Array Changing Technologies: the preview

Once again, **pv magazine** is bringing together the most innovative PV products launched this year. In 2018, Array Changing Technologies returns to recognize those solutions which are helping to push more power out of solar installations large and small, aiding the technology's growth into new regions and new markets, and contributing to the renewable energy system of the future.

With such a wealth of new modules, inverters, mounting systems, trackers, batteries, energy management systems, and PV array supporting components on offer, the feature will be spread across two issues, with a jury of industry experts set to cast its eye over the crop of submissions, and choose an overall winner in time for September.

This winner, and a select few finalists, will also qualify as candidates for the inaugural **pv magazine** award, to be given at the end of the year. The recipient of this award will be chosen from the top submissions to the various features running throughout the year, covering all of the industry's major segments.

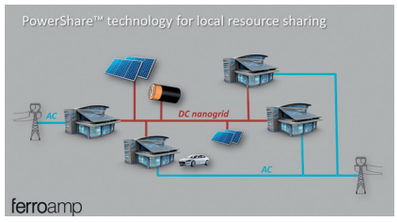
Now, a selection of some the strongest solutions launched in 2018, many of which will be on display at Intersolar Europe in Munich, and at Intersolar North America in San Francisco. Which will turn out to have truly Array Changing potential? Only time will tell… pv

Ferroamp

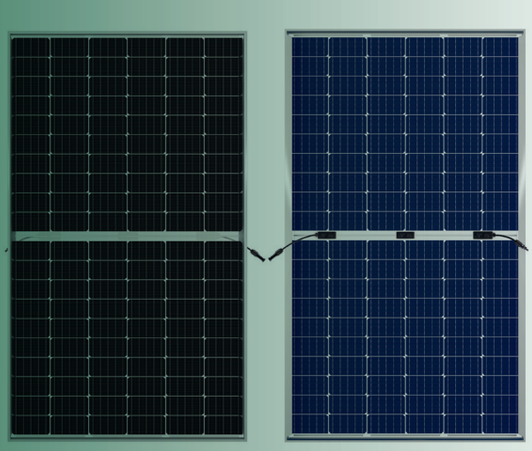
PowerShare small-scale nano-grid

Current electricity grids are centralized, top-down systems. But what would a bottom-up system look like? Ferroamp's Powershare is a good example of such an approach. It is a small-scale DC nano-grid shared by a small group of consumers as a backup to the main AC grid. The Powershare nano-grid consists of small-scale generation – usually PV and/or wind – and often also batteries and electric vehicle charging stations.

A number of successful projects in Sweden have shown the feasibility of the solution by connecting local office buildings in a small grid. This provides them with backup electricity in the case of a power outage, but also creates a local micro-economy and reduces their electricity tariffs. The company acknowledges that regulatory hurdles exist in many countries in which there are few distribution companies with a natural monopoly. However,



the European Union's "Winter Package" has taken steps toward opening up markets for micro-grids operated alongside traditional monopolies.



LONGi Solar

LR6-60HBD module

With front side conversion efficiency of up to 18.9%, LONGi Solar's new bifacial mono-PERC module also utilizes half-cut cell technology. Its front side power ranges from 310-320 W, and the bifaciality is higher than 75%.

LR6-60HBD is designed with durability in mind, and LONGi Solar backs this up with a generous 30 year linear power warranty of 84.95% performance, which equates to an annual power degradation rate of less than 0.45%.

Furthermore, the company states that the glass-glass module designed with frame is highly robust in terms of mechanical strength, and also easy to install.

LONGi Solar's half-cut bifacial module is perfect for environments with diffuse light, or where space is at a premium.

The company will be displaying the LR6-60HBD module and more at Intersolar Europe in Munich.

Intersolar Europe: Hall A1, Booth 440

Huawei

FusionSolar Smart PV intelligent inverters

Huawei is no stranger to large-scale. Its inverters can be found in the largest single PV plant (1 GW in Yanchi, Ningxia, China), the largest solar plant with tracking (700 MW in Ningxia, China), and the largest rooftop plant (300 MW in Zhejiang, China). According to GTM Research, 52.2% of the global inverter market in 2017 was captured by three-phase string inverters, of which 56% were supplied by Huawei, including 10 GW of shipments outside of China. Huawei's rise and rise does not appear to be waning as it introduces its FusionSolar Smart PV Solution.

