



Innovative milestones in the history of inverter technology

Founded in 2006, KOSTAL Solar Electric has grown to become one of the leading suppliers of innovative string inverters for the private and small business sector. Keen to learn some secrets of its success so far, PES spent time in the company of Thomas Garber, Senior Product Manager at KOSTAL.



PES: It's lovely to speak to you Thomas. By way of an introduction to KOSTAL Solar Electric, the company is part of the KOSTAL Group, correct?

Thomas Garber: Yes, that's right. And from the very beginning, KOSTAL Solar Electric has always focused on delivering the highest quality. This has been an integral part of how all divisions of the KOSTAL Group have operated since 1912.

The company has remained true to its philosophy since the very start, creating innovative power electronics and photovoltaic technology that meet the highest quality standards.

PES: What is the main focus for the company today?

TG: KOSTAL develops and produces modern inverters to generate alternating current from solar power, making it available for the electricity required in buildings, as well as the public grid.

PES: Where did it all begin; what was your first product and why was it introduced?

TG: In 2007 PIKO was launched, the first three-phase feed-in inverter. We developed the product with the Fraunhofer Institute and Solarfabrik. It was originally named Convert 6T. It was sometime later that the device was given its current name: PIKO, an abbreviation that stands for Photovoltaic Inverter KOSTAL.

PES: How was it innovative?

TG: The compact PIKO 5.5 was a groundbreaking product of the first power electronics generation. Contrary to the mainstream at the time, the inverter had a three-phase design. In addition, at 5.5 kW the inverter was powerful and already had three DC inputs. This made it a pioneer in the flexible design of the solar strings that connect the modules to the inverter.

PES: And how did it rate compared to the competition?

TG: Due to the maximum permissible phase unbalanced load of 4.6 kW, the PIKO 5.5 outperformed single-phase market competitors with 20% more rated output. Equipped with central network interfaces and an integrated data logger, i.e. providing the option of viewing data using a web-based application and integrated display, customers were impressed by how easy the PIKO was to use. The optical push-button on the PIKO 5.5 was a fantastic detail, designed for many years of use in PV operation.

PES: So a successful beginning then?

TG: Yes, in fact, the success was so great that the next chapter in the KOSTAL inverter's story was in 2008, with a new series of the PIKO with 10 kW and later with 20 kW. The PIKO series continued to launch several successive models onto the market, but the name has remained and today is still synonymous with innovation and success.

PES: How has the company been able to address challenges around performance with innovations over time?

TG: With the PIKO BA the idea was to achieve greater performance by connecting up a battery storage system and so the PIKO BA arrived on the PV market. It was the first KOSTAL hybrid inverter with a three-phase connection option and a bidirectional DC input for a high-voltage battery. It even received the ees Award at Intersolar 2015.

The hybrid inverter set new standards in all areas. It offered three power classes with 6, 8 and 10 kW and the option of emergency power supply in the event of a malfunction, or failure of the supply network within a changeover phase of 20 seconds. Another feature was a high-voltage battery with 228 V nominal voltage. It was based on a lead-gel structure from Hoppecke, which was a highly unusual practice for the time. In 2015, it was replaced by the lithium solution PIKO Battery Li. And lithium iron phosphate was deployed, something that has now become a common technology.

The high-voltage storage solution included several outstanding features. It created ideal conditions for greater power processing at a higher voltage, lower currents and smaller cable cross-sections. In addition, the efficiency of the battery could be adjusted via a management system and could later be easily converted to a lithium storage unit, which had become affordable in the meantime.

PES: How have you been able to meet the needs of different customer bases? For example, businesses and private customers?

TG: In 2017 we added the first three-phase inverter to our product range, for commercial use. With six DC inputs, an MPP tracker and 36 kW AC power, the device therefore closed the gap in the PIKO family and, as another

product component for the classic private customer base, for the first time ever served the specific project market segment.

We understood very early on that the power requirements of inverters would increase hugely in the coming years. Therefore, in 2021, we introduced the commercial project inverter called PIKO CI, which can now be flexibly designed to work on its own and offers a higher output in interconnected operation.

PES: What are the sales pledges that make the PIKO CI stand out, in terms of software?

