Quadrical Ai

Centralized Data Platform with Digital Twin AI, for RealTime Monitoring

For our customer, a Solar developer, operating a growing portfolio of solar assets brought new complexities every season, every day and every hour.

Their 160MW portfolio comprised of multiple operational SCADA systems in 5 plant locations, with a plan to double in size within 18 months.

As solar plant operating data is stored in different databases within SCADA, each plant had different table structures, at different time ticks. This meant they needed to run custom scripts for each plant, even for every generation report or outage.

A centralized data monitoring platform capable of providing detailed performance analytics would allow them to focus on growing their portfolio, not trying to make excel do complex work.

This is where Quadrical Ai came in. As Solar Data Cloud specialists, we partnered to help extract and aggregate their data on a single centralized cloud Data Platform.

Being able to visualize and monitor their whole portfolio in RealTime – regardless of data acquisition systems– SCADA, dataloggers, databases, sensors, 3rd party services would make their life easier.

Portfolio Studied

Capacity
160 MW, 5 Plants

Location
India

Toral Area
804 Acres

# of Panels
491732

# of Inverters (Central)
93

Sensor Level / String Monitoring Box (SMB) Level
SCB (3 Plants)
String (2 Plants)

# of Sensors (SMBs)
889

# of Sensors (WMS)
12

Configurations
Single-Axis and Seasonal Tracker

SCADA vendors
Rockwell (1 Plant)
ABB (2 Plants)
Armax (2 Plants)

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Challenges

Each plant in the portfolio naturally had a different layout, topology and capacity, but also 3 different SCADA vendors in their 5 plants. Each database stored plant operating data in a custom schema format corresponding to its plant's architecture and SCADA setup.

Plant performance reporting turned complex as each database demanded custom handling. The team tackled siloed data, data latency. Management found it difficult to visualize real time unified portfolio performance.

They also needed to build and standardize processes for plant performance analytics as well as speed up the implementation effort across their portfolio.

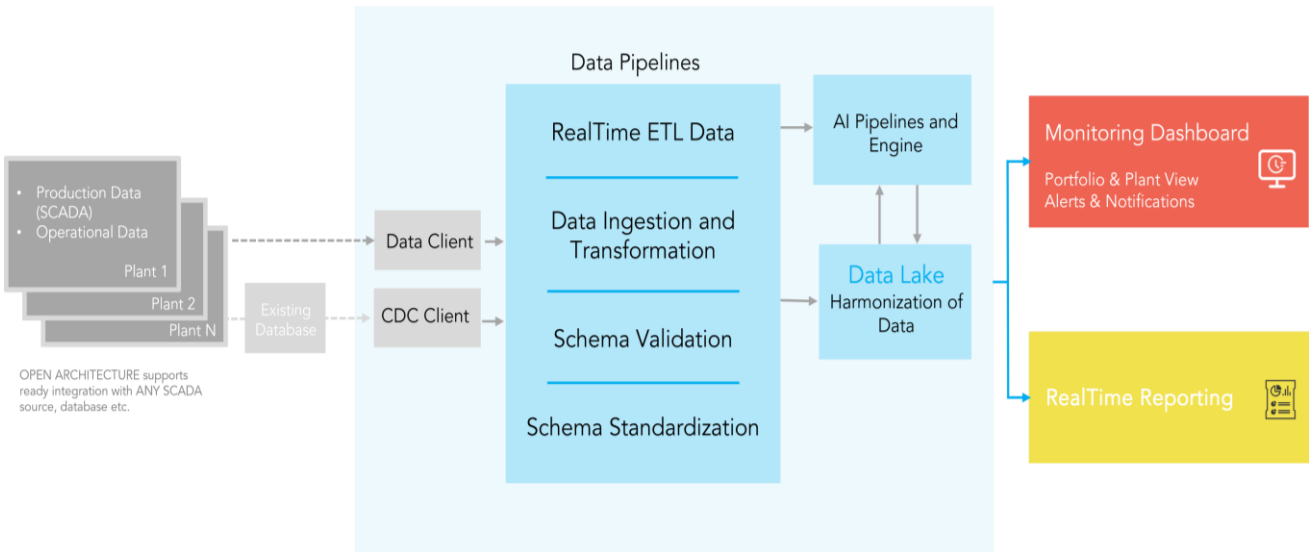
Increase in operating costs: Different sets of analysts to figure out schema for different plants directly accelerated HR requirements, resource wastage and risks of error.

Not RealTime: Non-centralized databases often were not updated/synced with live plant data due to plant site Internet connectivity issues.

Lack of insights: Valuable analytical insights inevitably fell through cracks – resulting in inefficient operations management and financial downsides.

Limited Visibility, Information Asymmetry: Management was completely dependent on Field teams for optimizing operations and reporting due to lack of visibility. This was multiplied as they had no way of sharing best practices across plants which was important to the company.