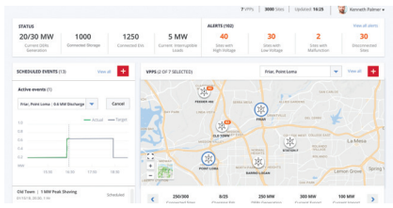
FusionSolar Smart PV adds a layer of artificial intelligence to the inverters, aiding in operations and maintenance (O&M). It can detect numerous faults, reveal points of failure, and ultimately increase yield while reducing O&M costs. It offers a cloud-based platform with an app so plant managers can rapidly see how their plant is performing.

Intersolar Europe: Hall B2, Booth 230

SolarEdge

Grid services and virtual power plant solution

Intersolar Europe: Hall B3, Booth 110
Intersolar North America: Booth 8521



SolarEdge offers an innovative solution for grid services and virtual power plant (VPP) management. It supports a new model of energy generation based on an interconnected grid and distributed generation. SolarEdge's grid services aim to foster a shared energy economy with near real-time aggregate control and data reporting. Consequently, users could pool PV, storage, and electric vehicle chargers in the cloud for the creation of VPPs. SolarEdge states that its solution would benefit all stakeholders. Utilities benefit, as the solution provides them with the tools to leverage distributed energy generation systems to more efficiently meet demand. Energy retailers can enjoy increased protection from price peaks. PV system owners can increase their revenue from joining this new energy economy.

Hanwha Q CELLS

Q.PEAK DUO-G5 module

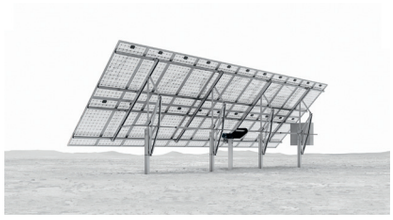
Hanwha Q CELLS' new module series Q.PEAK DUO-G5 comes in four varieties: 315 W (min. 18.7% efficiency), 320 W (min. 19% efficiency), 325 W (min. 19.3% efficiency), and 330 W (min. 19.6% efficiency). The six busbar modules contain 120 half-cells. The aluminium frame is certified for high snow and wind loads, at 5,400 Pa and 4,000 Pa respectively.

The modules are also available as the all-black Q.PEAK DUO BLK-G5. Finally, the performance warranty: Hanwha Q CELLS guarantees at least 85% performance in year 25 to allay any investors' concerns. The Q.PEAK DUO-G5 series continues to push the envelope and raise the bar for competing modules in terms of efficiency, durability, and clean design.

Intersolar Europe: Hall A1, Booths 180 & 270

Mounting Systems

Sigma Tracker



Mounting Systems is offering an innovative single-axis tracker system. An efficient electric motor drives the torque tube and the jack in a tilt range of up to +/-50°. The Sigma Tracker was designed with two main goals: to achieve static stability and minimize vibrations during operation; and to create a smooth and low friction system that will ensure a low level of energy demand.

The Sigma Tracker is unique in that it mounts up to three modules in portrait unlike competing solutions. Additional portrait and landscape configurations are also possible, providing design flexibility and ensuring optimized project layout. Further, the Sigma Tracker can withstand wind speeds of up to 260 km/h.

The coated steel that makes up the system is self-healing, ensuring durability even in highly corrosive environments. In addition, all electrical and moving parts were designed to withstand extreme weather to minimize maintenance occurrences. The system has already been installed in the field in a 4 MWp plant in Jordan and a 64 MWp plant in Egypt.

One of the most flexible solutions on the market, the Sigma Tracker is sure to turn heads at Intersolar Europe in Munich.

