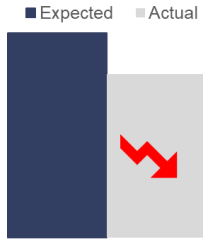


We help you get
MORE out of your
Renewable Assets!

The Problem



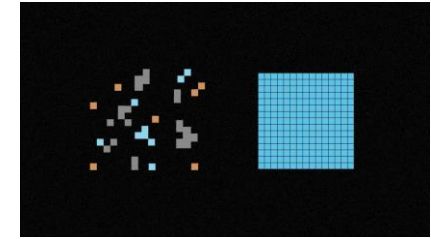
Underperformance

Utility solar plants constructed post 2015 underperform by avg. **7 – 13 %** compared to the P50 estimates

CAUSE UNKNOWN

Unknown Breakdowns

5% -20% revenue loss due to delay in fault identification & defects – and hence the subsequent action



Bad Data Quality

50% manpower productivity loss in manual reports - higher costs and inefficient decision making for O&M and Asset Management Team

Apollo eliminates the pain points while Digitalizing your Assets

What do we do?



Apollo is a comprehensive enterprise grade APMS software for renewable energy
Central Monitoring | Computerized Maintenance | Advanced Predictive Analytics

MAXIMIZE performance ~ 5% - 7%

- Identify Energy Gain Areas
- Advanced Loss Bucketing
- Automatic Insights

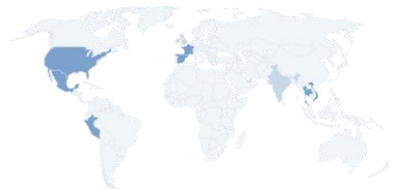


REDUCE OPEX costs ~ 20%

- Centralized Live Monitoring
- Automated Reporting
- Automated Work Orders



12,500 MW



AVEVA



apollo
Energy Analytics

AVEVA and Apollo
Energy Analytics
partner to empower
the renewable
energy industry

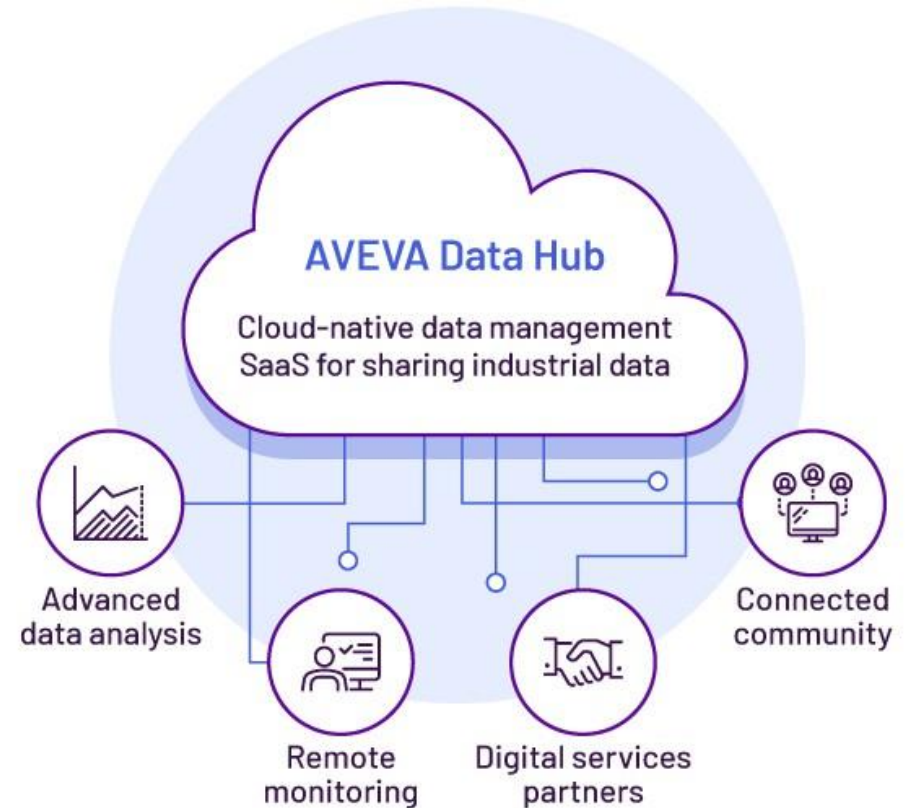


AVEVA – Apollo Technology Partnership

Empowering the solar energy industry with deep insights and advanced analytics

By integrating Apollo with AVEVA Tools – we are able to empower existing AVEVA customers to monitor the performance and efficiency of their assets, streamline operations and maintenance, and optimize their solar, and wind energy production. Apollo integrates seamlessly with :

- ✓ AVEVA Data Hub
- ✓ AVEVA Insight
- ✓ AVEVA Pi



Differentiators



Patent: Solar PV Digital Twin WO2020202184A1

SINGLE PLATFORM

Centralize all data in one place

Solar | Wind | Battery Storage

Advanced Analytics

Dedicated Dashboards

Automated Insights

AUTOMATED WORKFLOWS

Digital Efficient Operations

Detect Anomaly – Raise Alert

– Generate Work Order –

Ensure SLAs – Automated

Reports

FAILURE PREDICTION

Asset Failure Prediction

4 Weeks in advance for
Transformer and Inverters



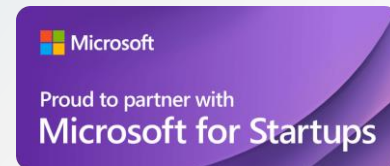
Nex-Gen
Product of the
Year



Smart Start-
Up of the
Year Award
Winner



Best Service
Provider of the
Year- Solar
Analytics



Apollo is ISO27001 and SOC2 Compliant – Your data is secure with us

Apollo – Services



**Plant
Performance
Enhancement**

**Custom Auto
Reports**

**Video Wall and
Hardware**

End to End Performance Enhancement Services

ROI for Apollo

CUT DOWN COSTS

Higher efficiency in Reporting & Central Monitoring to **REDUCE**

COSTS by up to **20%**

MAKE O&M BETTER

Track Open tasks

Incentivize O&M teams to **DELIVER ROI**

Digitize your **ENTIRE OPERATIONS**, standardize processes

MAXIMIZE PERFORMANCE

Get up to **7% Higher Generation** through Apollo.

