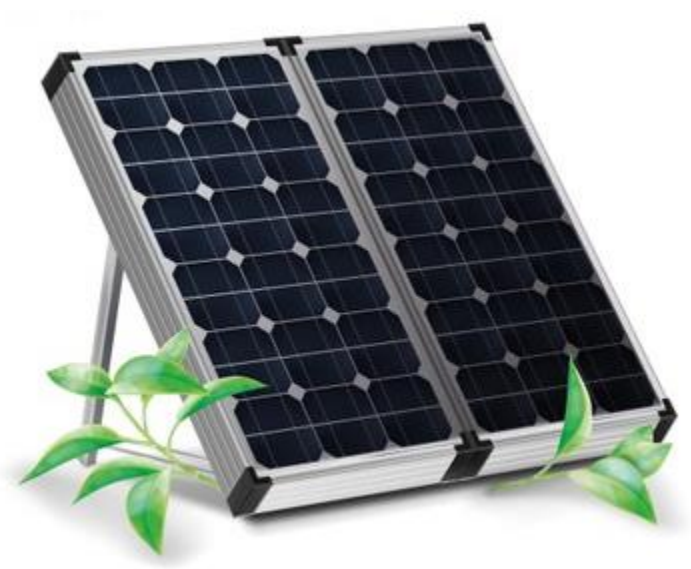
ZIGRON
Connected Application Expert

TERRASMART

SOLAR ENGINEERING

The digital transformation of **Solar Energy**



TERRASMART.

The digital transformation of Solar Energy - A Case Study

TerraSmart was renowned for having over 10 years of experience working on 3.2 GW's of ground-mount solar projects, pioneering a turnkey solar installation process. They needed a complete and all-inclusive software system for accurate, reliable, and scalable solar energy management and monitoring.

Challenge

TerraSmart had the equipment and technology to work with over 3GW's of utility-scale solar projects. However, they were searching for an all-inclusive software system for accurate, reliable, and scalable solar energy management and monitoring. To this end, we led the transformation and automation of their product, TerraTrak to deliver optimal cost efficiency and energy yields. This entailed making their static solar panels more intelligent to track the sun's movement for high energy yields, and creating a cloud-based infrastructure to store and analyze massive amounts of data collected from on-site sensors. Additionally, we were responsible for automating the development process for improved agility.

Project goals:

Remote Maintenance

Agile Process

Cloud Management

Data Analytics

SOLUTION

After holding extensive discussion with TerraSmart to understand their vision for the project we evaluated their existing architecture and prepared a detailed plan. The proposal outlined project requirements, measurable metrics, appropriate technology stacks, and an actionable roadmap towards success.

Our team of experts transformed and automated the monitoring and control of their PV modules to reduce costly site visits that translated as reduced year-end OPEX figures. We modernized and optimized their firmware with top-tier tools over 18 months. Dedicated to the project's success, we implemented DevOps with Amazon Cloud to streamline data collection and processing from on-site sensors.

These collective efforts resulted in them entering the market with great success and TerraSmart eventually got acquired in 2020 for $220 million.

Technology Stack

Dev Language & Framework:

JavaScript, Nodejs, React Js, GraphQL

Databases:

PostgreSQL, Elastic Search

Cache:

ElastiCache (Redis)

Languages

Python, C, GraphQL

Communication Protocols

HTTP, HTTPS, WebSocket/Socket.IO, MQTT, SSH

Platform Development

Due to the early maturity level of the project, there were no proper systems for technical documentation about the existing cloud platform. This was required to:

Get missing information about system modules (Planning stage)

Get missing scenarios for the test plans and standards (Quality assurance stage)

We were able to bring the system to a minimum stability level through reverse engineering.

Our teams created a powerful dashboard for TerraSmart with advanced analytics and visualization to remotely monitor their solar site and control PV modules. Data collected allowed performance assessment of photovoltaic systems by considering:

- Capacity factors
- Performance ratios
- Final yield
- System efficiency

This ensured maximum energy production and revenue generation per kilowatt-hour of production. The dashboard features included:

- Data Analytics for O&M management
- Remote site monitoring (e.g., weather and ground conditions)
- Tracker management of live solar sites
- Alarms and Event Management
- Backend AWS Cloud

AWS Cloud Enablement

We created and connected their system and dashboard with Amazon Cloud to continually assess operational performance and store data for analytics from various site locations. This enabled features such as:

•Monitoring in real-time through the dashboard
•Site-mode control from the cloud
•Individually tracking row control
•Cloud intelligence (alerts/notification module)
•Access devices & firmware updates module (admin dashboard)
•Multitenant companies site projects & user management

Solar energy facilities are typically located in remote areas, far from technicians trained to fix equipment. We integrated IoT SiteWise with Amazon Cloud to effortlessly collect, organize, and analyze data from large-scale solar equipment. This allowed:

•Monitoring asset performance remotely
•Real-time and historical data
•Pinpointing equipment issues
•Allow dispatching the right resources

IoT Based Solar Power Monitoring System

We integrated TerraSmart's sensors with the capability to access real-time insights for mission-critical assets.