Intersolar Europe: Hall A3, Booth 340

MBJ Services

Smart UV light micro-crack screening kit

Micro-cracks can be a massive drain on a solar plant in terms of time, effort, and – most crucially – lost revenues. MBJ Services seeks to simplify micro-crack screening with its Smart UV light. It is a compact and portable kit containing a high power UV spotlight, a clip-on UV filter for smartphones and tablets, two pairs of safety glasses, instructions, and power adaptors for the device.

Taking pictures is simple: Put on the protective glasses, clip the UV-filter onto your smartphone or tablet, and take photos of the cell while shining the UV light onto it. Ideally, this should be performed without ambient light, so operation at night is best. The kit can reveal both micro-cracks as well as various issues with defects in the ethylene vinyl acetate (EVA) along the busbars.

Intersolar Europe: Hall A2, Booth 250

K2 Systems

D Dome V and S Dome V mounting system

The new S-Dome V and D-Dome V mounting systems will be unveiled at Intersolar Europe, and presented in our July webinars for both **pv magazine** Germany and **pv magazine** International. The S-Dome V is single-sided and the D-Dome V is double sided, with an incline of 10°. Combining stability and ease of installation, the mounting systems sit atop an elastic mat with a very high friction coefficient for lower ballast requirement.

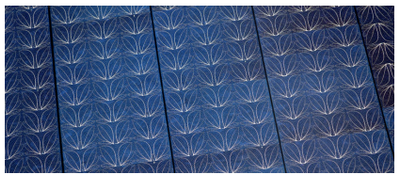
K2 Systems has its own development department consisting of mechanical and structural engineers that develop, test, and certify its products with independent institutes. It boasts that it only uses high-quality aluminum and relies mainly on production 'Made in Europe.'

The systems appear to be solid additions to this month's Array-Changing Technologies feature, and will surely draw a lot of interest at Intersolar Europe.

Intersolar Europe: Hall A3, Booth 540

S'Tile

Linea aesthetic solar modules



S'Tile offers something different to other solar module manufacturers. Its Linea range of modules are manufactured to customers' requirements and utilize its unique i-Cell technology. The integrated cell, or i-Cell, is a busbarless solar cell that integrates a number of smaller cells on a single silicon wafer. These are then connected in series resulting in a significantly lower current circulating within the module. The innovation reduces resistive losses within the module, and cuts down on copper and busbar ribbons on the front of the cells. The process uses 50% less silver and 75% less copper than competing processes.

Achieving a maximum efficiency in excess of 20%, S'Tile's modules have a power output of 320 W+. The offering also comes in a number of interesting styles and shapes to match different applications. With over 20 patents, a decade of history, and shareholders including Fraunhofer and VC fund Emertec, S'Tile looks like it has the right ingredients to seriously disrupt the market with its novel modules.

Solaria

PowerXT solar module

Oakland, California-based Solaria will be showcasing its sleek, all black PowerXT solar module at Intersolar North America in San Francisco. Clocking in at 360 W of power, Solaria is one of the few U.S. answers to the global dominance of Chinese manufacturing. On the back of an extra $23 million funding announcement in January, Solaria can proudly state that investors believe in its technological prowess.

The PowerXT utilizes advancements such as ribbon-less and solder-free interconnections, to eliminate inactive space between cells.

Its patented cell cutting and assembly processes are the core technological innovation that Solaria is bringing to market, and it is sure to attract attention at Intersolar North America and beyond.

Intersolar North America: Booth 7130

Sungrow

SG3125HV central inverter

The shift to 1,500 V systems has been more rapid than some predicted. Sungrow enters the fray with its SG3125HV central inverter clocking in at 99% maximum efficiency.

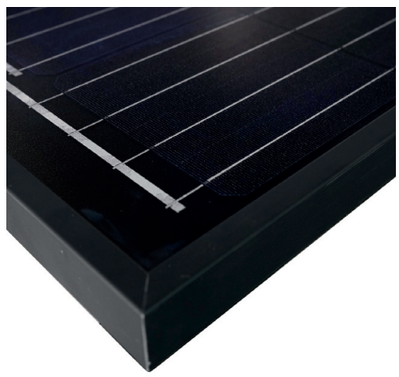
The company boasts of the system's efficient cooling with full power output even at 50°C. Transportation is made easy with the standard 10-foot container (2.991 × 2.591 × 2.438 m).