No additional hardware required, we connect to the on-site SCADA directly

Redefine Portfolio Management with the power of AI-powered Platform

Apollo™ used by your Portfolio companies – To **deliver** your ROI



ASSET MANAGER

- Satellite Weather Integration
- Central Monitoring of KPIs
- Advanced Events and Pareto
- Custom Alarms
- Financial KPIs
- Solar, Wind and Battery



PERFORMANCE ANALYST

- Failure Prediction
- Digital Twin
- Loss Bucketing
- Actual vs PVSyst
- Equipment Health Score
- Equipment benchmarking

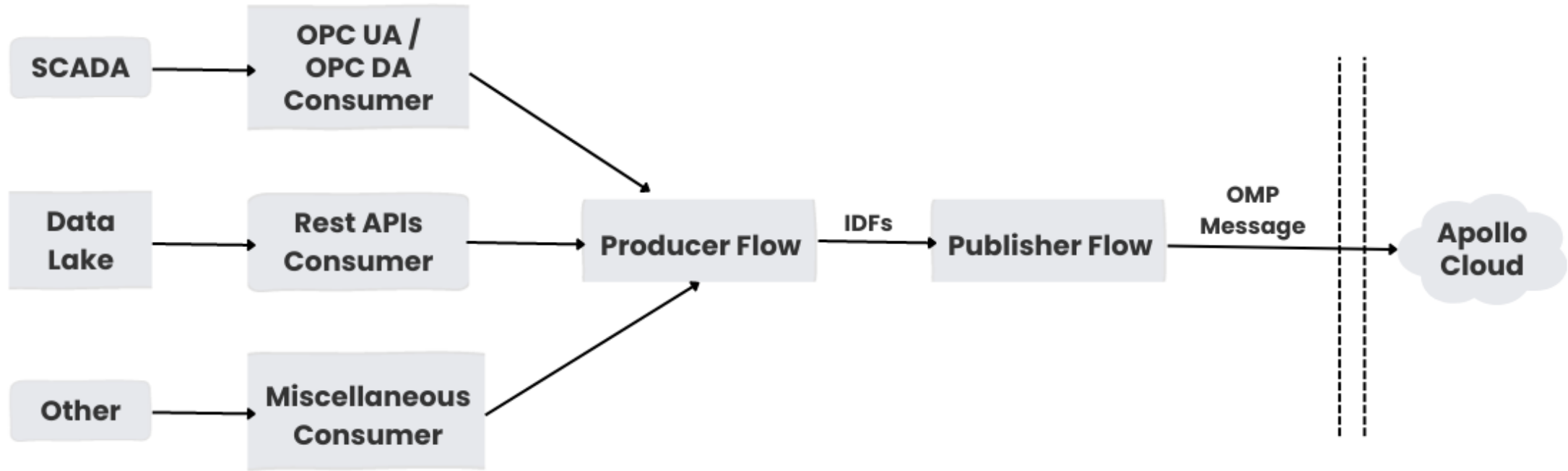


O&M MANAGER

- Preventive Maintenance
- Predictive Maintenance
- Operations and Work Orders
- Mobile App for PM
- Spares and Inventory

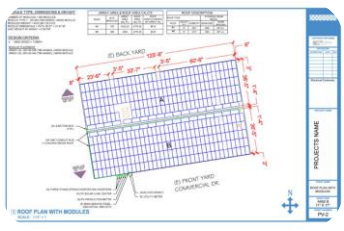
Apollo™ – Asset Operating System for your Portfolio companies

Apollo EDGE



*IDFs - Intermediate Data Files

Apollo Process Flow: 6 – 8 Weeks to Go-Live!



Customer Plant SCADA

Auto Data Acquisition S/W

Design Data Collection

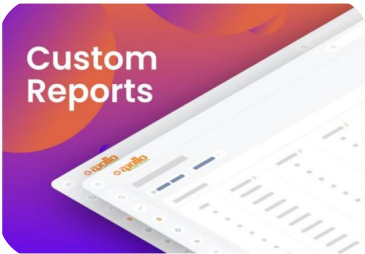
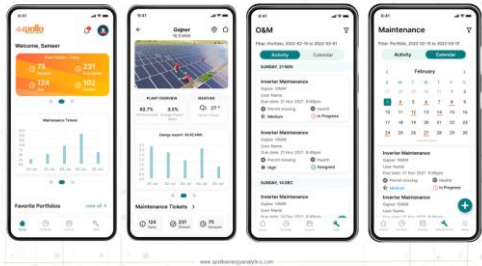
Apollo Web App

