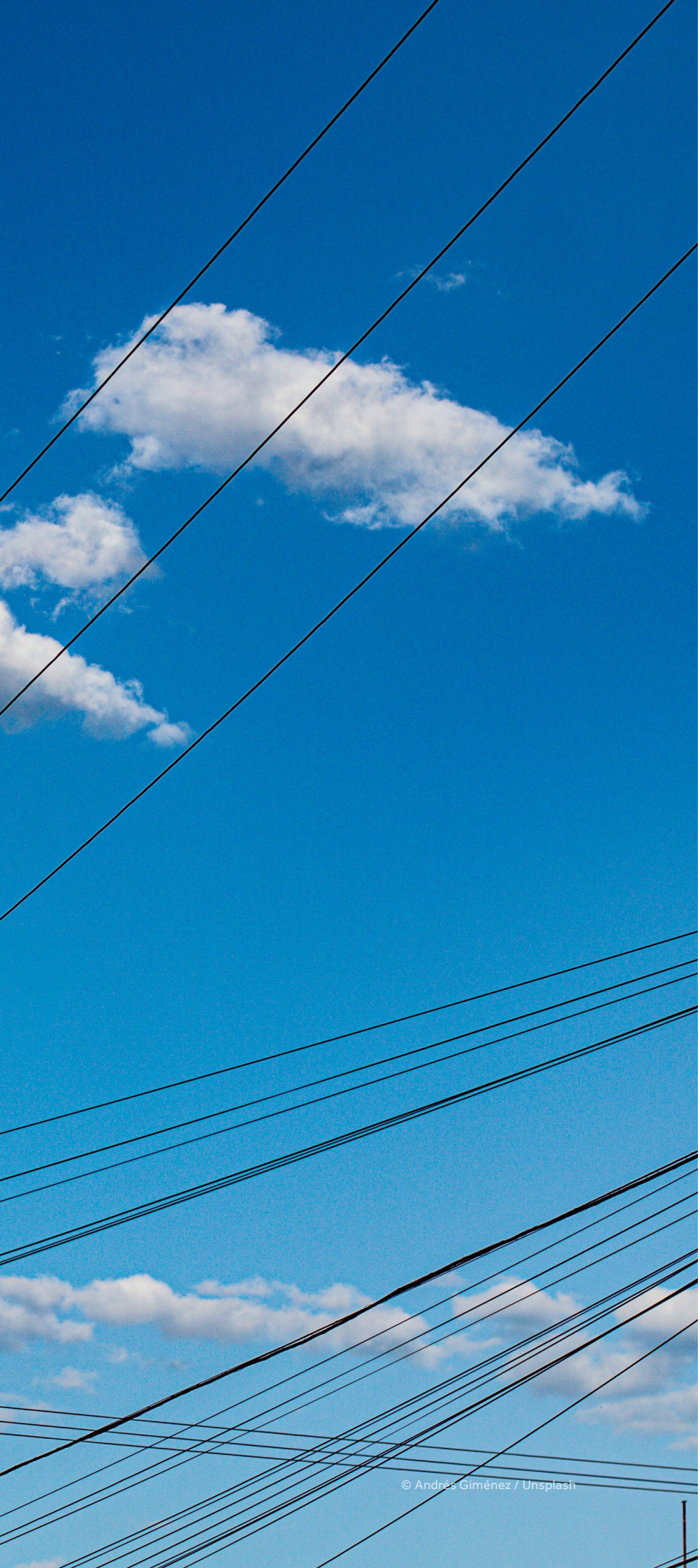
Is the grid ready for the next phase of solar?

Solar has spent much of the past decade answering one question: how quickly can it grow? Increasingly, another question matters just as much. Can the electricity system keep up?





