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Envisaged Capabilities In Energy Domain

Microsoft
Partner of the Year
2021

Microsoft Partner

Microsoft

- Gold Data Analytics
- Gold Application Integration
- Gold DevOps
- Gold Data Platform
- Gold Application Development
- Gold Cloud Platform
- Gold Security
- Gold Datacenter
- Gold Cloud Productivity

Traditional Enterprise + Modern Cloud

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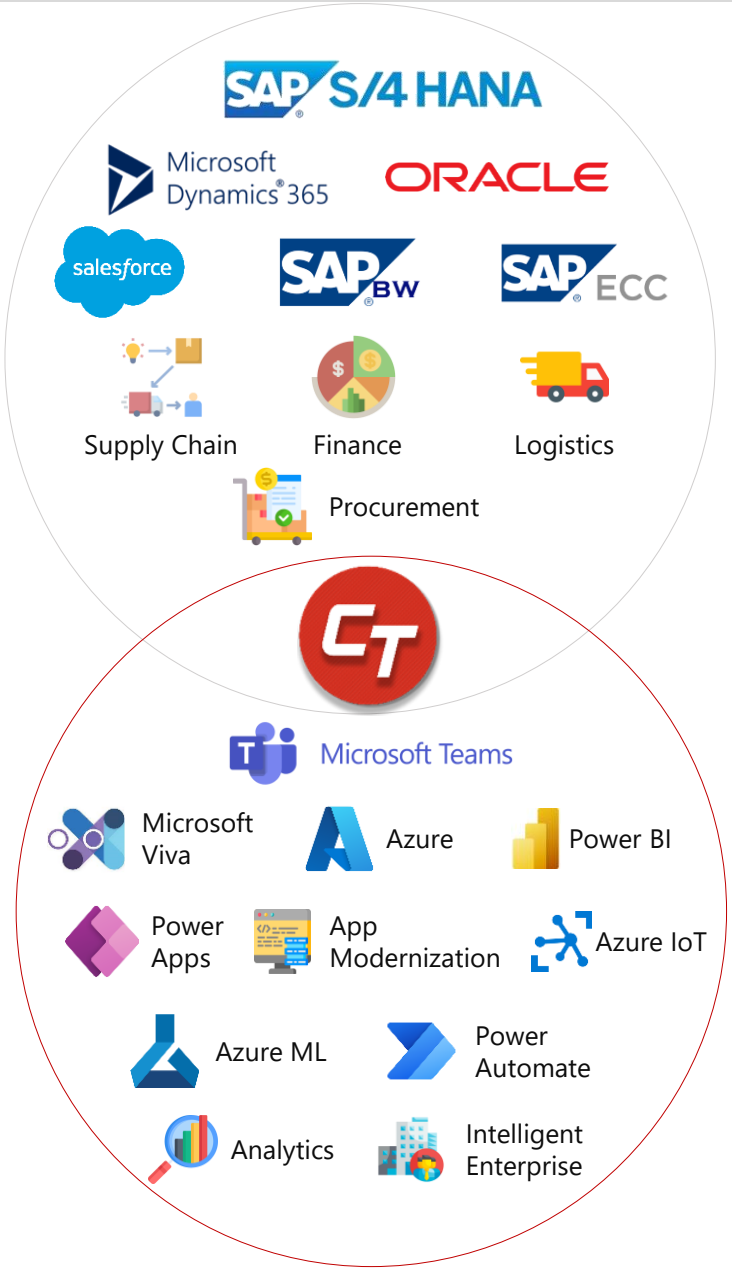

2021 Microsoft Winner Country Partner of the Year India

1800+ Employees

720+ Azure Certifications

Advanced Specialization

- AI & Machine Learning
- Analytics
- Windows & SQL server migration
- Kubernetes

Global Presence

US, Canada, UK/Europe,
Asia Pacific, India, Latin America

databricks Regional System Integration Partner of the Year - 2021

The Economic Times Channel Icon Summit & Awards

Economic Times
Best Independent Software Vendor

Leadership

Anirudh Kala
CEO & Co-founder

Anupam Gupta
Co-founder, Head Corporate Strategy

Dinesh Thawani
Chief Technology Officer

Abhishek Goyal
Solutions Sales Principal

Piyush Gupta
Global Head, ERP Modernization Practice

Srinivas Satyanarayana
BFSI Practice Lead

Anish Ashirgade
Head Celebal Tech. Singapore

Mukul Biswas
Head Celebal Tech. UK

Our customers

CELEBAL TECHNOLOGIES

BFSI

ICICI Bank
SBI MUTUAL FUND
AXIS BANK
ADITYA BIRLA CAPITAL
AU SMALL FINANCE BANK
BAJAJ FINSERV
HDFC BANK
NCDEX
YES BANK
SBI
RELIANCE GENERAL INSURANCE
RBL BANK
BHARAT Financial Inclusion Ltd
IndusInd Bank

Manufacturing

ITC Limited
EUREKA FORBES Your friend for life
Pidilite
EXIDE
Mahindra
Johnson Controls
FEV
Syngene
LT Foods
asianpaints
MARUTI SUZUKI
ROYAL ENFIELD
Godrej
Coromandel FUTURE POSITIVE
ADITYA BIRLA GRASIM
CAIRN WE FUEL AMAZING
TATA TATA CONSUMER PRODUCTS LIMITED
TVS
ADITYA BIRLA GROUP

