Case Study

PILLER
Power Systems

3Sun photovoltaic (PV) panel factory, Sicily, Italy.

Piller Italy deploys next generation Uninterruptible Power Supply systems with flywheel kinetic energy storage at major European solar panel manufacturing plant.

Start date: NOVEMBER 2022
Hand over: SUMMER 2023

THE OBJECTIVE

Italy's 3Sun photovoltaic (PV) panel factory is located in the so-called "Etna Valley," Sicily's industrial and technological hub.

This major manufacturing plant produces 3GW of advanced PV panels capable of generating more than 5.5TWh of electricity every year.

Manufacturing production capacity exceeds over 5 million panels annually.

Thanks to advanced manufacturing processes and materials, 3Sun bifacial panels are robust and can have an operating life of up to 30 years. In addition, 3Sun produced Hetero-junction (HJT) modules have industry leading efficiency achieving record yields of 24.63%.

Manufacturing end users want full protection against losing the grid, voltage, frequency and other power quality issues.

This means in just the first ten years of use 3Sun PVs can deliver clean power generation that avoids the production of an additional 25 million tons of CO_2 emissions. This is truly sustainable power.

For the factory, which has been operational since 2011, clean, reliable, and continuous power is vital to successful manufacturing. As a major player in Renewable Energy Resource (RER) sustainability manufacturing, equally important to 3Sun is the achieving maximum efficiency and the best carbon profile for all equipment on which its operations depend.

Precision manufacturing relies on techniques and processes that minimise the risk of errors which can result in incurring huge costs through loss of product quality and lost time.

Production of high value equipment using just in time methods means the tolerances for interruptions are minimal. Gaps have cascading effects which impact programmes and delay projects. Such delays can result in loss of production, breaks in supply chains and ultimately costs to both supplier and end client.

Today's modern manufacturing environments must also follow a sustainability agenda where any excess energy use is removed from the process without impacting production.

That means power chain infrastructure design must utilise every efficiency advantage such as those energy storage technologies that deliver maximum efficiency, reliability and sustainability while reducing or removing operational and embodied carbon.

THE SOLUTION

Within any electricity intensive manufacturing environment the end user requires assurance of protection against losing the grid itself and protection against voltage, frequency and other power quality issues.

In 3Sun's factory the primary power feed is through access to high voltage lines (2x150 kV). However, in the facility's first decade of operation it became clear that the necessity to protect against voltage dips which had the potential to stop production was unsustainable.

The company realised it required a secure and reliable power chain for critical loads, sustainable kinetic energy flywheel storage and cogeneration gensets which when combined could effectively act as an integrated or islanded Microgrid.

For a total critical load of 5MW 3Sun's power protection and back up is built around 2 x 5MW Bergen engines, which are already installed (and which provide efficient heating/cooling to the factory); 2xUBV2700 units (2.7MW each) vertical axis rotary UPS systems. Piller UPS system will protect the critical load and Bergen cogeneration system and further it will guarantee the island operation in case of grid brown out.

The use of the UB-V UPS delivers medium voltage protection which also improves performance by cutting power losses compared to a LV solution. The medium voltage power supply of the UPS allows for better flexibility and management of continuous electrical loads. For example, it is possible to increase the critical loads under the HQ bus that were not initially considered, or to add other electrical panels without purchasing new UPSs.

In terms of protection the Piller UBV system in PCD configuration is able to remain connected to the network for up to 200 milliseconds, even with a 100% loss.

With current grid power quality, this means that more than 86% of the anomalies are protected by the PCD Piller, without opening the input switch and remaining connected to the network.

Benefits of the technology and configuration include protection of the critical load and cogeneration protection from anomalies coming from the grid.

Management of the off-grid cogeneration system and power the critical loads and the ability to adjust the frequency on the high quality (HQ) bus when the system is in isolation.

The combination of UB-V and Powerbridge provides a 20-year high performance solution with a small physical footprint.

Flywheels have been used for millennia as a highly reliable and efficient means of storing energy. Today, kinetic energy flywheels such as Piller Powerbridge (PB60+) provide the ideal energy storage for UPS power back up in manufacturing environments where the need is for predictable performance combined with carbon free operation, long service life, reduced space use and low maintenance.

The vertical axis design of the UB-V UPS has additional benefits through less friction and less stress on the bearings. As well as improved performance, this reduces the number of planned (and unplanned) maintenance interventions amounting to significantly more uptime over the lifespan of operations.

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A UB-V with Powerbridge Flywheel Kinetic Storage Power Enclosure

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> 3Sun can begin to look forward to decades of sustainable, efficient, low maintenance and high-performance power protection

Electrical coupling between flywheel and alternator enables bi-directional power: i.e., charge and discharge. This is a significant improvement over the pre-existing mechanically coupled solution.

The two Piller UBV UPS and P60+ flywheel units are replacing previously installed ageing horizontal rotary UPS equipment at the site. While a LV static UPS solution using batteries. requires frequent maintenance interventions, expensive replacement at regular intervals, and an energy hungry air conditioning system to maintain correct ambient conditions necessary for the satisfactory performance of the batteries.

With the grid as the primary power source in the event of a grid brown out or loss, Bergen Engines act to provide many hours of back-up power. This effectively means running the power as an island Microgrid.

Lanfranco Pedrotti, Piller Italy MD, said: “Providing long term, future proof solutions to protect the critical operations of customers such as 3Sun is fundamental to Piller’s mission. Our view is always long term and we work closely with partners and customers to ensure every project’s goal of reliability and sustainability is realised.”

THE RESULTS

All large energy users are seeking alternatives to traditional methods of power protection and provision as they move to reduce energy consumption and eradicate high carbon emission in every aspect of operations.

For decades modern industrial applications and manufacturing production lines have used the UPS (Uninterruptible Power Supply) as the key electrical protection technology for critical and sensitive loads.

But in the post carbon emissions world the factors that inform technology choices to deliver power protection have changed considerably.

The system will be fully delivered, deployed, commissioned, tested and operational by late summer 2023.

Looking to the future a third UB-V unit is to be deployed in response to continuing expansion of 3Sun’s manufacturing capacity in Sicily.

3Sun can begin to look forward to decades of sustainable, efficient, low maintenance and high-performance power protection.

Nothing protects quite like Piller.

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