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The change has been remarkable. In 2025, solar generated a record 369 TWh of electricity across the EU, more than double its output five years earlier. Its share of EU electricity rose above 13% and, in June, solar became the EU's largest source of electricity for a month for the first time.[1]

This is a success story, but it is also changing what the industry needs to think about. Installing more generating capacity remains important, yet the next phase of solar will depend increasingly on what happens around the panels: the networks that connect them, the storage that shifts their output, the demand that can respond to periods of abundant generation and the technology that keeps an increasingly complex electricity system stable.

Solar can be built. The more difficult question now is how effectively all that electricity can be used.

Growth is exposing a different constraint

Solar projects can be developed far more quickly than major grid infrastructure. According to the International Energy Agency (IEA), renewable projects such as solar and wind can typically be built in one to five years, while planning, permitting and completing new grid infrastructure can take between five and 15 years.[2]

That difference is becoming increasingly difficult to ignore.

More than 2,500 GW of renewable generation, storage and large electricity demand projects are currently stalled in grid connection queues worldwide. The IEA also estimates that annual grid investment will need to increase by around 50% by 2030 from today's level of approximately USD 400 billion if networks are to meet forecast electricity demand.[2]

Europe is already feeling the effects. The European Commission reports that grid connection queues were present in at least 16 EU countries by mid-2026. Around 120 GW of mature renewable projects, including some 1.5 million household installations, could be at risk of not receiving timely grid access by 2030.[3]

Building more network capacity is clearly part of the answer. But simply adding more lines will not be enough, particularly when the infrastructure can take considerably longer to deliver than the projects seeking to connect to it.

We also need to get more from the grid that is already there.

When cheap electricity becomes a warning

One of the clearest signs of the changing relationship between generation and the grid can be seen in electricity prices.

Negative wholesale prices have become increasingly common in a number of European markets. In 2025, negative prices occurred

during around 6% of hours in France, Germany, the Netherlands and Spain. In the first half of 2026, the figure in Spain reached 17%.[4]

It can be tempting to interpret negative prices as evidence that renewables are producing 'too much' electricity. In practice, they tell us something rather different. At certain times, the electricity system simply does not have enough flexibility to make full use of the generation available.

Solar brings the issue into particularly sharp focus because so much generation arrives within the same daylight hours. As more capacity is installed, periods of very low daytime prices can become more frequent, while demand and prices can rise sharply after the sun goes down.

For solar developers and asset owners, this affects more than the wholesale market. If a solar plant increasingly generates during the lowest-priced hours, the value of each unit of electricity it produces can fall. Curtailment adds another pressure, with potentially useful renewable electricity deliberately reduced because the system cannot accommodate it.

The problem, then, is not simply that there is too much solar. It is that there are not always enough places for that electricity to go, whether across the network, into storage or towards demand that can be moved to the hours when solar is abundant.

Storage changes the equation

This is where battery storage is beginning to make a significant difference.

Europe installed 36 GWh of new battery energy storage systems in 2025, taking total operational battery capacity beyond 100 GWh for the first time. Utility-scale batteries accounted for more than half of those annual installations.[5]

A battery can absorb electricity when solar generation is plentiful and prices are low, then release it later when demand and prices rise. At system level, storage can also provide services that help manage the network and maintain stability.

There are already signs of what this could mean in practice.

Germany curtailed around 3.1% of its solar generation in 2025, according to analysis by energy think tank Ember. Across wind and solar combined, an estimated 9.6 TWh was curtailed. Ember calculates that Germany's announced battery projects, had they been available to absorb otherwise wasted generation, could have avoided around a third of that curtailment.[1]

Storage will not remove the need for grid investment, but it can change how effectively existing and future infrastructure is used. It can also alter the economics of solar by allowing electricity generated at midday to be sold or consumed later.

The battery market is responding quickly. SolarPower Europe expects annual European battery installations to exceed 50 GWh in 2026 under its medium scenario, with utility-scale projects providing almost two-thirds of the total.[5]

Even so, batteries are only part of the picture.