Retail

Coromandel
STARBUCKS COFFEE
TATA CONSUMER PRODUCTS
TATA DIGITAL
TITAN COMPANY
ADITYA BIRLA FASHION & RETAIL

Realty

KALPA-TARU
Sime Darby

Telecom/Media

viacom 18
TATA sky
voot
SINGAPORE SPORTS HUB
indus TOWERS
TATA
TATA COMMUNICATIONS

ITES

DRB Systems
genpact
servicenow
SUTHERLAND
Tech Mahindra
GINESYS RETELLING RETAIL
eTeam
firstsource
virtusa

Logistics

vedanta transforming elements VEDANTA LIMITED
Grab

Energy/Utility

ReNew POWER
adani
THERMAX
IndianOil
SB Energy
CAIRN WE FUEL AMAZING

Government

Government of Rajasthan
Madhya Pradesh Agency For Promotion of Information Technology
NIC National Informatics Centre

Unicorn/E-Commerce

rentomojo
INMOBI
udaan
indiamart

Pharma

CADILA PHARMACEUTICALS LIMITED
svaas
Dr.Reddy's
Piramal
Biocon
DKSH
ADVANZ PHARMA
accord The Evolution of Generics

Education

POORNIMA GROUP

Advisory

Deloitte.
EY Building a better working world
ITC INFOTECH Business-friendly Solutions
FLUENTGRID seamless digital transformation

About Emergent Ventures (EVI)

Sustainable Solutions for the Planet

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Climate | **Sustainability** | **Renewable Energy**

EVI is a leading full-service consultancy for Climate Change Management, Sustainability, and Clean Energy (Solar, Wind, Hybrids). Headquartered in India, we have a global service delivery footprint across 28+ countries since 2004, serving some of the largest corporates, development banks, governments, think tanks, technology companies etc. Mitigated 150 Mn T of Co2 equivalent

Renewable Energy

	Project Design	Equipment Selection	Construction & Installation	Asset Management (O&M)	Repowering & Upgrades
1	Project Design	Energy Yield Assessment	Cost & Financial Evaluation	Basic Engineering	ESG Assessment
2	Vendor Contracting	Bidding Document Preparation	Bid Evaluation	Vendor Selection	Contracting
3	Project Management	Design Review	Quality Assurance	Pre & Post Commissioning Tests	Construction Supervision and compliance
4	Post Implementation Support	Monitoring O&M	Periodic Plant Audits	EoC Warranty Assessment	Operation & Maintenance

360°

3 Layer Structure

Use Of Drone

Use of Proprietary Analytics Tool

Quick Turn Around

RE policy & programs development

Technical services:

- Resource Assessment of 200 GW+
- Technical Due Diligence
- Lender Engineering Services
- Performance Audits and Improvement Plans
- Project Management Services
- Quality Assurance
- O&M management

Technologies:

- Wind, Solar, Hybrids, Off-Shore Wind Biofuels, Bioenergy, Waste-to-energy
- Pioneer in wind-solar hybrid solutions,

18 GW+ RE Capacity Supported

How can Tech Support RE Ops?

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Flexibility & Ease Of Viewing Data Output

SCADA auto-updates

- Compare performance across years,
- Compare against irradiation data across years, or
- Compare data from different sites

Live Tracking Component Level Health

Declining component performance can go unnoticed

- Tracking component parameter trends to predict breakdowns/degradation
- Avoid breakdowns, maintain data for warranties

Forecasting and Scheduling

Minimizing grid penalties related to scheduling

- Well-tracked and proactive management of scheduling can reduce penalties significantly
- Scenario Analysis of Plant Performance

Reliable Loss Analysis

Live-updating point-wise Loss analysis is critical for improving generation

Better control on on-site activities

How to track Activities of O&M Vendors and staff

- O&M Vendor/staff reports are not automated, leading to inaccurate capture of anomalous plant operations.
- O&M activities need smart task allocation and management. Delays lead to losses.

Monitoring Periodic Maintenance Actions

RE Generation is directly related to effective preventive maintenance actions taken periodically (e.g. module cleaning for solar)

- Need a digital platform to track preventive actions and the effectiveness of actions on plant performance.

Internal Grid Health And Up-Time

Grid Downtime results in large generation losses. Internal grid down-time is avoidable and should be tracked

Spares Inventory Optimization

Early warning and optimized spares management can reduce downtime-related generation loss with optimal inventories

Digitization & Automation Can Address Several Pain Points In RE Operations

Celebal Tech : Emergent Ventures - Energy Team

Anirudh Kala

Co-founder, Director, Chief Data Scientist

Vinod Kala

Founder, Director, Emergent Ventures

Nikhilesh Singh

Managing Director, WindForce- Wind Services

Abhinav Chawla

APAC Sales Lead

Pramod Pattar

Delivery Manager

Tushar Mittal

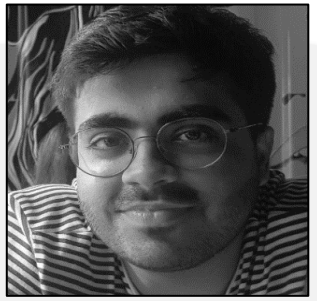
Azure Practice Lead

Bharat Singh

Data & AI Lead

Rohan Saini

AR/VR Lead



Mayank Jhamb

IOT Lead

Forecasting

Forecasting

Future Scope

Phase 1

Supply

- High accuracy of generation forecast using Microsoft DeepMC Algorithm Framework
- Model: Autoencoder LSTM, SARIMAX, Prophet, SES, DES and Tree based regression models

Ability to model weather events (rains, storms, snowfall, etc.)

