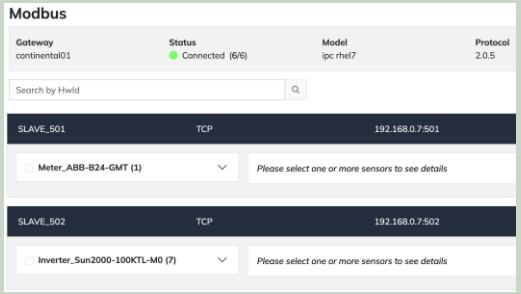
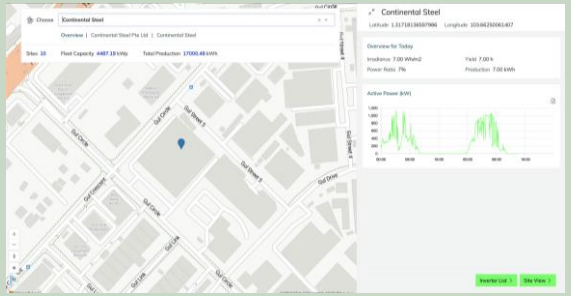
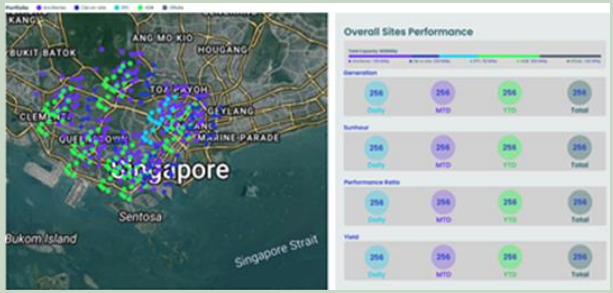
Solar DG with EDP IoT Global Platform

Framework







Through advanced technology, Solar DG behind an innovative initiative that aims to maximize energy production, optimize operating costs and improve process efficiency through automation and remote management of IoT devices.

EDP Renováveis is a global leader in the renewable energy sector and the fourth-largest producer of wind energy in the world. The company is also a leading developer in solar energy. EDP Renováveis operates in 28 markets and has a robust development pipeline, first-class assets, and market-leading operational capacity.

The company has excelled in recent years and is committed to bringing renewable energy solutions to everyone, everywhere. Recently, EDP Renováveis was awarded capacity contracts of 160MW for its first storage projects in Poland and began construction of its first standalone storage project in Europe.

Additionally, EDP Renováveis is expanding its presence in markets such as Germany, where the Ketzin solar park is expected to become operational in the second half of 2025.

Chalenge

Efficiency, security and performance on Solar Distributed Generation, enabled by a Data&IoT strategy

1. **Dependence on external suppliers**: The current architecture relies on external suppliers for real-time data generation, which limits scalability and future development.

2. **Data integration and visibility**: The lack of end-to-end data and process integration increases department-centric thinking and hinders project data analysis from development to asset operations.

3. **Automation and monitoring**: The absence of full business process automation and reliance on manual work and Excel for PowerBI reporting.

4. **Edge device management at scale**: The inability to manage Edge devices at scale, with cybersecurity policies and active updates not being applicable.

5. **Real-time reporting and monitoring**: The standard SaaS platform is not suitable for real-time reporting for energy customers and regulators, requiring specific customizations.

Problem to solve

As Is operation

3000+ IoT Gateways

12000+ Devices

1200 proprietary hardware

2000 edge devices to migrate OTA

2 External cloud SaaS vendors

Before the implementation of the solution, EDP faced several significant challenges that required urgent resolution.

Firstly, there were two isolated SaaS IoT platforms, which resulted in **substantial manual work in consolidating generation data**. This situation caused **a lack of global and adjusted monitoring, compromising operational efficiency**. Additionally, the absence of edge cache resources meant that, **in case of communication loss, data had to be manually filled in, increasing the risk of errors and workload.**

Another critical issue was the dependency on software and hardware edge devices from specific vendors. **There were 2,000 edge software devices from SaaS IoT vendor #1, which were locked to the vendor, with no security and remote management features**. Additionally, there were 1,000 edge hardware devices from SaaS IoT vendor #2 with vendor-specific software. New 800 proprietary edge hardware devices were not usable by any other vendor.

