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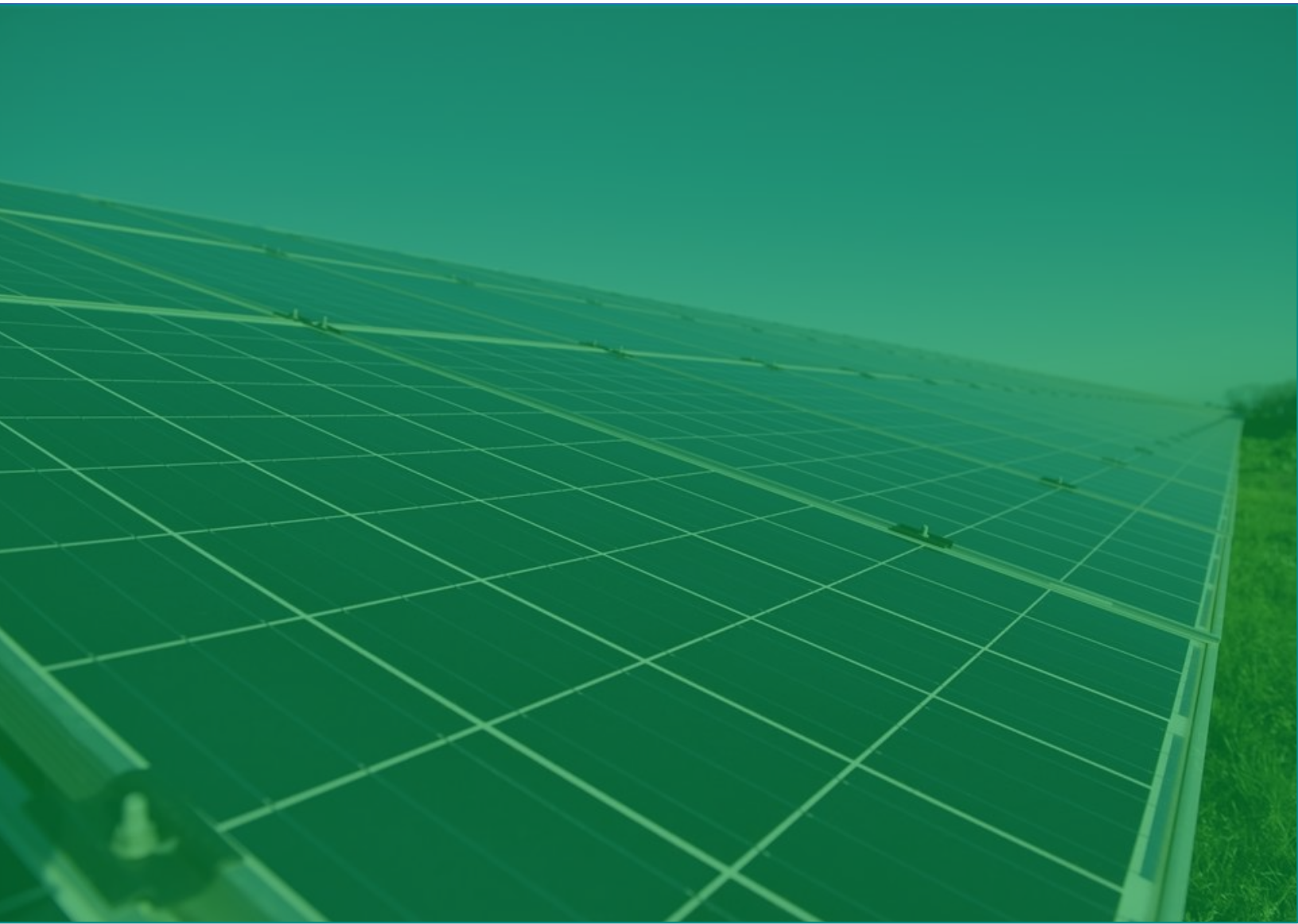
TECHNOLOGY

Over 100 GW of 1500 volt solar inverters to be shipped in next 2 years



Over 100 GW of 1500V solar inverters to be shipped in next 2 years

Over the last decade, the cost of solar PV has dropped dramatically, and the technology can now compete with conventional power generation in many regions. The average global cost of a utility-scale PV system hardware has fallen by a staggering 50% from 2013 to 2018, and the average fell below $1/W for in 2018 (with many regions well below this). Following such impressive reductions to the capex of PV systems, the technology is now considered rather mature, margins are relatively slim, and only marginal improvements to costs are to be expected. As such, the focus has shifted more towards improving performance and reliability in order to drive down the LCOE (levelized cost of electricity) of the system. At times, some such innovations can result in significant additions to the upfront cost of a system – such as trackers, which have now become common place in utility-scale systems around the world – but the overall improvement in the output of the system more than counteracts this, leading to an overall lower LCOE. Another major trend in this vein, is towards higher DC voltages, with a rapid shift occurring toward 1500 volt (V) systems in utility-scale PV markets around the world. One of the main enablers of this trend is the growing number of 1500V inverters that are now available on that market.