Optimize forecast based on deviation penalties and options for surplus sale. Scenario tools.

Phase 2

Demand

- Forecasting of customer demands, based on customer operation data, weather data, seasonality data, and any other suitable parameters.
- Predicting the performance of meeting demand

Phase 3

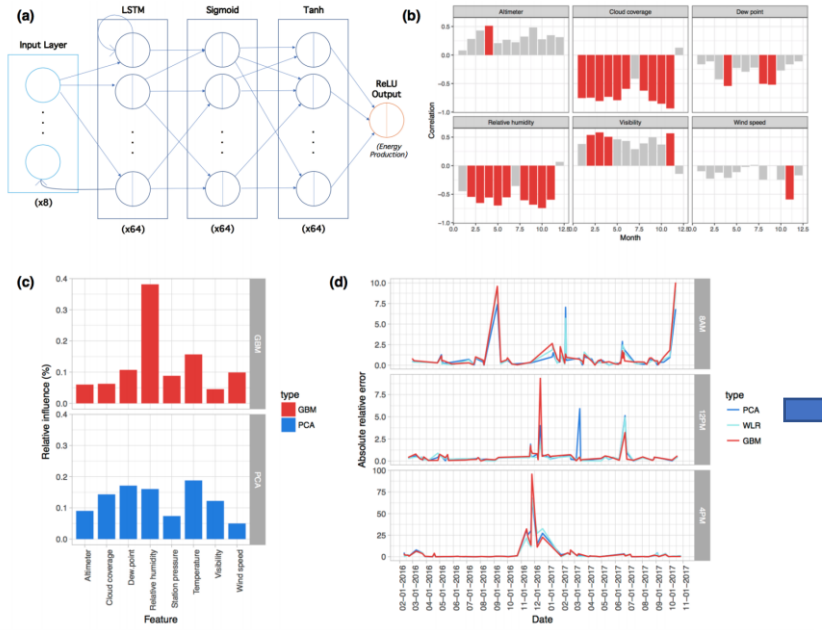
Management of Demand & Supply balance

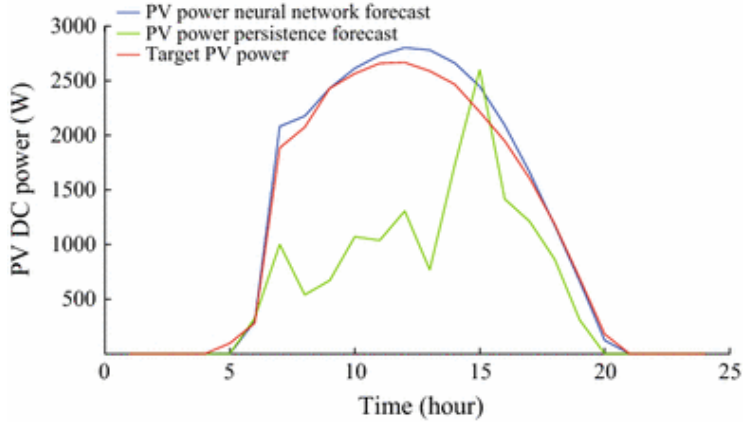
- Forecast of surplus, deficits and decision support for optimized actions:
  - Sourcing from Exchange's
  - Long-term- short-term sourcing from third parties
  - Resource capacities (energy storage, generation capacities)
- Scenarios of revenues, penalties, costs to support optimization of contract conditions, planning of capacities and choice of customers

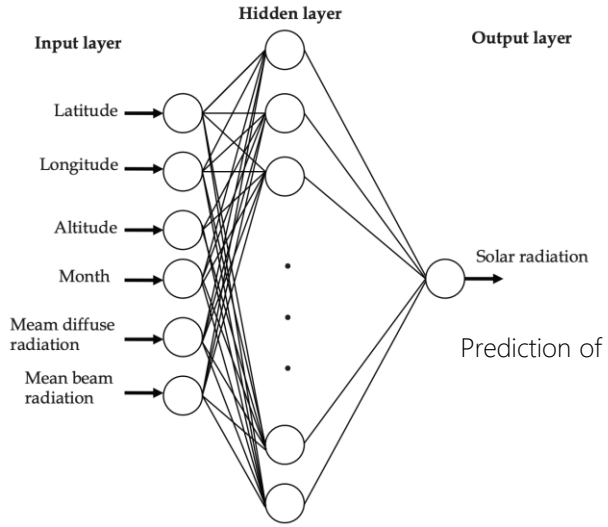
Generation Forecast

Solar Station Parameters

- Global horizontal irradiance (GHI)
- Direct normal irradiance (DNI)
- Diffuse horizontal irradiance (DHI)
- Diffuse solar irradiance (Diffuse)
- Downward infrared irradiance (Terrestrial)
- Solar Zenith Angle (Zenith)
- Air Temperature
- Wet Bulb Temperature
- Dew Point
- Relative Humidity
- Wind Speed and Direction
- Precipitation
- Mean Sea Level (MSL) Atmospheric Pressure
- QNH Barometer Pressure
- Station Level
- Visibility
- Losses at the string level, inverter level
- Scada Data info
- Cloud cover