No additional Hardware Required

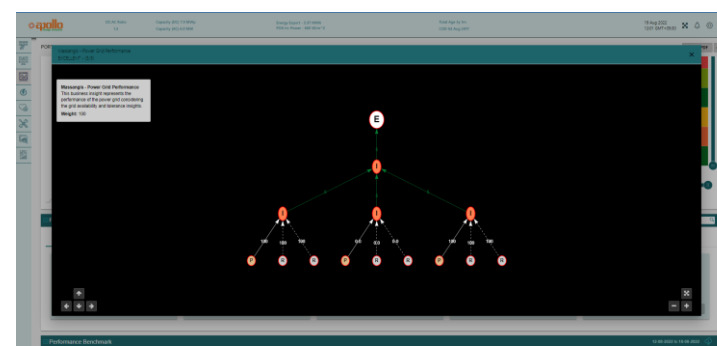
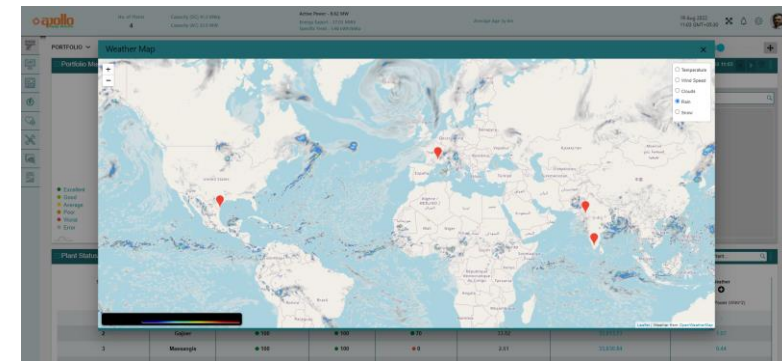
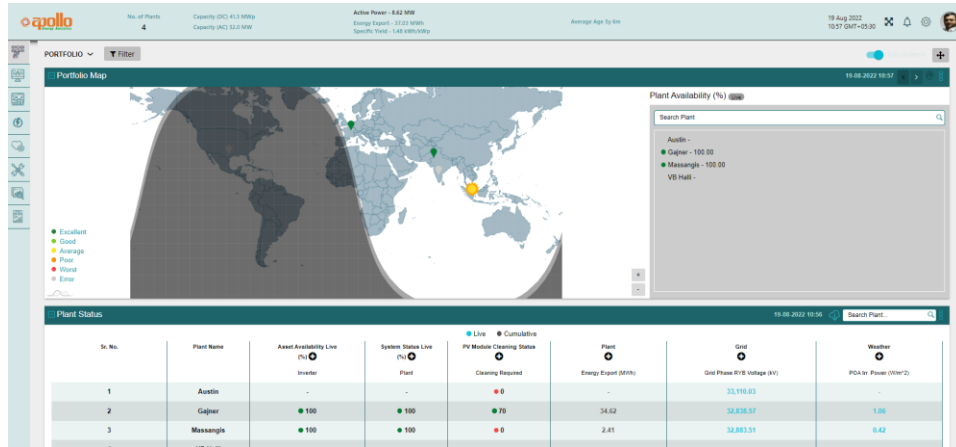
Mobile Apps

Auto Insights

Custom Reports



Solar PV Dashboard



9:41

Welcome, Sameer

Plant Tickets - Today

- 75 Delayed
- 231 In progress
- 124 Due
- 102 Closed

Maintenance Tickets

Bar chart showing maintenance tickets from 01-Jul to 05-Jul.