TG: The PIKO CI has communication interfaces, such as WLAN as standard. It can be conveniently controlled with the associated PIKO CI app. This means that it is easy to trigger updates via the app or network. Configuration is very easy, even for interconnected operations. The import/export function is used here so that the slave devices connected to the PIKO CI master can be parametrised quickly and easily. The PIKO CI's country-specific set-up also has a role to play here. In the app, the device can be configured in accordance with all currently valid guidelines in the countries of operation.

PES: What makes it possible for the PIKO CI

to handle the higher input voltage?

TG: Solar module technology and sizes are developing rapidly due to the growing demand for power. Subsequently, they offer more power, because larger semiconductor wafers mean higher currents. The PIKO CI must be able to process these perfectly. In this respect, we are now at 18 amps per DC input for the 50/60 kW model of our series.

The PIKO CI is therefore already compatible with project modules of over 670 W and can process the higher input currents safely and without loss of power. But even the new 400W modules with 108 cells made of 182 mm wafers can now be interconnected even more flexibly. Of these, even three strings can be connected to one MPP tracker.

PES: And what can we expect from PIKO CI in the next stages of development? High compatibility with ever increasing input voltages, anything else?

TG: Correct, one major issue is extended input currents. In future PIKO CI generations, we will purposefully move away from 60 kW and achieve higher performance classes. In terms of software, the AutoUpdate function will bring new features to the device that will make operation even more flexible and efficient.



Thomas Garber

In terms of storage solutions, we will develop more alternatives, such as a joint venture with LG by 2023. The power extension for the PLENTICORE BI battery inverter to 20 kW is also taking us in this direction.

PES: Looking ahead then, is there further innovation to come?

TG: We will continue to inspire customers with



<p>2007</p> <p>PIKO 5.5 The first three-phase inverter</p> 	<p>2009</p> <p>PIKO 3.0/3.6 The first single-phase inverter</p> 	<p>2012</p> <p>Arc Detection The first innovative prevention in the inverter</p> 	<p>2013</p> <p>PIKO FUTURE The first inverter family</p> 
<p>2013</p> <p>PIKO BA The first hybrid inverter for high voltage batteries</p> 	<p>2016</p> <p>PIKO MP/PIKO MP plus The single-phase all-round inverter</p> 	<p>2017</p> <p>PIKO 36 EPC The first project inverter</p> 	<p>2018</p> <p>PLENTICORE plus The first all-in-one solution, flexible with activation code</p> 
<p>2019</p> <p>KOSTAL Smart Energy Meter The first intelligent energy meter</p> 	<p>2020</p> <p>PLENTICORE BI The first battery inverter</p> 	<p>2020</p> <p>PIKO CI The first inverter for large areas</p> 	<p>2022</p> <p>ENECTOR The first wallbox for solar charging</p> 

innovative and market-leading solutions.

This year, we are launching our own AC wallbox. In combination with the KOSTAL Smart Energy Meter and the right activation code, customers are impressed with its exciting accessible features.

In addition, we are continually adding new functions to the existing inverters, such as the higher input current for the PIKO CI commercial inverter, or the communication enhancements for the PLENTICORE plus hybrid inverter. Also there is a completely new generation of inverters with exciting innovations waiting in the wings.

PES: One the one hand, the solar industry is booming. On the other hand, the procurement of parts is proving difficult. How is KOSTAL responding to this situation?

TG: KOSTAL's capacity for hybrid inverters has already been expanded by 50% compared to last year. Unfortunately, ongoing supply difficulties for electronic components do not currently allow this new capacity to be fully exploited. However, despite the current supply bottlenecks, production capacity will be extended even more over the next three years. In this way, we are laying the foundation for quadrupling capacity utilisation by 2025 compared to 2021.

To support sustainable growth, this project will be accompanied by further measures. Two new laboratories, established in 2021 and 2022, will secure development and testing procedures. A new test field will be dedicated solely to inverters, storage systems and generators to test the model generations that will be introduced as a result of growing power requirements. At the same time, KOSTAL is expanding its international sales and service footprint to anchor its innovative products in the European market.

PES: Thank you very much for this interview Thomas.

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