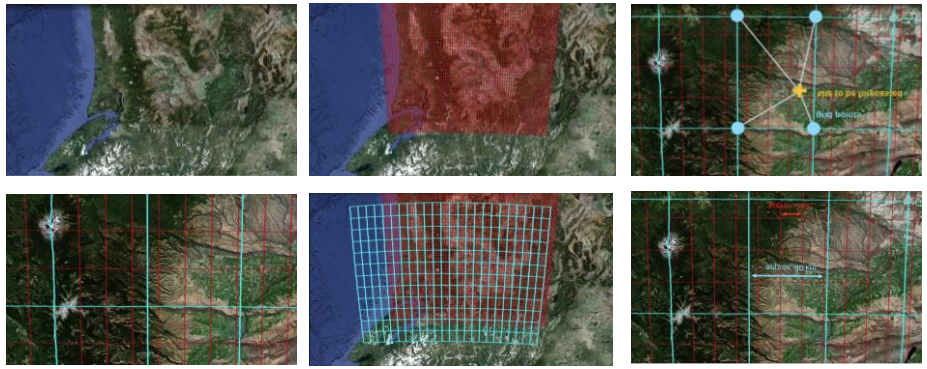




Prediction of irradiance at the Lat Long level

Forecast improvement due to the intelligent model combination!