The inverter offers an integrated current and voltage monitoring function for online analysis and fast troubleshooting. There is also active and reactive power control and power ramp rate control to optimize performance. The product complies with both the IEC 62116 and IEC 61727 standards and visitors to Intersolar Europe will be able to learn more.

Intersolar Europe: Hall B2, Booth 330

Sonnenstromfabrik

Excellent Glass/Glass PERC60 module



Sonnenstromfabrik's goal is to reduce the impact of solar module manufacturing in terms of carbon emissions. And according to French testing center Certisolis, this module produces 40% fewer emissions than competing German products.

Excellent Glass/Glass PERC60 black Low Carbon is a PERC module that comes in four power classes: 290 W, 295 W, 300 W, and 305 W. The firm claims the module outperforms similar products in the long term, and offers a 30 year linear performance guarantee and a 20 year product guarantee.

The market for modules is certainly a competitive one, and Sonnenstromfabrik's all black module is a solid offering in this space. ***Intersolar Europe: Hall B2, Booth 180F***

JA Solar

MBB Mono PERC module

Only months ago, JA Solar set a module efficiency record for mono PERC.
Furthermore, the company claims that its multi-busbar monocrystalline passivated emitter rear contact (PERC) module has a lower risk of micro-cracks than competing products due to the number of busbars, ensuring better reliability and higher conversion efficiency.

On top of its high conversion efficiency, it has less shading area and lower resistive loss, and in turn higher output power. It also performs better across a range of temperatures (-0.36%/°C at P_{max}). Once again JA Solar has brought a solid, dependable module to market that will continue to raise the bar of efficiency and reliability.

Intersolar Europe: Hall A2, Booth 480

meteocontrol

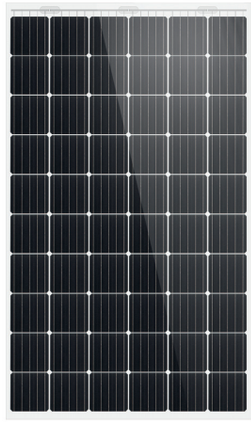
blue'Log X-Control power plant controller

Meteocontrol's blue'Log X-Control is a power plant controller for plants of any size. The controller works hand-in-hand with meteocontrol's blue'Log monitoring solution and is fully configurable with a usability-optimized user interface, so it needs no additional project-related programming.
Typical setpoint methods like characteristic curve control Q (U) or Q (P) are all implemented. Third-party Modbus interfaces – such as Solar Trading or German 'Direktvermarktung' can easily be added by the built in VPN client.
It offers secure, encrypted remote access for state of the art monitoring. The model-based design approach allows users to easily share the controller's simulations models.

Intersolar Europe: Hall B2, Booth 251

JinkoSolar

Eagle Bifacial module series



JinkoSolar's Eagle Bifacial series' glass-glass structure protects from oxygen and moisture, increasing lifetime operation up to 30 years. The company also states its frameless design reduces the likelihood of potential-induced degradation (PID).
In performance tests, JinkoSolar's bifacial PERC modules have shown outstanding results with reduced cell cracks and less than 5% degradation in the 3,000 hour damp heat test (DH 3000). With an additional power from the rear side of about 30%, almost 40% of land could be saved, compared to PV plants based on monofacial technology.
Jinko Solar's Eagle Bifacial monocrystalline five busbar module series comes in three configurations: 60-cell (290-310 W), 72-cell (355-375 W), and 72-cell passivated emitter rear totally diffused (360-380 W).