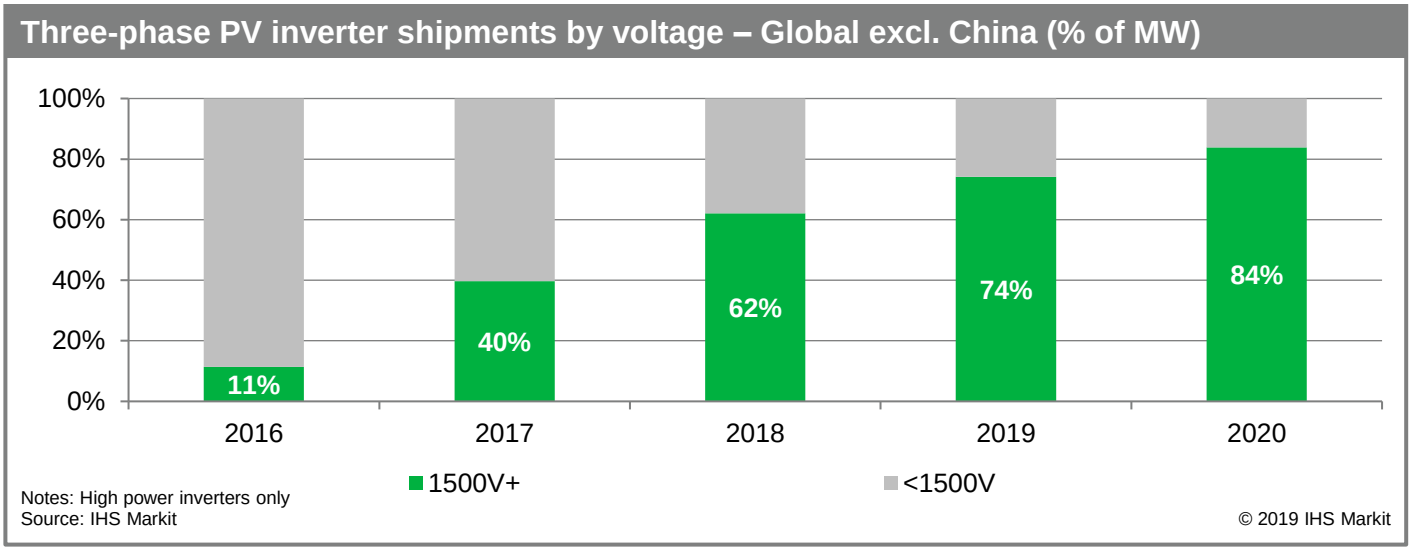
Why switch to higher voltages?

The rationale for pushing toward higher voltages in PV systems is actually rooted in rather basic science and the classroom taught relationship between electrical power (P), current (I) and voltage (V) – "P=IV". This formulaic relationship indicates that to deliver a fixed amount of power, the amount of current required reduces as the voltage increases. It happens to be that electrical losses are also less at lower levels of current. For the same reason that high voltages are used when sending electricity long distances along transmission lines, PV system voltages have been increasing wherever possible in order to reduce electrical losses in the system, therefore increasing the yield of the system. In addition, the ability to create longer - and therefore fewer - strings also simplifies systems and can reduce the number of other components required (e.g. string combiners), aiming to reduce the overall cost of a system.

The trend to increase voltages has been taking place for a long time. Approximately a decade ago, the industry was engaged in a conversation around the transition to 1000V inverters, which are now common place in PV systems in most regions of the world. As early as 2012, German integrator, Belectric, announced that it had used 1500V inverters at ground-mount plants in Germany. The following year, it announced that they would continue to roll out the technology. Since then, 1500V inverter technology has gone from being marketing talk at tradeshows and conferences, to being deployed in very real volumes all around the world, with the most significant early volumes being installed in countries such as United States, Germany, United Kingdom, Chile and Mexico.

1500V has quickly become a requirement for large-scale PV projects. A large number of notable projects which have utilised 1500V technology, including the 300 MW in Sakaka, Saudi Arabia, which grabbed headlines in 2018 for signing a record breaking agreement to sell electricity for ~$2.3c/kWh (Halala 8.78/kWh). Major utility-scale tenders in India (the second largest utility-scale market behind China over the coming three years) have also been dominated by 1500V technology, and other markets are following the same trend.

In fact, IHS Markit predicts that outside of China (which has been relatively slow to adopt the technology in comparison to international markets), 1500V products will account for 84% of high power PV inverter shipments in 2020, in comparison to just 11% four years previously.



What are the challenges?

Of course, there are also specific challenges associated with making the transition to 1500V PV systems. Earlier on, the availability of suitable components such as fuses and switches held the trend back, in addition to a lack of PV modules with a 1500V output. Over the last few years, suppliers have responded and a mature supply chain is now in place making the required electrical components and PV modules readily available.

While 1500V is becoming the standard in large-scale PV systems, the adoption in roof-top systems is lagging behind. In such systems, the deployment of 1500V is limited by safety standards, building codes and electricity regulations. Local regulations may allow such systems in commercial buildings in certain circumstances, but a general broad rollout is not expected. Use of 1500V systems in the residential sector is not anticipated within the foreseeable future.