Demand has to become part of the system

For decades, electricity systems have largely been designed around generation responding to demand. With much larger amounts of solar and wind on the system, there is an opportunity to make demand more responsive too.

An industrial process that can move some electricity consumption into the middle of the day, an electric vehicle that charges when solar output is plentiful or a building that changes when it heats, cools or stores energy can all provide flexibility without requiring additional generation.

The IEA estimates that only around 100 GW of demand response was being used globally as of 2024, despite a much larger technical opportunity.[6]

This could prove important for the next stage of solar. Rather than treating demand as fixed and trying to fit generation around it, some electricity consumption can be shifted towards the times when power is abundant, inexpensive and available locally.



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For businesses, that could make energy management a more active part of operations. For grid operators, it provides another way to relieve congestion. For solar, it creates demand when generation is at its highest.

Electrification adds another dimension. Electric vehicles, heat pumps, industrial electrification and data centres are increasing electricity demand. Managed intelligently, some of that demand could help absorb renewable generation rather than simply placing another burden on the grid.

Getting more from the grid we already have

Physical network expansion remains unavoidable, but Europe is also looking more closely at how connections are allocated and how existing capacity is used.

The European Commission's European Grids Package includes measures intended to improve grid planning, speed up permitting and make connection procedures more efficient. Its guidance includes moving away from a simple 'first come, first served' approach where appropriate, towards systems that consider whether projects are genuinely ready to proceed.[3]

Flexible connection agreements offer another option. Instead of making a project wait until the network can guarantee unrestricted access at all times, a generator or consumer may be connected earlier on the understanding that its use of the grid can be limited under specified conditions.[3]

Better forecasting, digitalisation and clearer information about available network capacity could also help developers choose locations where projects can be accommodated more readily.

None of this removes the need to reinforce ageing networks. What it does recognise is that a grid designed for a more centralised electricity system cannot simply continue operating in the same way while the generation mix around it changes so profoundly.

Inverters have a bigger job to do

The changing grid is also placing greater demands on technology that, to many outside the industry, remains largely invisible.

Traditional power systems have relied heavily on large synchronous generators, whose rotating machinery inherently contributes to characteristics such as system inertia and voltage support. Solar PV connects to the grid through power electronics, so as inverter-based generation becomes a larger part of the electricity mix, those technical characteristics have to be provided differently.

This is increasing interest in advanced and grid-forming inverters. Rather than simply following an existing grid waveform, grid-forming technology can contribute actively to establishing and supporting stable grid conditions.


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The IEA identifies grid-forming inverters, alongside measures such as synchronous condensers, as one of the technologies that can reinforce system strength as the proportion of synchronous generation declines.[6]

For the solar sector, the implications are significant. The inverter is no longer simply the equipment that converts DC electricity from the modules into AC electricity for the grid. Solar and storage assets are increasingly being asked to contribute to the operation and stability of the wider power system.

The next phase is integration

Grid congestion, curtailment and negative prices can easily be presented as warning signs for solar. They are also evidence of just how far the technology has come.

Solar is no longer a relatively small addition to the electricity mix. It is becoming one of its central components. In 2025, wind and solar together generated more electricity in the EU than fossil fuels for the first time. Solar alone supplied more than 13% of EU electricity.[1]

At that point, what happens around solar matters almost as much as the generating capacity itself.

The next phase will involve grids planned with future demand and generation in mind, storage that moves energy between hours, consumers able to respond to changing supply, stronger interconnection between regions and power electronics capable of providing services once associated mainly with conventional generation.

These are not arguments against further solar growth. Quite the opposite. They are the consequences of solar becoming a mainstream part of the electricity system.

Solar has already proved that it can be deployed rapidly and in enormous volumes. The task now is to make sure the electricity system develops with it.

If it does, the next phase of solar will not simply be about how many more gigawatts are installed. It will be about how much more value we can get from every gigawatt already connected and every one still to come.

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