01

Predictive Maintenance
Data collected from on-site sensors helped predict when maintenance would become necessary to avoid breakdown of solar assets and maximize uptime.

02

Condition Monitoring
Real-time monitoring of industrial solar equipment so immediate repairs could be made. It also allowed TerraSmart to pinpoint where repairs were needed.

03

Remote Monitoring
TerraSmart could track, monitor, and manage multiple assets in diverse locations to reduce costly site visits and year-end OPEX figures.

04

Data Analytics
Advanced analytics were applied to massive historical and real-time data collected from sensors on-site. This allowed TerraSmart to monitor energy yields

05

Solar Panel Provisioning
We streamlined the provisioning of solar panels and ensured its secure connection with Amazon IoT

06

Server Monitoring System
Alerts were set up to monitor the health of the overall infrastructure. These alerts were generated through emails, SMS, and calls for prompt remediation of any critical issues.

07

Alert Management
Reliable alerts allowed immediate remediation of incidents and ensured solar sites always operated at optimal levels.

08

Tracker Automation
Solar panels were equipped with local processing and configured to track the sun for maximum energy production even when disconnected from the cloud.

DevOps Enablement

Our team worked closely with TerraSmart to help them achieve the true benefits of automation with DevOps. Many of TerraSmart's processes were running manually, which delayed deployment rates and reliability. Their system lacked agility which made task management and reporting weak.

We assessed their DevOps maturity level and created a strategy to seamlessly implement a cloud-based DevOps. We provided included offering a Scrum master who used agile methodologies to resolve team and task management issues. Our team helped them attain excellent code quality, efficiency, faster delivery, cost reduction. Our efforts with DevOps went further by offering:

Code Inspection and integration

Constant automated scanning of code at every stage of production to identify defects immediately before actual tests were run. This prevented errors and duplication at later stages.

Configuration Management

The software was automatically maintained in its desired state to ensure the quality and consistency of the software.

CI/CD pipeline

Prevented code duplication and stability by building and testing code when changes were made. This ensured code remained consistent and clean to improve release rates and accuracy.

Containers

We structured their application as a collection of highly maintainable, testable, and independently deployable packages. This made deployment rates faster and even better security.

Infrastructure management and automation

With time TerraSmart's infrastructure grew in size and complexity. To avoid delayed updates, patching, and resource delivery, we automated management tasks such as provisioning, configuring, and deployment.

Security Integration

Implementing a windows application firewall ensured that their web apps remained protected by filtering, monitoring, and blocking any malicious HTTP/S traffic, and preventing leaks of unauthorized data.
With load balancers, we ensured that no single server had too much demand to prevent downtime and issues with heating and cooling.

Environment Management

From code management to platform automation, we automated configuration deployment implemented single service management for all environments, and generated detailed activity reports with Slack (integrated with CloudWatch).

Monitoring and Logging

For optimal application health, our teams continuously monitored applications and production environments to collect data in multiple logs.

Infrastructure Management

Our DevOps experts integrated automation at every stage to quality management and monitoring. We provided TerraSmart with automated provisioning.

Support

Our teams were present around the clock to offer prompt remediation of any alerts generated.

DevOps Tools

Code Inspection/Integration:
SonarQube

Configuration Management:
IAM, JSON, AWS Roles

Infrastructure monitoring:
CloudWatch

Continuous integration:
Bitbucket pipeline

Infrastructure automation: Terraform Partially

Microservices:
ECR, ECS, FARGATE

Process Implementation:
Jira

Security Integration:
WAF, AWS VPC and Security Groups

Benefits and Results

- Remote maintenance with TerraTrak to avoid costly site visits
- Reduce year-end OPEX and CAPEX figures
- Actionable insights from real-time analytics
- Advanced tracking algorithms and controller communication enhanced
- Experienced a revenue increase of 25% to 35% to valuable insights with AWS cloud services
- Significant cost-saving and energy production through cloud enablement of tracker
- Minimized downtime and improved energy yields due to our monitoring services

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