Centralized Data Platform



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Our Solution

Our managed Azure cloud (we're cloud agnostic) lets connected devices interact easily and securely with cloud applications and other devices.

Our Data Engineers deployed a standardized data migration process, a flexible backbone architecture and expert support to ensure RealTime snapshots of performance across complete portfolio.

- Massive Data Platform running for each plant
- Structured and standardized schema based on RealTime data
- RealTime data visualization and analysis on entire datasets
- Reliable system benchmark with accurate, insightful data analytics

This efficient data management process meant cost savings, greater visibility, chance to build deeper insights which would help increase generation in the very near future.

Using this AI based Data Platform, data could be further analyzed to issue Predictive O&M Guidance based on maximum revenue impact.

- Revenue impact driven O&M directions
- Streamlined O&M activities to minimize downtimes and optimize operating costs
- Leveraging data-driven decision making to maximize profitability and information symmetry

Now with cleaned and harmonized data stored in a centralized location, it became available for comprehensive, advanced analytics based on plant IDs.

Data Client

Data client solved for seamless integration with legacy 3rd party asset management systems.

We did this by:

Fetching and posting data from all sources in RealTime to Data Platform, solving the multiple data source complication.

Our team has the requisite expertise to acquire data from any type of plant, data acquisition system, or database in a single cloud-based platform with zero data loss and zero downtime guarantees.

Next, we started the Data Platform's various pipelines for cleaning, transforming, interpolating data. Our client's data science team was able to easily manage all the data with a single code base, from the standard schema we generated.

Lastly, all processed data was shifted into an AI-first Data Lake – making it possible for the data to be utilized seamlessly.

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The Quadrical Ai Advantage

A Single Standard Schema – Each plant in portfolio has the same structure of data making it both **Flexible** and **Scalable.**

Open Architecture Integration
Public API - Our proprietary Digital Twin data is accessible for your team to enrich your analytical scope, while we continue to build our advanced analytics.

Clean raw data available in the Data Lake allows for deployment of your own data analytics libraries, KPI calculations etc. directly via Tableau, PBI, Python notebooks.

Significantly improved data quality

Real, actionable plant data with Static, Dynamic and Progressive Alerts

Cloud Service based on Customer preference

Alerts benchmarked to Quadrical Ai's proprietary Digital Twin baseline leading to significant improvements.

Zero Sync Issues - All data is fetched, processed, and can be utilized via the Data Lake in RealTime – OPC/CDC data clients enable this live sync.

State-of-art cloud storage and data archiving solutions provide unlimited scale, 99.99% data availability, 99.5% or more system uptime performance, highest standards of data security and secure encryption in-flight and at-rest.

We protect sensitive data by restricting access using Azure **Role-based and Network-based access controls**, and other specific controls such as encryption in SQL and other databases, so that data in transit stays protected against 'out of band' attacks (e.g., traffic capture) using encryption.

RealTime Monitoring

Quadrical Ai RealTime Monitoring Reporting – available with Data Platform.

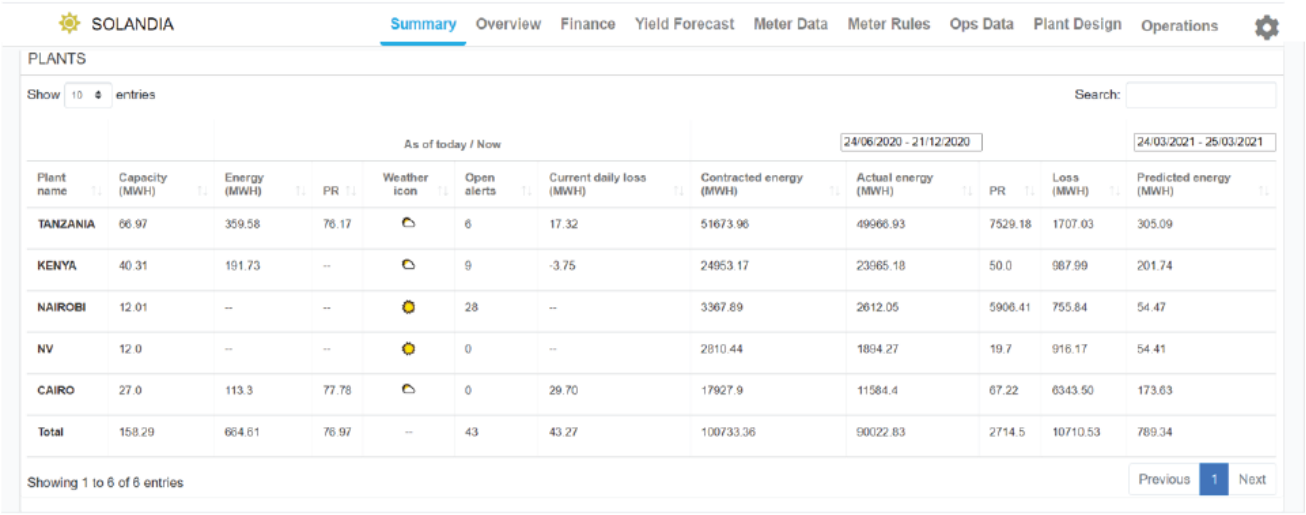
Helps extract value from plant operating data by identifying and analyzing loss buckets, streamline O&M and ticketing management in a single workflow, define key performance indicators (KPIs) and benchmark plant performance with Digital Twin AI.