Intersolar Europe: Hall A2, Booth 180
Intersolar North America: Booth 7311

NEXTracker

TrueCapture Smart Control System

NEXTracker states that its TrueCapture system can increase plant yield by up to 6%. It does this by drawing from the latest meteorological forecasts on diffuse light conditions such as clouds, fog, or pollution particulates. Then its self-learning algorithm corrects panel direction to minimize production loss due to inter-row shading and clouds. Further, the system has smart panel sensors that provide real-time sensing information on each tracker row's shading and light conditions. This approach is unique due to the incorporation of machine learning algorithms. These improve system behavior over time and let it adapt to local conditions. NEXTracker will be showcasing the solution at Intersolar Europe, and it will be interesting to see which other AI-driven solutions are on offer at the show.

Intersolar Europe: Hall A3, Booth 320

SolarEDGE

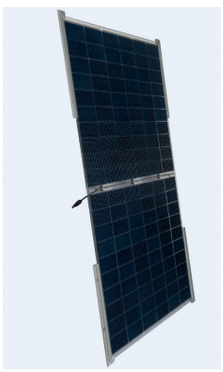
Level 2 EV Charger

SolarEdge's EV charging single phase inverter integrates with the company's residential energy solution, allowing users to manage their generation from a single interface, boosting-self consumption.

The Level 2 EV Charger can supplement grid power with PV, for faster EV charging. According to SolarEdge, the charger's 'solar boost mode' allows charging up to six times faster than a standard EV charger. With SolarEdge's monitoring app users can charge remotely, or pre-schedule charging for a particular time. The app offers separate monitoring of EV power usage, and is demand response ready.

The charger is compatible with multiple EV connectors, and SolarEdge points out that its solution will save on the cost and space of having a standalone EV charging solution.

Intersolar Europe: Hall B3, Booth 110



Suntech

UltraD module series

Chinese solar module manufacturer Suntech is set to reveal its UltraD solution this year at Intersolar Europe in Munich.

The extremely tough glass-glass module is far more durable than competing products, says Suntech. With its highly transparent, ultra-thin tempered glass and unique structural design, Suntech states the UltraD is 20% stronger than a conventional glass-glass module.

With a front side module efficiency of 18.3%, if there is a white coating on the floor beneath the bifacial module, Suntech states it can increase total power generation by 25%. The Ultra D solution offers far greater physical sturdiness than competing products and time will tell if such a product finds applications in the market.

Intersolar Europe: Hall A1, Booth 260

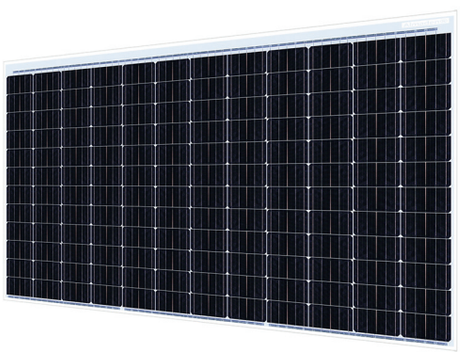
Almaden

SHAB72W-375 module

Almaden's focus is on pushing the envelope on ultrathin, lightweight, yet high-efficiency modules. It is a difficult undertaking to squeeze as much efficiency into as small a module as possible. The company's bifacial half cell glass-glass SHAB72W-375 module clocks in at a lean 18.5 kg, yet packs quite a punch: Its front side can output up to 370 W, and the back side can increase power output by 10-30%. It also comes in a 365 W or 370 W variety.

The module's front uses 0.85 mm glass with chemical strengthening technology, while the rear side has 2 mm glass. It utilizes PERC technology, is bifacial, and contains highly reflective ceramic film back glass to reduce loss of valuable photons. Its water vapor absorption rate is only 10% and the company offers a 30 year guarantee. A reminder that efficiency does not have to be bulky and cumbersome, Almaden's module is certainly a worthy contender.

Intersolar Europe: Hall A1, Booth 509



Fronius

Ohmpilot consumption regulator

Fronius offers its Ohmpilot, a consumption regulator designed to use any excess solar power to heat water. It has continuously adjustable regulation ranging from 0 to 9 kW which feeds surplus PV electricity to consumers in the household.