These problems resulted in **operational inefficiencies**, **additional costs**, and **a lack of flexibility that limited EDP's ability to respond quickly to market and customer needs**. The developed solution aimed to address these challenges through **automation**, **remote management**, and **technology integration**, resulting in significant improvements in operational efficiency, cost reduction, and increased customer satisfaction.

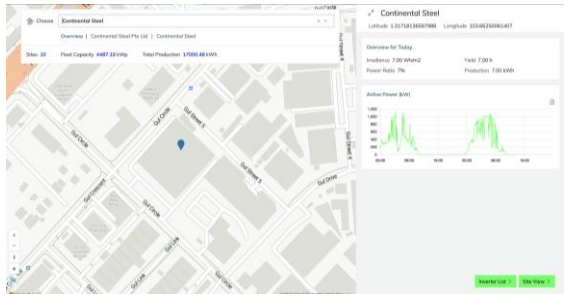
Solution

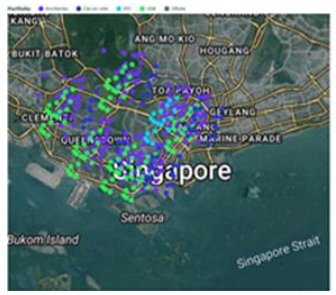
The solution found to address the challenges of the current architecture involves **automated data capture** is carried out by the EDP IoT Global Platform or by external sources, based on the standard EDP IoT edge image (hardware agnostic) and **real-time Cloud to Cloud integrations** (developed by EDP). **Data capture is automated and consolidated in the EDP Data Lake**, enabling real-time monitoring and advanced analytics.

Proprietary hardware gateways will be converted into **Standard IoT gateways**, with **remote management and update capabilities**. Additionally, **the Data and IoT strategy will extend the capabilities of current SaaS solutions with the added flexibility**, allowing full control over the data and centralizing the data acting as a single source of truth, facilitating reporting and automations.

A process of acquiring new simplified peripheral equipment from various suppliers is underway. **Using standard IoT platforms, such as Azure IoT**, the EDP IoT Global Platform achieves hardware agnosticism, allowing the reuse of proprietary edge hardware. **This approach has resulted in significant cost savings – more than 500,000 euros in hardware.**

The solution also includes the implementation of **advanced data analysis techniques, integration of billing systems, and the use of Artificial Intelligence and Generative AI** to improve efficiency in areas such as field services and asset performance.





Technologies

- Azure IoT Edge: Standard IoT Gateways with remote management
- Azure Cloud: Automated onboarding (through an API) and simplified GUI for easier adoption
- Azure Data Lake
  Data centralization allowing transversal access and analytics with PowerBI

Impacts/Sustainability

- **Operational Efficiency:** Phase I of the implementation of EDP's global IoT platform and Data Lake has been completed, enabling the integration and remote management of edge devices at scale, as well as cybersecurity monitoring on agnostic hardware.
- **Automation and Monitoring:** Data capture has been automated and consolidated in EDP's Data Lake, allowing for real-time monitoring and advanced analytics.
- **Cost Savings:** The use of EDP's global IoT platform, based on standard cloud platforms like Azure IoT, has resulted in significant cost savings – over €500k in hardware.
- **Global Scalability:** The EDP IoT edge image developed in this project is being used in other geographies such as Brazil and Portugal, demonstrating the global replicability of the solution.
- **Customer Impact:** Integrated and real-time reports for digital customers, including a real-time channel with cloud-to-cloud integration based on event-driven architecture and a customer web portal, offer digital and automated self-service access to generation and asset data. SLA management and reporting are integrated, increasing value for customers and company performance.

- **Maximization of Energy Generation:** Automation and remote management of IoT devices maximize energy generation, reduce waste, and increase clean energy production.
- **Operational Cost Optimization:** EDP's global IoT platform saves over €500k in hardware, enhancing financial sustainability and enabling investments in sustainable areas.
- **Process Efficiency:** Integrating IoT, OT, and IT technologies improves process management, reduces manual interventions, and minimizes errors.
- **Automation and Remote Management:** Remote management and updates of IoT devices reduce physical travel for maintenance, lowering the carbon footprint.
- **Global Scalability:** The solution is replicable in other geographies like Brazil and Portugal, expanding sustainable practices globally.
- **Real-Time Monitoring:** Data capture and consolidation in EDP's Data Lake enable real-time monitoring and advanced analytics, quickly identifying and correcting inefficiencies.
- **Customer Impact:** Integrated and real-time reports for digital customers, including a real-time channel with cloud-to-cloud integration and a customer web portal, offer digital and automated self-service access to generation and asset data. This promotes transparency and environmental responsibility.