- Needle-in-Haystack (granularity and accuracy for catching leakage losses)

Sharat Singh
Quadrical Ai
CEO

Our state-of-the-art Centralized Monitoring SaaS guarantees RealTime clean and harmonized data in a standardized AI-enabled cloud Data Lake. As our platform automatically adapts to your data, improving at each tick daily, your team can focus on Yield improvement and O&M best practices to utilize our advanced product that's simply future-ready.

- Patterns predicting outages with no evident current loss.
- Structural Issues (degraded panel, cables, equipment and shading)
- Temporal (DC, Cabling, Inverter or other equipment maintenance, slackers)
- Soiling



SOLANDIA

Summary | Overview | Finance | Yield Forecast | Meter Data | Meter Rules | Ops Data | Plant Design | Operations

PLANTS

Show 10 entries

Search:

							As of today / Now	24/06/2020 - 21/12/2020			24/03/2021 - 25/03/2021
Plant name	Capacity (MWH)	Energy (MWH)	PR	Weather icon	Open alerts	Current daily loss (MWH)	Contracted energy (MWH)	Actual energy (MWH)	PR	Loss (MWH)	Predicted energy (MWH)
TANZANIA	66.97	359.58	76.17		6	17.32	51673.96	49966.93	7529.18	1707.03	305.09
KENYA	40.31	191.73	--		9	-3.75	24953.17	23965.18	50.0	987.99	201.74
NAIROBI	12.01	--	--		28	--	3367.89	2612.05	5906.41	755.84	54.47
NV	12.0	--	--		0	--	2810.44	1894.27	19.7	916.17	54.41
CAIRO	27.0	113.3	77.78		0	29.70	17927.9	11584.4	67.22	6343.50	173.63
Total	158.29	664.61	76.97	--	43	43.27	100733.36	90022.83	2714.5	10710.53	789.34

Showing 1 to 6 of 6 entries

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With end-to-end visibility, our customer could view their entire portfolio at present and at any point in history.

They could now respond to all production impacts in RealTime. All stakeholders (Finance, Plant Management, O&M and Analytics) had exactly the information they needed in intuitive dashboards.

As our AI based Data Platform was built in 2020, it was and is entirely **Plug & Play** and extensible. Additions whether they occur in 2020 or in 2027 will add on easily. No legacy systems here.

Key Outcomes

Management now has 360° visibility based on benchmarked KPI's with reliable data.

Best practices and processes can be percolated across plants and across portfolio allowing yield optimization everywhere.

Field teams get reliable data to pinpoint underperformance wherever it occurs in any plant.

All field activities (panel cleaning, issue fixes) will now be transparently reflected in the yield generated in RealTime.

Plant data is stored in a Data Lake on the cloud, which provides stringent security and safety for all company data with zero data loss.

Optimization of cloud infrastructure used to restore, backup, storage and RealTime data availability.

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Future Performance

Globally, almost every solar company faces similar challenges. As assets age, prices paid per MWh are decreasing, while scale and complexity are increasing. This makes holistic long-term planning essential for asset owners and managers.

We know that a Digital Twin AI solution can tell natural variances in the system apart from problematic performance.

The Quadrical Ai platform will continue to optimize your plant assets even at Year 25, with its ability to adapt continuously with time and learning.

Digital Twin Based AI for Complete Solution

- Robust Metrics and Benchmarking
- Energy Forecasting with Storage, Trading, and Pricing Optimizations
- Monitoring with Accurate Needle-in-Haystack Identification
- Predictive Maintenance for Outage Prevention
- O&M Guidance with Revenue Prioritized and Actionable Tickets
- Plant Audits

Benefits

Set Up

From all plants irrespective of SCADA & OPC implementations. No more delays or missing/lost data, but RealTime with integrated archiving in cloud.

Management

RealTime Portfolio Performance Monitoring & Revenue Impact.

Finance Team

Automated reports against standardized schema for each site, so no more data juggling in excel.

O&M Team

Not just threshold-based alerts or generic stats-based deviations, but revenue-prioritized each-device based personalized Digital Twin alerts for even the smallest of leakages.

Internal Data Science Team

RealTime Structured Schema Based Data of Actual as well as Reliable System Benchmark – Digital Twin data, and all of it available on a RealTime dashboard.

The Quadrical Ai Solar Monitoring Platform