Fronius' device is usually used to control heating elements for hot water in boilers and buffer storage tanks, but can also be used for infrared heating or towel radiators. Generally, for a family with average levels of water consumption, the Ohmpilot can provide most hot water for about seven months per year. The company states its device seeks to maximize self-consumption and reduce a household's CO_2 emissions, in turn causing less wear on the building's main heating system during the summer months.

Intersolar Europe: Hall B2, Booth 310

Growatt

8K-11KTL3-S inverters

Hailing from Shenzhen, China, Growatt now offers its 8K-11KTL3-S series of three-phase inverters. The inverters target the residential and small-scale C&I segments and are compatible with Growatt's monitoring devices and cloud platform. They offer a maximum efficiency of 98.4%, maximum power point tracking (MPPT) of 99.5%, and a wide DC voltage range of between 160 and 1,000 VDC.

With IP65 ingress protection and natural fan-free cooling, it has very low noise compared to competing products and is suitable for outdoor environments. Growatt's solar inverters have been installed in more than 100 countries across all continents but Antarctica, and the company's new offering is sure to see similar uptake to its previous inverters.

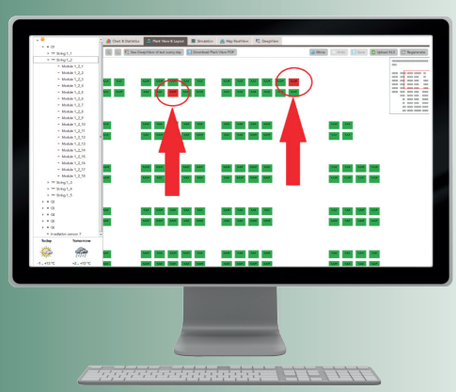
Intersolar Europe: Hall B3, Booth 320

HiVE Energy Systems, LLC

HiVE Renewable Energy Storage System

Scalable for C&I and utility-scale, the HiVE residential system with 22 kWh of storage can power an average three to four bedroom house (based on an assumed 9,800 kWh consumption per year and a 6-7 kW solar PV system). A HiVE customer is still tied to the grid, but only as a backup – as they can achieve 100% self-consumption. The company also states that its solution has fewer components with built-in chargers, incorporates innovative cell tray design, and requires less wiring, thus lowering installation costs.

The battery is lithium iron phosphate (LiFePO4), a battery chemistry well-known for its safety and low risk of thermal runaway. The battery management system controls power switching, which can be broken under load (400 V at 100 A) in excess of 10,000 cycles. Furthermore, breaking under full load will rarely occur, ensuring longevity.



SunSniffer

Digital Twin data analytics platform

SunSniffer identifies two major problems with time-series data. First, it reflects the system's health only indirectly (e.g. the system is delivering less power but the root cause is unclear). Second, the amount of data increases over time making analysis increasingly complex. Its Digital Twin concept offers a PV mathematical model which maps physical measurements and continuously learns from measured data. The big data analytics engine provides health indicators for each element of the PV system. The AI knowledge engine outputs system status and reports on any required maintenance actions.

SunSniffer's solution looks to remove a significant amount of human analysis from operations and maintenance, as well as optimizing the labor involved in service. The three-pronged approach will surely have an impact on plant profitability.

Intersolar Europe: Hall A3, Booth 360

Spectrafy

SolarSIM-G pyranometer

The pyranometer is a key tool in assessing plant performance. It detects how much solar irradiance is hitting a given surface, and enables plant owners to determine whether their installation is underperforming. Spectrafy's SolarSIM-G goes above and beyond traditional pyranometers by also measuring global spectral irradiance.

By removing spectral noise, O&M metrics can be captured with far greater certainty, allowing far more accurate predictions of future performance.

Spectrafy's solar spectral sensors have been widely used in research institutions worldwide, and the recent introduction of SolarSIM-G brings its technology to the commercial market.