Weather Data

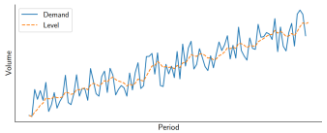


Different Input Sources – NWPs, Online

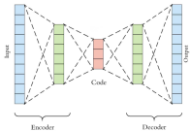
SCADA

OpenWeather

Forecasting Algorithm Framework



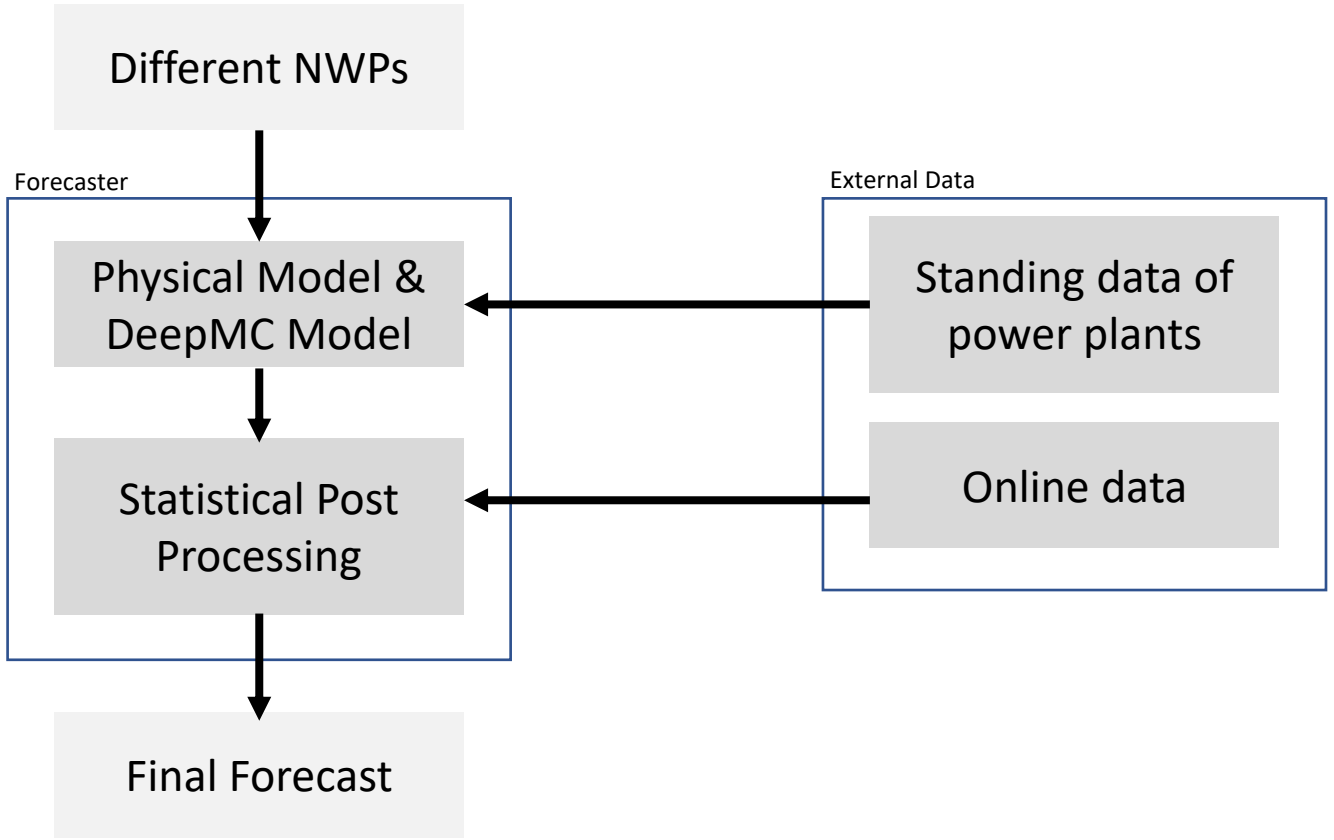
SES, DES, TES

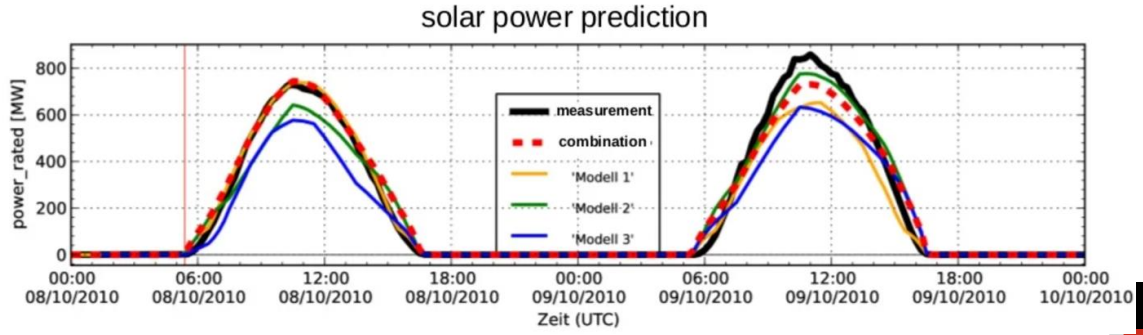