Results

#1 Cost savings	• 500k cost saving in acquisition of new hardware – 1.500 devices reused • Competitive hardware procurement for new new ”all-in-one” edge gateway • Re-utilization of all existing edge gateways (3.000 edge devices)	It represents a reduction in hardware costs
#2 Operational efficiency	• With the new IoT platform and the EDP Data Lake, was enabled the management of Edge devices at scale and cybersecurity monitoring on agnostic hardware.	Improving operational efficiency
#3 Automation and Monitoring	• Automated data capture by Azure IoT, consolidated in the EDP Data Lake, has enabled real-time monitoring and advanced analysis with PowerBI and data exploration. • Improved performance (profitability) due to the better capacity to monitor and act on the generation resources.	Reduced response time for problem resolution
#4 Global Scalability	• Solar DG with EDP IoT Global Platform monitoring solution built is being used also in Brazil and Portugal, demonstrating the solution's global replicability • Internal effort reduced: Generation data provided automatically by API	Increased global scalability
#5 Customer Impact	• Integrated, real-time reporting for digital customers includes a real-time channel with cloud-to-cloud integration based on event-driven IoT architecture (MQQT) and a web portal for customers, offering automated, digital access to generation and asset data • Data loss due to lost-comms is now avoided due to cache management on the edge and automated data gap fill capability.	Increased customer satisfaction

Challenges Overcome/Next Steps

Analyze historical data to gain a better understanding of site performance by comparing it with the maximum potential of the equipment and considering external factors such as communications, weather, and light periods.	• **Advanced Analytics:** Implementing more sophisticated data analysis techniques to extract deeper insights and drive further optimizations.
Manual effort is required for data validation and reporting in the billing process. There is an inability to detect abnormal generation data early.	• **Billing Integration:** automated data validation (near real time) and digital integraton with billing systems to streamline financial processes and improve accuracy in invoicing.
Enhance solar generation performance by improving the efficiency in identifying site issues (communications, inverter, or gateway) and associated recovery procedures. Optimize asset maintenance to reduce costs and minimize site unavailability.	• **AI and GenAI on Efficiency:** Leveraging Artificial Intelligence and Generative AI to enhance efficiency in areas such as field service and asset performance, ensuring continuous improvement and innovation.

Testemonials

Pedro Santos, DGU Data Arch. & Engineering CoE

“I had the incredible opportunity to lead the implementation of an IoT platform to monitor solar distributed generation assets at EDP Renewables APAC. As the lead IoT architect, I designed and deployed a robust infrastructure that provided real-time data analytics, predictive maintenance, and enhanced operational efficiency. This platform allowed for remote monitoring and control of solar power plants, significantly reducing operational costs and improving reliability and uptime.

One of the most remarkable aspects of this project was the globalisation of the solution. By implementing a standardized IoT platform across different regions, we streamlined operations and ensured consistent performance and quality. This approach facilitated the sharing of best practices and knowledge across the global EDP Renewables network, fostering a culture of innovation and continuous improvement. Overall, this project showcased the transformative power of IoT in the renewable energy sector, contributing to a more sustainable and efficient energy future.”

Pedro Enes, DGU Asia Pacific BP

“The foundations established by the APAC IoT Platform and Data Lake offer significant business benefits by enabling secure, sustainable, and efficient Solar Generation growth, as well as improved decision-making based on automated and accurate data.

The global model, which allows other EDP regions to leverage developments made by one region, is a game changer.

With increased Digital Maturity, EDP APAC is streamlining processes and is starting his AI journey, ultimately driving better performance and cost savings.”

Michael Silva, DGU Data Arch. & Engineering Coe

“I am thrilled to share my experience as part of the Solar DG monitoring project in the APAC region, where we utilized advanced IoT technology to enhance solar energy management. This initiative allowed us to collect and analyze real-time data from solar installations, significantly improving system performance and reducing maintenance costs through remote monitoring and swift anomaly detection. Being a key member of this project, I witnessed the transformative impact of integrating IoT solutions into our solar infrastructure.

Our team's collaboration and dedication were crucial in overcoming challenges and delivering a robust solution that sets a new standard for solar energy monitoring. This project underscores EDP's commitment to innovation and sustainable energy solutions, and I am proud to have contributed to its success.”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