Cobalt Energy

PV-Serve and PV-Vision electroluminescence inspection

Inspection services are not as sensational and headline-grabbing as some parts of the PV value chain, but are a quiet achiever in the plant manager's arsenal. U.K.-based Cobalt Energy offers the PV-Serve and PV-Vision solutions that work together to enable night-time electroluminescence inspections, dark I-V curve tracing, and bypass diode function checks. First, PV-Serve injects a reverse current flow into a given string or module. Then PV-Vision can capture high definition video and photographs of electroluminescence. Active cells emit a bright grey or white light, while damaged or inactive cells appear darker or even jet black. Detectable defects include: mechanical stresses, manufacturing defects, potential-induced degradation (PID), and bypass diode failures.

SolarisFloat

Protevs floating PV solution

As land becomes increasingly scarce, floating PV has begun to emerge. With flagship plants across Asia and elsewhere, it appears to be on the rise. Portugal-based SolarisFloat recently unveiled its Protevs floating PV system. It is a circular island comprised of 180 photovoltaic modules with dual-axis tracking. Its bifacial modules ensure that reflected sunlight from the water is harvested for at least a 5% boost in output. The close proximity to the water results in a cooling effect for an extra 10-15% increased output compared to an equivalent ground-mounted system. With its ready-made Protevs solution, SolarisFloat has developed a unique offering for floating solar PV – a market that to date has been driven by a custom design from project to project. If floating PV could be scaled in such a way to significantly reduce the costs, it could become competitive with large-scale ground-mounted, and the future of PV could look vastly different.

TrinaBESS

TrinaHome S&T Series Energy Storage System

The S&T Series residential storage system from TrinaBESS aims at boosting self-consumption for PV system owners.

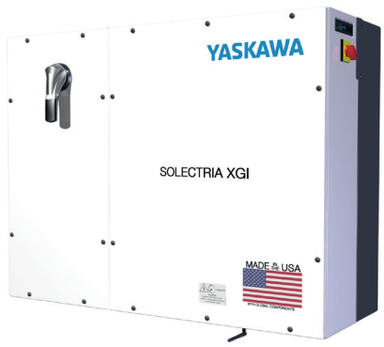
According to TrinaBESS, the hybrid inverter replaces both the PV inverter and the battery inverter, meaning installation costs can be reduced by as much as 40%.

The system allows for load shifting – charging from the grid at off-peak price times, and discharging during peak periods – and can also be used as an emergency backup power supply in the event of a grid outage.

The system comes in the single phase S series and three phase T series. The S series features a power rating of 3.7 kW, and a capacity rangin from 3 to 12 kWh, while the T Series power rating is from 5.2 kW to 9.8 kW, with a capacity of 6-12 kWh or 9-18 kWh.

Yaskawa Solectria Solar

XGI 1500 utility-scale inverter



One of two 1,500 VDC inverters to appear in this issue's Array Changing Technologies, Solectria's XGI 1500 is made in the USA and compliant with the new Buy American Act. It meets the latest IEEE 1547 and UL 1741 standards for safety and comes in four models: 125 kW/125 kVA; 125 kW/150 kVA; 150 kW/166 kVA; and 166 kW/166 kVA. In a power plant, all inverters can be accessed on-site via Wi-Fi from one location, and it offers remote diagnostics and regular firmware upgrades with enhanced features.

Similar to other solutions, web-based monitoring allows plant owners to monitor performance and troubleshoot remotely. As the market shifts to 1,500 V, Solectria's solution appears set to be a serious contender in a competitive space.

Goodwe

ET Series storage inverter

From leading Chinese inverter supplier Goodwe, the ET Series is a high voltage storage inverter, which seeks to maximize self-consumption for residential users.

The inverter's features include export limits and time-of-use shifting to reduce the customer's electricity bills, as well as uninterruptible power supply for loads such as air conditioning or refrigeration, with a UPS switchover time of less than 10 milliseconds. The inverter comes in 5kW, 8kW, and 10kW versions. The inverter is compatible with a wide range of voltages, and features fanless cooling via natural convection, for quiet operation and increased reliability.

The ET Series is compact, weighing 25 kg, and operates at a maximum efficiency of 98.3%. Users can take advantage of AC charging, to charge and bypass loads, and up to 100% backup overloading, with peak output of 10,000 VA for 60 seconds.