Auto Encoder
LSTM

PROPHET

FBProphet





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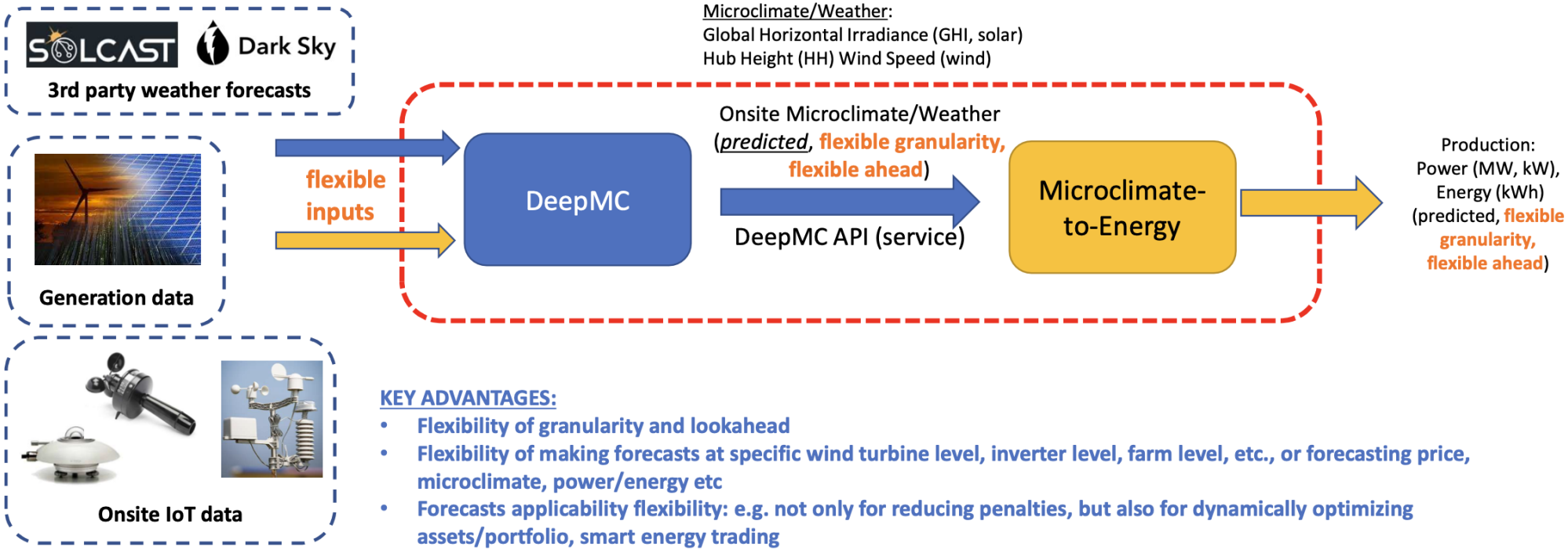
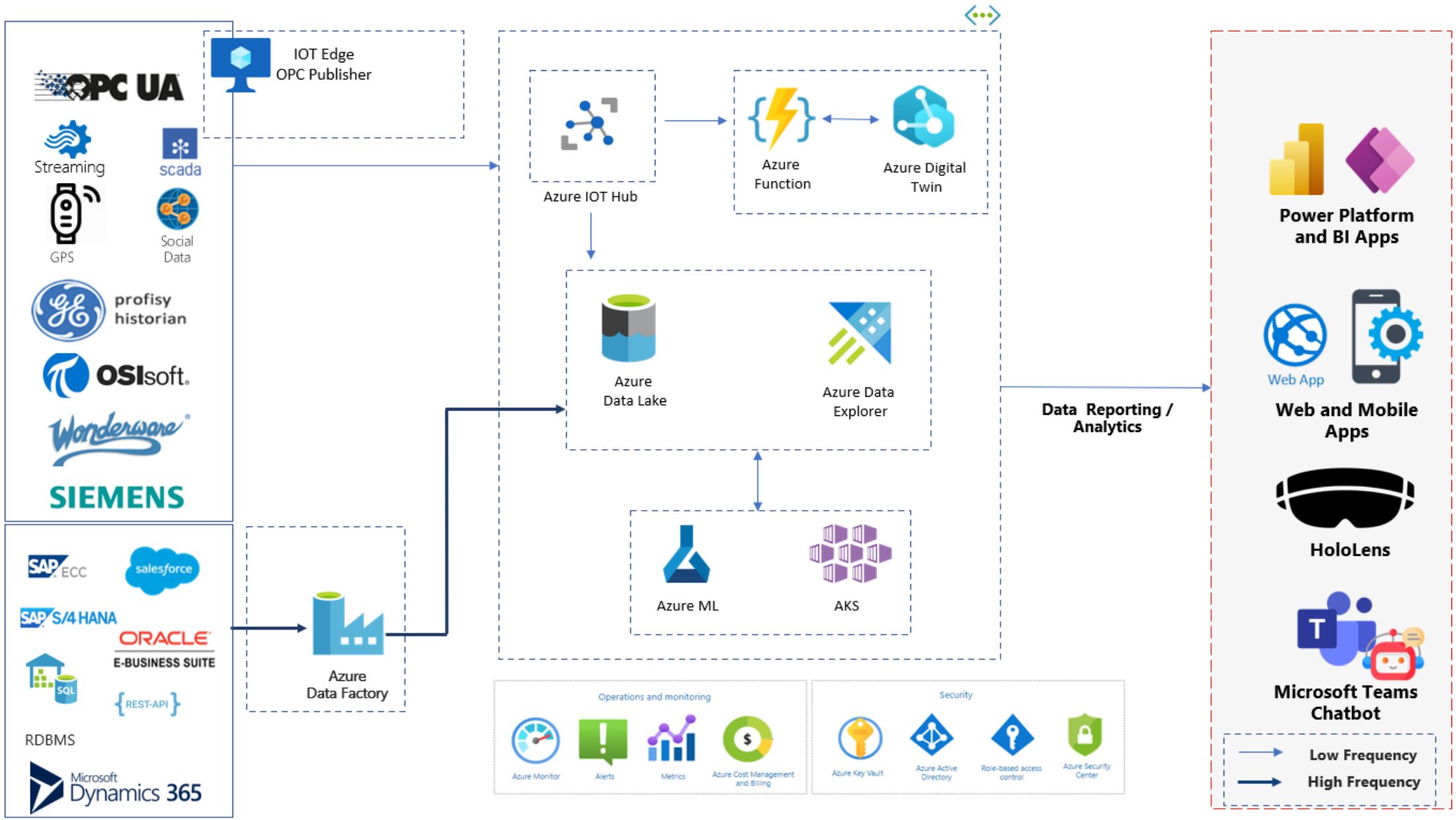
Forecasting: *Accurate, Flexible, Scalable* Foundation to Support Many Applications