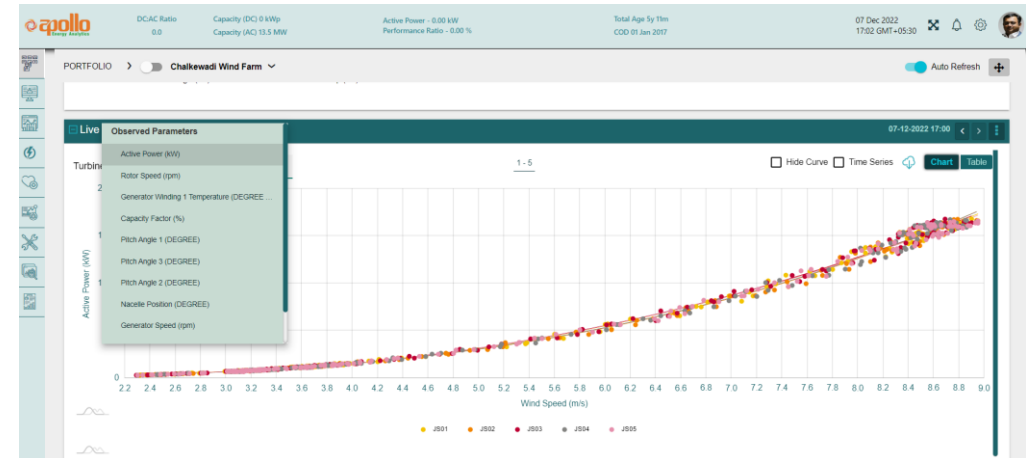
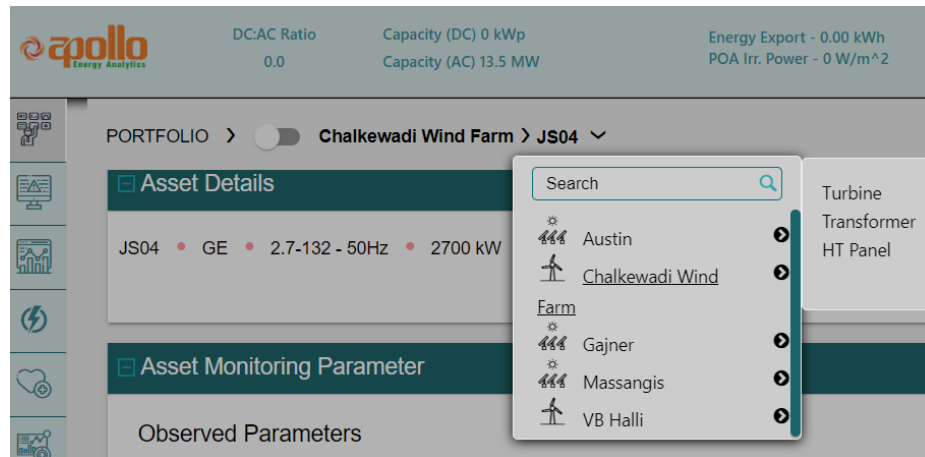
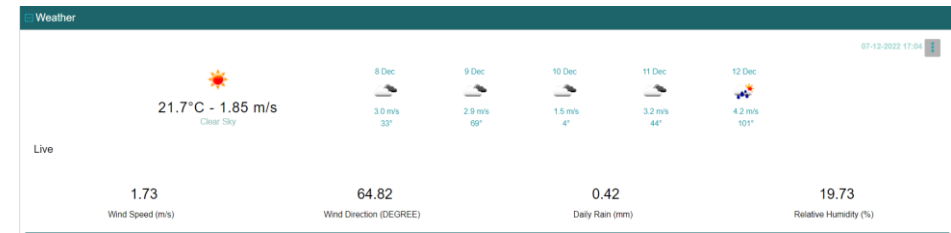
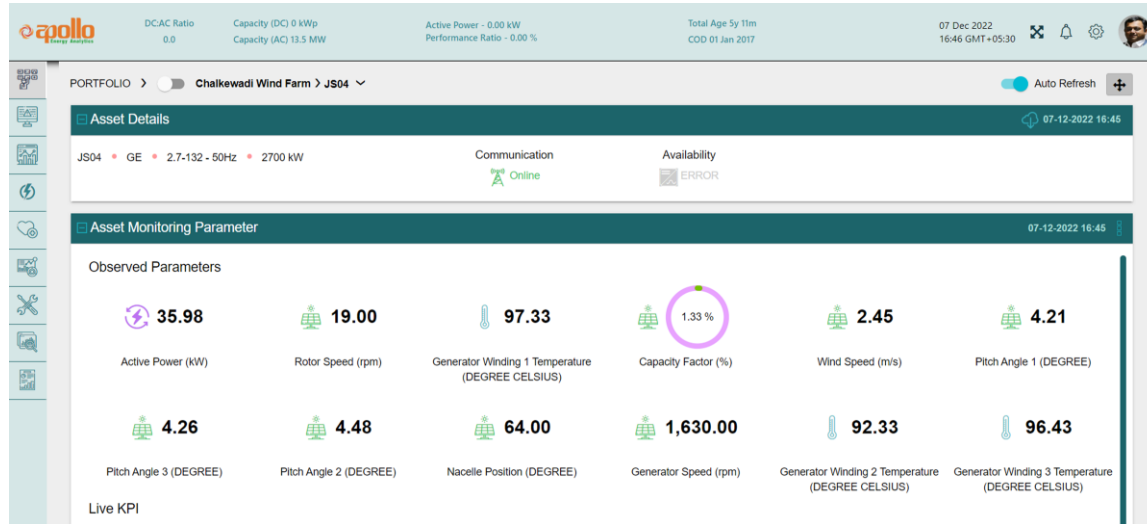
Favorite Portfolios

- Gajner: 76 Maintenance Tickets, 6 New, 20 In-progress, 5.6 MW AC Capacity
- Veerabommana: 76 Maintenance Tickets, 6 New, 20 In-progress, 5.6 MW AC Capacity

Home | Portfolio | Events | Maintenance

Central Monitoring – CMMS – Loss Bucketing – Digital Twin – AI Failure Prediction

Wind Dashboard

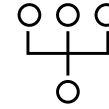


Central Monitoring – Advanced Analytics - CMMS

All Cutting Edge Technologies - To help your team deliver !

Performance Analytics

Automated performance bench-marking for your plants & its assets



Remote Operations Centre (ROC)

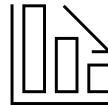
Real-time monitoring of your portfolio plant & its assets.

Operations & Maintenance (CMMS)