String inverters also adopt 1500V technology

Alongside the increased adoption of 1500V, the utility-scale PV sector has increasingly turned to 'string' inverters over recent years. With Chinese telecom's giant, Huawei, leading the charge – the benefits of a more distributed approach to PV inverters have been heavily marketed and EPCs around the world have begun to favor the approach over large central inverters. IHS Markit estimates that nearly 25 GW of string inverters were shipped to utility-scale PV installations in 2017.

Naturally, with string inverter suppliers now aggressively targeting the large-scale PV sector, they are now increasingly releasing 1500V products in order to capitalize on this growing trend. The table shows the 1500V portfolio of the 12 largest PV inverter

1500V portfolio of 12 largest PV inverter suppliers

Supplier	Low power (≤200 kW)	High power (>200 kW)
ABB	✓	✓
Fimer	✓	✓
GE		✓
Huawei	✓	
Kstar	×	✓
Power Electronics	×	✓
Schneider Electric	✓	✓
Sungrow	✓	✓
Sineng	×	✓
SMA	✓	✓
TBEA	×	✓
TMEIC		✓

✓ = Offers a 1500V product in that power class. × = Offers that power class, but does not have a 1500V product. Blank = Does not offer that power class at present – Based on 2017 global shipments.

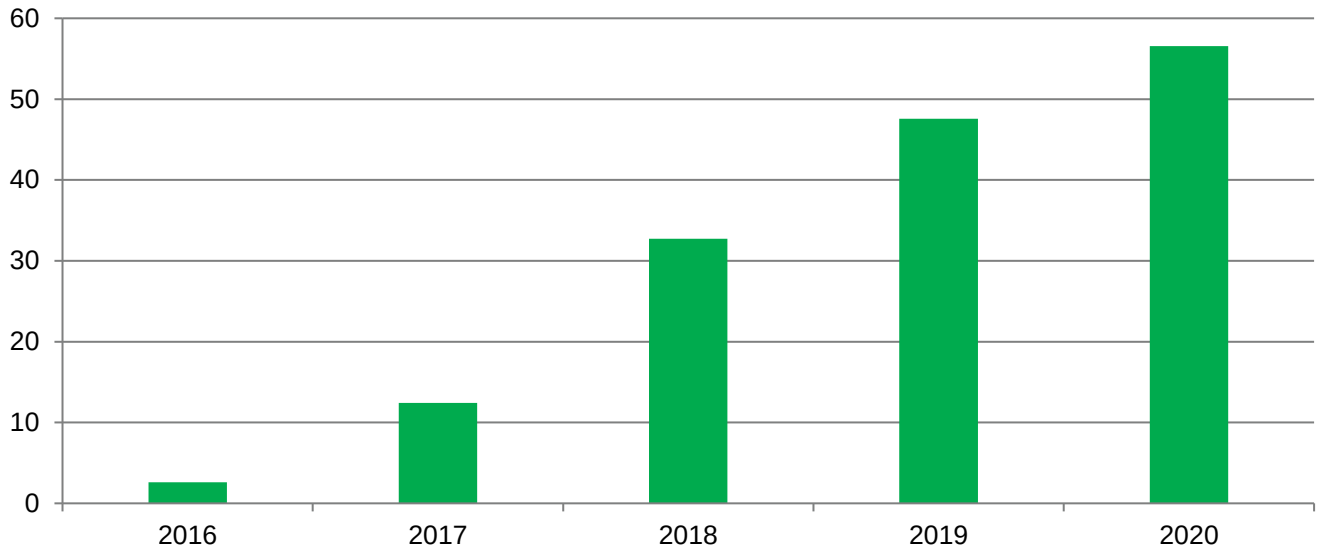
Source: IHS Markit

suppliers globally. It clearly shows that every provider of high power (central) inverters already offers a 1500V product. Six out of the ten providers of lower power string inverters have also released a product, and more are to be expected as 1500V string inverter projects are increasingly adopted in large-scale projects around the world.

The future of 1500V inverters

Clearly, 1500V PV inverter technology has gained significant traction in the industry and the benefits of the approach are increasingly accepted by EPCs, developers and project owners. The transition to 1500V systems is a major global trends that and their use is predicted to continue growing – particularly in large utility-scale systems (defined as larger than 5 MW by IHS Markit), with them becoming mainstream by 2020. IHS Markit predicts that having grown from just 2 GW of shipments in 2016 to surpass the 30 GW milestone in 2018, 1500V inverters will continue their growth trajectory, and over 100 GW will be shipped in 2019 and 2020 combined.

Global 1500V PV inverter shipments (GW)



Source: IHS Markit

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@IHSMarkitTech

CUSTOMER CARE AMERICAS

T +1 800 447 2273
+1 303 858 6187 (Outside US/Canada)

CUSTOMER CARE EUROPE, MIDDLE EAST, AFRICA

T +44 1344 328 300

CUSTOMER CARE ASIA PACIFIC

T +604 291 3600

E CustomerCare@ihsmarkit.com

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