KEY ADVANTAGES:

- **Flexibility of granularity and lookahead**
- **Flexibility of making forecasts at specific wind turbine level, inverter level, farm level, etc., or forecasting price, microclimate, power/energy etc**
- **Forecasts applicability flexibility: e.g. not only for reducing penalties, but also for dynamically optimizing assets/portfolio, smart energy trading**
- **On request retraining**
- **Flexibility in inputs (and in ensembling / fusing with in-house AI models, or climate models)**
- **Extensible to Demand Forecasting, Price Forecasting (or any time-series / IoT parameter of interest)**

Reference Architecture



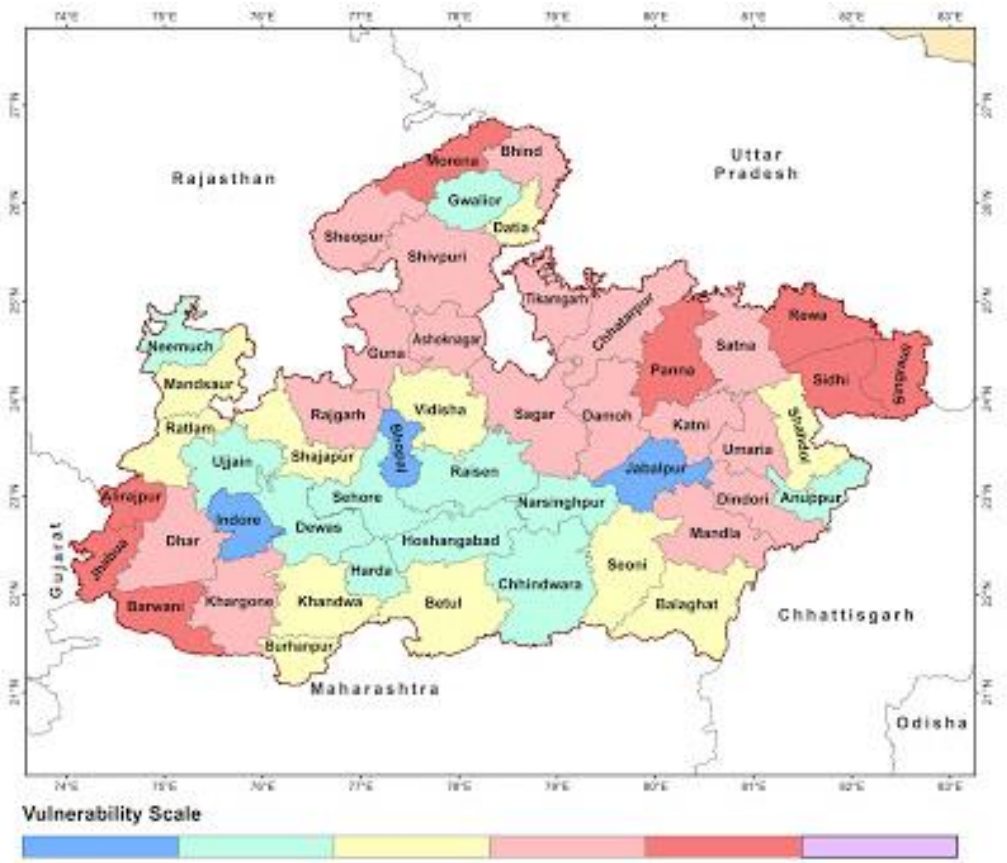
Demand Forecast - Renewable

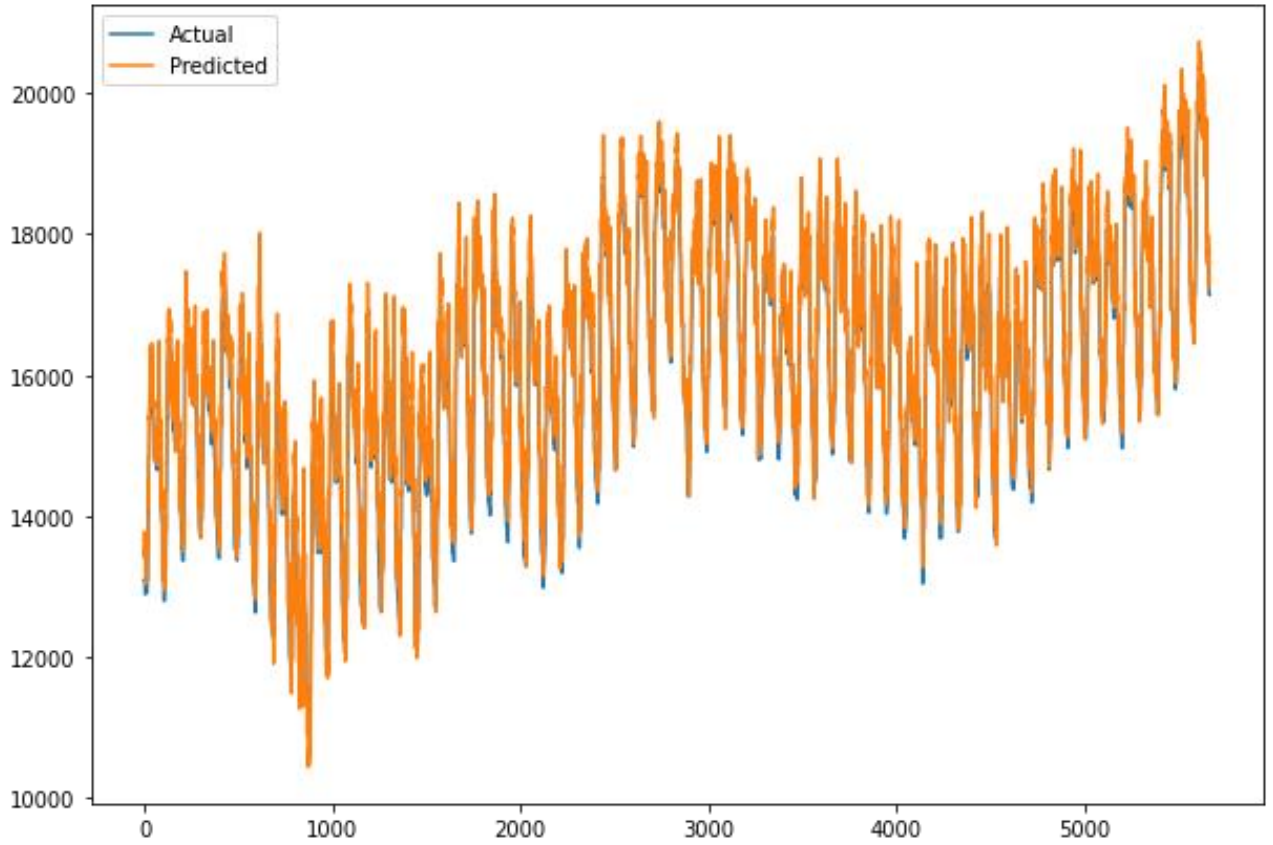
Forecast demand from all beneficiaries for one of the Customer's plants on a short and long timeline. This will include predicting the generation at the various Renew, Hydro, and Thermal Plants for those states and as per the merit order, customer will provide the energy basis the demand.

A model can predict energy demand from beneficiaries on 15 minutes block level at an R^2 of 0.943 and MAPE of 3%.

- SAP data for historical generation /FO/PO/RSD.
- RLDC WBES website for schedules of both Generators /Buyers
- IEX website for historical Market Clearing Prices and Volumes for each Market Product
- MOD stack of all states from respective states SLDC website /www. MERITINDIA.in website.
- Real-time generation of Customer units from PI data.
- Weather data from the IMD site.
- Historical Actual Demand/Generation from POSOCO/CEA/RPCs
- Boundary conditions like ramp rates, tech min schedules, Normative parameters of Gencos.