Streamline Maintenance Activities of your entire portfolio



Energy Loss Analysis Benchmark Energy Losses in the Power Plant



Health Insights

Predict asset failure & health deterioration



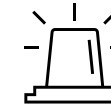
Report & Custom Analysis

Carry your own custom analysis



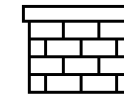
Power Forecast

Manage the regulatory requirements & reduce penalties



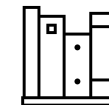
Event Analytics

Discover anomalies in your assets for predictive maintenance



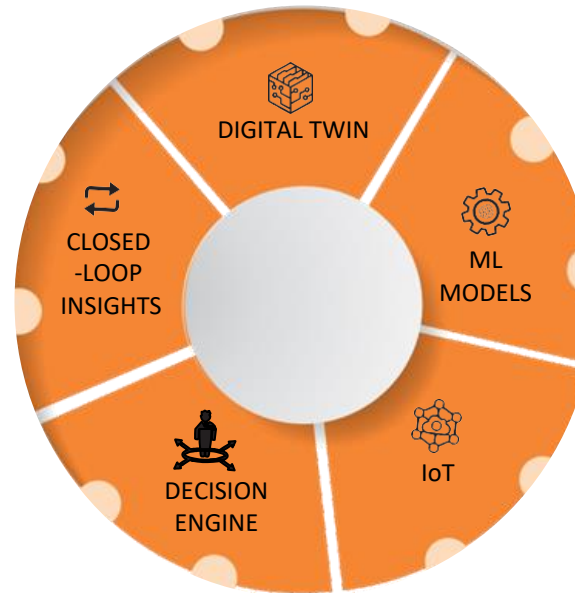
Plant Configurator

Digitize your entire portfolio



Master Equipment Library

Setup master data of OEM devices specifications



Case Studies



Use Case: Generation up by 3.4%



300+ MW Solar Plant, Middle East

1,000,000 PV Modules

1500 Inverters

54 Transformers

1250 Single Axis Trackers

1200 Acres of Desert Land

Variety – 1000s Tag types

Velocity – Collected every 1 minute

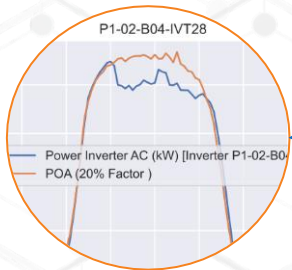
Volume – 1 Bn + Tags / Day



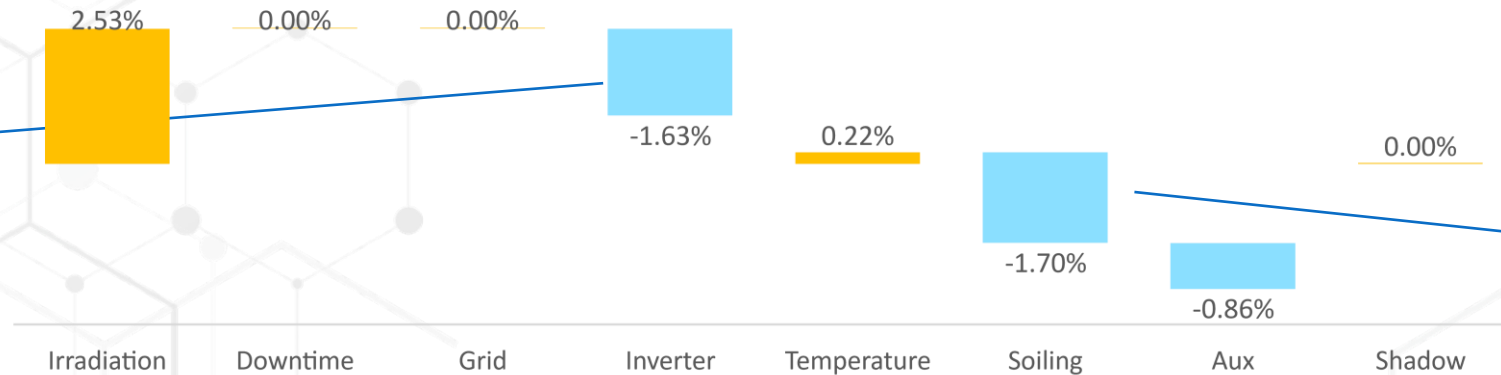
Apollo Impact in ~ 45 Days

1. Generation gain by **3.4 %**
2. Productivity increase by **50%**
3. Annual Loss Saved – **USD 1.5 Mn**

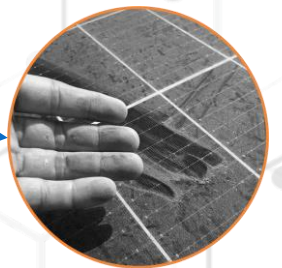
Plant System Loss Analysis



Generation Gain:
USD 2,500 / Day



Generation Gain:
USD 2,188 / Day



Use Case : Generation gain via patented Digital Twin & Loss bucketing



50 MW Solar PV Plant , Asia

150,000 PV Modules

50 Inverters

14 Transformers

230 Acres of Desert Land

Variety – 1000s Tag types

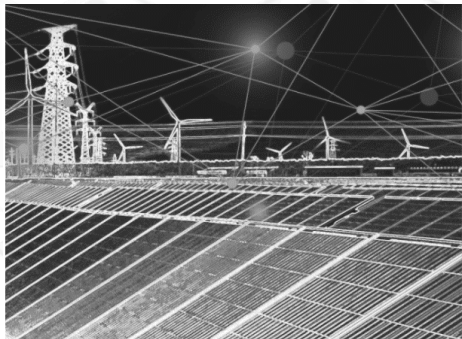
Velocity – Collected every 15 minute

Volume – 100,000 + Tags / Day



Apollo™ Impact in ~ 12 Months

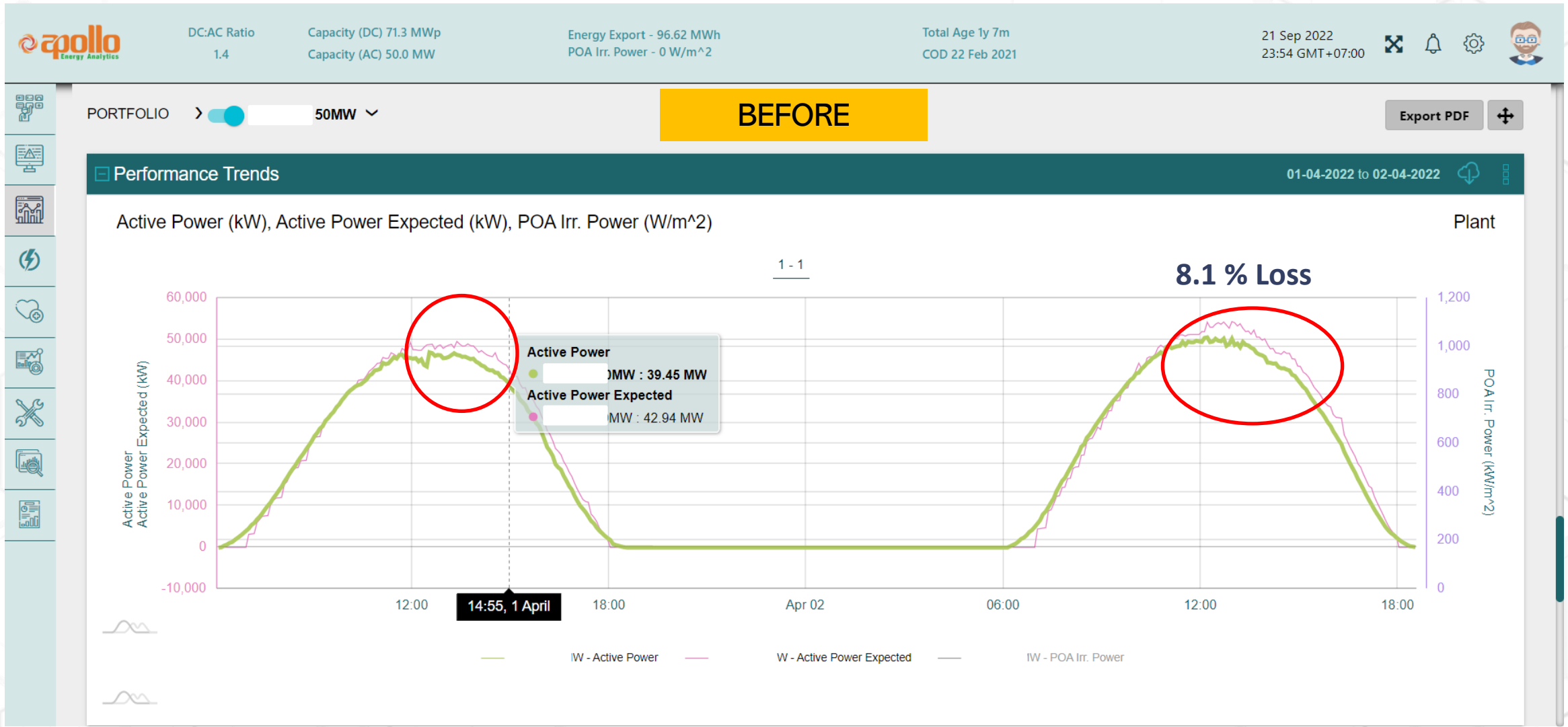
1. Generation gain by **6.5 %**
2. Annual Loss Saved – **USD 0.24 Mn**



The Digital Twin is an electrical replica of the Solar or Wind power plant and uses both historic and current behavior using sensors, and data combined with modeling and simulation.

Traditional Remote Monitoring and SCADA are limited in their impact since they don't consider actual weather, air mass, sea level, the equipment design, placements, ageing, damage history, and individual performance of components and **hence can't inform if there is under-performance LIVE.**

Use Case: Apollo identifies the underperformance



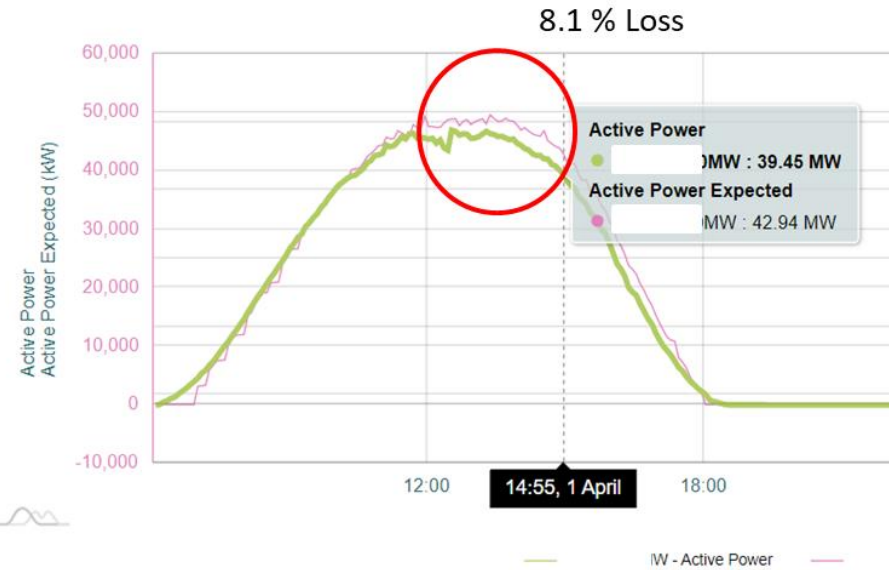
02 April 2022

Use Case : Loss buckets are identified to take action

8% Loss identified by Digital Twin

Performance Trends

Active Power (kW), Active Power Expected (kW), POA Irr. Power (W/m²)



Reasons for the loss of 8% identified through Loss Buckets

Component	Loss Type	Actual Loss (MWh)	Expected Loss (MWh)
Inverter	Total Energy Loss	3.10 MWh (1.64 %)	2.34 MWh (1.4 %)
	DC to AC Eff Loss	3.10 MWh (1.64 %)	2.34 MWh (1.4 %)
	Asset Breakdown Loss	-	0 kWh (0 %)
	Clipping Loss	-	0 kWh (0 %)
	Deration Loss	-	0 kWh (0 %)
	AC Energy Output	189.16 MWh	166.37 MWh
Transformer	AC Energy Input	224.64 MWh	173.06 MWh
	Total Energy Loss	4.76 MWh (2.56 %)	754.91 kWh (0.46 %)
	LV To HV Efficiency Loss	4.62 MWh (2.49 %)	754.91 kWh (0.46 %)
	Asset Breakdown Loss	-	0 kWh (0 %)
	Auxiliary Loss	141.46 kWh (0.08 %)	-
AC Energy Output	185.63 MWh	164.94 MWh	
Cable	Total Energy Loss	652.08 kWh (0.35 %)	- 0
	Inverter to Transformer	427.88 kWh (0.23 %)	- 0

Use Case: Soiling Loss Identification for max gains in deserts



50 MW Solar PV Plant , India

150,000 PV Modules

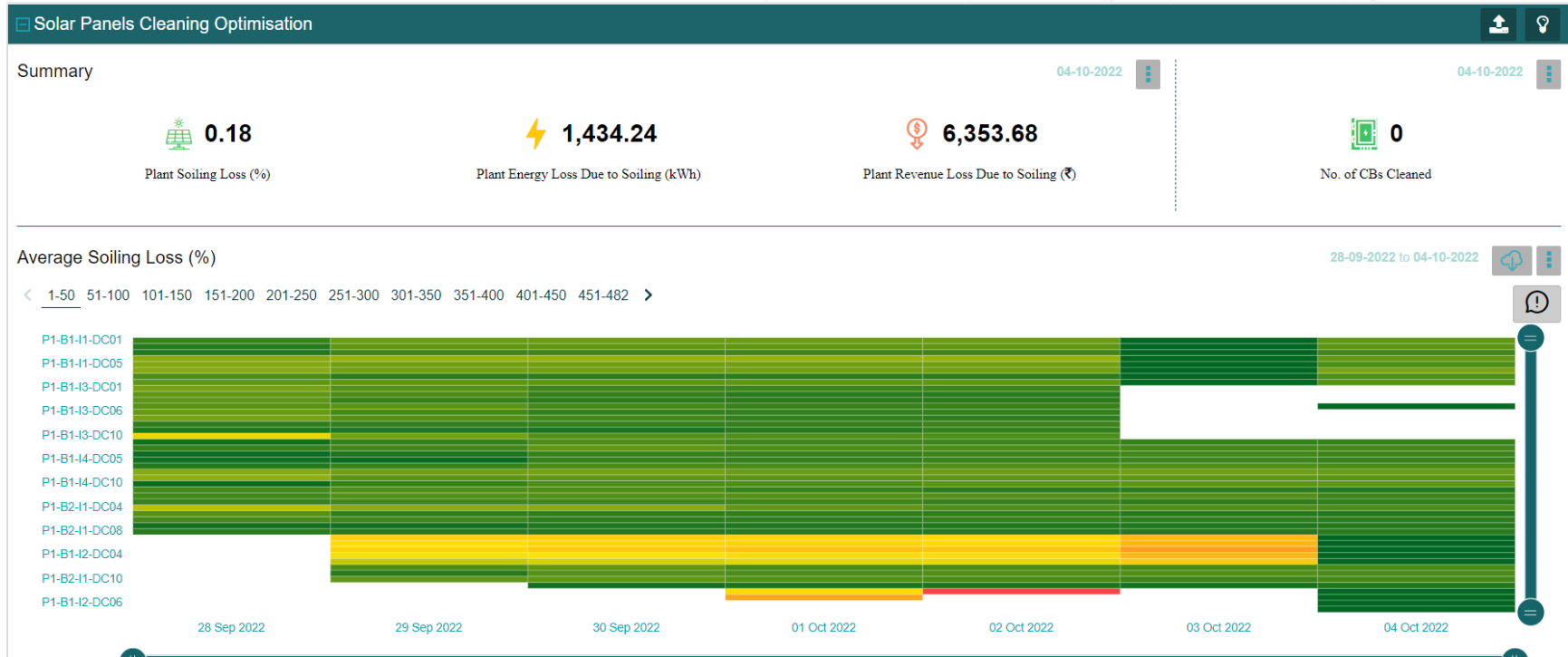
50 Inverters

14 Transformers

230 Acres of Desert Land

Apollo Impact in ~ 12 Months

1. Minimise Soiling Loss from **6% +** to **0.2 %**
2. Annual Loss Saved – **USD 0.1 Mn**
3. Also find out the efficacy of cleaning!



Cleaning Schedule Recommendation

Inverter	Combiner Box	Clean up Method	Last Clean up Date	Clean up Recommended Date	Clean up Recommendation Reason
B1INV01	P1-B1-I1-DC01	DRY	2022-10-02	2022-07-07	Ineffective Cleanup Done
B1INV01	P1-B1-I1-DC02	DRY	2022-10-02	2022-07-07	Ineffective Cleanup Done

Use Case: Actions taken on-site to increase generation by 7%



08 June 2022

Use Case: Americas IPP Data at their fingertips !

Solar and Wind Portfolio

Plants – 300

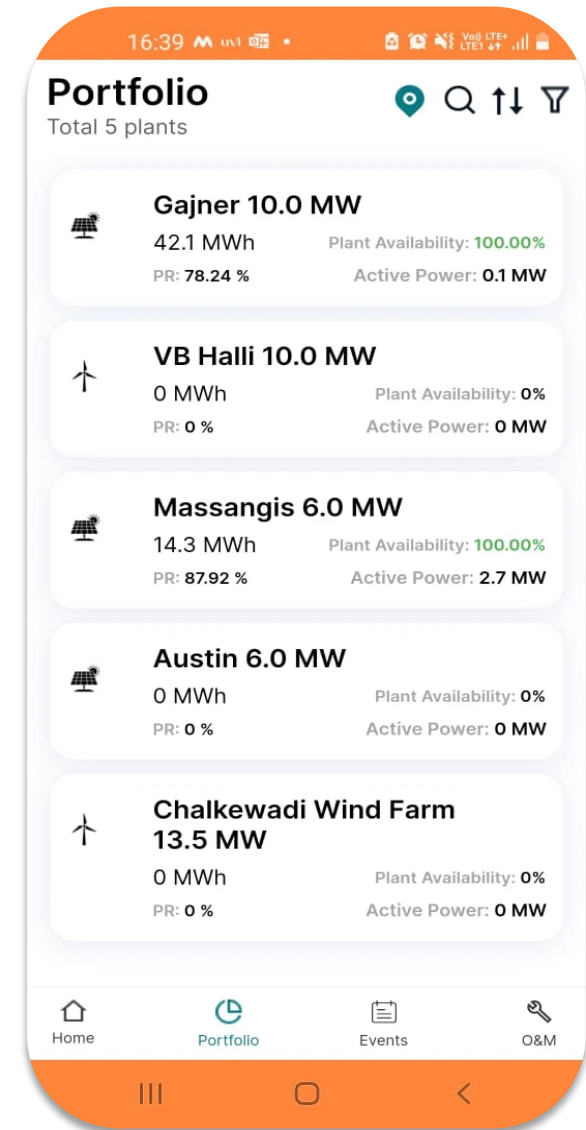
DC Capacity – 125 MW

AC Capacity – 100 MW



Apollo Impact

1. CXO view for all the KPIs
2. Plant view for In-charges
3. Role-based access
4. View and Transact on the app
5. iOS and Android mobile apps



Use Case: IPP Transformer Failure Prediction



10 MW Solar PV Plant, Europe

30,000 PV Modules

20 Inverters

5 Transformers

50 Acres of Area

Variety – 100s Tag types

Velocity – Collected every 15 minute

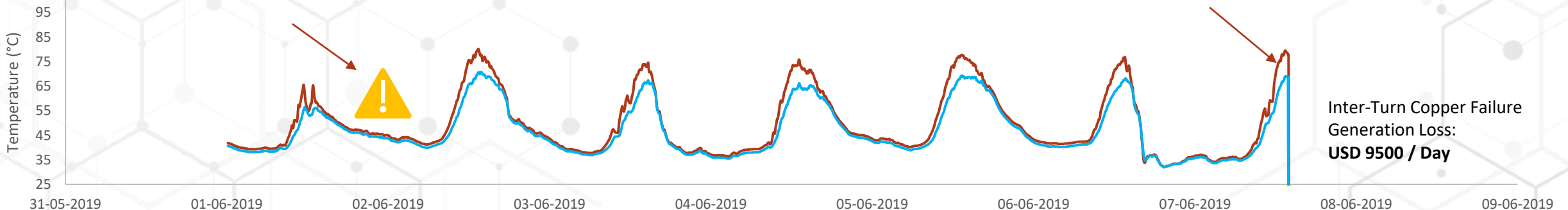
Volume – 10k + Tags / Day

Apollo Impact in ~ 180 Days

1. Transformer Failure prediction 6 Days in advance
2. Loss Saved – USD 0.37 Mn

Transformer Failure Prediction

Failure Prediction Algorithm send Alert – While all Vitals seemed ok



Failure Point of Transformer



Inter-Turn Copper Failure
Generation Loss:
USD 9500 / Day

Apollo Operators and Co-Founders



Abhay Tilwankar
Chief Executive Officer



15+ Year's experience - Built India's largest Solar Asset Management ISP 6.5 GW– Ex Mahindra, Schneider Electric, and L&T – Built & managed 10 GW+ Software platform

MBA MDI Gurgaon & BE Mumbai Univ



Dr. Keyur Gandhi
Chief Product Officer



12+ Year's experience Subject Matter Expert Solar PV and Renewables – Ph. D. Flexible Photovoltaics – Ex Mahindra , Fujitsu – Built and conceptualized Apollo product from scratch

Ph.D & B.E. University of Surrey



Saikat Roy
Chief Solution Architect

16+ year's experience in Technology Maverick with Hands-on design, development, architecting. Ex AMDOCS DVCI - Delivering enterprise grade applications for AT&T, Telstra, ADSA, Vodafone

BCSE Jadavpur University, Kolkata

Apollo Founder Investors



Nitin Tappe
Non Executive Chairman



25+ Years experienced Entrepreneurial leader
– Built global startups & ISVs – COO Geometric
– Delivered multiple Digital platforms

M. Tech IIT Mumbai & B.Tech GCE Amravati



Milind Barve
Tech Mentor + Director



25 years + experience in Software starting
from product development, Enterprise
solution architect, Pre-sales and technical
mentoring.

M.Tech IIT Mumbai & B.E. COEP



Prashant Anaskure
Operations Mentor + Director



20+ years experience in Software Delivery
and Operations - Entrepreneur focused on
the convergence of Digital Transformation,
SMAC & IoT technologies

MBA IIM Calcutta & BE IIT Kharagpur

THANK YOU !



ASIA-PACIFIC & INDIA

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Web: www.apolloenergyanalytics.com

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