Methodology





- Divide the state into a heat map
- At each heat map point/district level find out the variation of Energy consumption wrt to the weather data.
- Find out the weather forecast for the next 7 days for each of those points and then predict the energy using a simple Temporal based learning algorithm like LSTM.
- A different LSTM model would be created for all possible heat map points / Districts etc.
- LSTM will incorporate the heat map-wise behavior as well as the overall general behavior of the state.

ONM

Maintenance

Future Scope

Phase 1

Predictive Maintenance

- Predictive maintenance of equipment
  - Fault diagnostic, Fault Prediction, RUL Prediction etc.
- Equipment Health Analysis

This analysis platform can support

- Maintenance task allocation to the O&M team
- Early alerts can minimize irreversible degradation and loss of life
- Warranty claims for equipment

Reduced Loss of Plant Performance- long-term as well as short-term

Phase 2

Preventive Maintenance Management

- Automation of Preventive Checklist with a handheld digital tool. Observations can be fed back to the predictive maintenance module
- Real-time Alerting for anomalies while doing the checks
- Smart checks and preventive actions based on data gathered. Experts from a central control room can support this..

Phase 3

Integrated Maintenance Management

- Integration of predictive and preventive maintenance with breakdown maintenance
  - Breakdown analysis; root-causal analysis
  - Maintenance Performance Tracking
    - Correlating maintenance actions with plant performance
    - Performance tracking of O&M vendors/staff
  - Spares management; getting spares in time and preventing production loss

Enhanced Maintenance Practice for a Leading Company in India Using Predictive Analytics

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Business Scenario

- Developing an easily scalable renewable energy solution consisting of different types of predictive analytics use-cases for plant and equipment's such as Pyranometer, Inverter, Transformer and SCB's.
- It requires a great expertise in the field of statistics, deep learning, and significant knowledge of domain. Client was using Scada system to generate data of sensors present at different assets in plant. Power BI reports were reporting tool and Synapse has been used for storing transactional and modelling data.

Solution

- Predictive Analytics of Assets, that include Fault Diagnostics (Anomaly Detection), Fault Classification, Fault Prediction, Probable Reason of Failure/Remaining useful life of Assets.
- Generation-portfolio management and Power modelling that include Expected Generation, Losses Analysis, Performance of Plot Month on Month and Day wise Analysis.
- To deploy 1500MW Plots across different locations of India, currently we are using 20 containers with 300 collections and 15000 RU's in Cosmos DB

Impact

- Improve performance and reliability.
- Cost reduction by optimizing resource allocation on the assets that matter most.
- Transform network data into a condition-based asset-management strategy driven by the health and criticality of a utility's assets.
- Proprietary power modeling tools evaluating policy, energy trends, and forecasts for scenario analysis.
- 80%+ accuracy over failure and anomaly prediction for all the equipment's.

Use cases in Solar Plant

Features

Prediction

- Energy Forecasting
- Energy Generation Forecast for Solar/ Wind Power Plants.
- Load Forecasting
- Demand prediction for C&I customers.

Performance

- Plant efficiency analytics
- Plant level efficiency and factor affecting efficiency.
- Safely performance analytics
- Identification of over heating of Solar equipment/wind turbines to avoid fire risk.

Characteristics

Predictions

Predicting Next 5 days Weather, Expected generation, Temp, Rainfall, Humidity, Windspeed

Loss Distribution

Monitoring different type of loss distributions includes Soil, PR, Temperature loss

Plant Performance

Plant performance is measured by Capacity Utilization Factor(CUF), Performance Ratio(PR), Grid Availability.

Month Wise Loss Distribution

Loss Distribution month wise for above parameter (as KPI) to find out reasons and patterns for different types of losses

Month Wise Plant Performance

Plant performance measured for above parameters month wise to minimize losses and maximize generation

Use cases in Inverter – Celebal Tech prebuilt offerings

Features

Prediction

- Measurement Uncertainty of AC & DC side
- Anomaly detection of DC & AC parameter.
- Fault Prediction of inverter
- Prediction of Inverter Tripping
- IGBT Thermal Analysis
- Identify reason of overheat and early warning of IGBT failures.

Performance

- Equipment Efficiency
- Calculation of Inverter Efficiency
- Performance degradation
- Identify the performance degradation & its cause

Characteristics

Fault Diagnostics

- Identify abnormal event based on Current, Voltage.
- Count of abnormal event in last 'N timeframe.

(Ex 3 anomalies based on current, voltage in last 24hrs)

Probable Reason of Failure

Predicting the reason of failure.

- Over Temp. fault.
- Hardware over current fault.
- Drive failure fault.
- Over current Fault

Prediction

Prediction of Inverter Tripping in advance

- 1 day
- 7 day

Inverter Health Score

Calculate remaining useful life of Inverter

- X min remaining before any type of failure

(Ex: 10000 min , means there are chances of failure after 1000 min)

Comparative Analysis

Deviation (in hours) for all Inverters in ICR
(Deviation is calculated by model from actual o/p to predicted o/p, in ideal scenario deviation will be 0)

Scope- Predictive Maintenance ML Modeling

- Obtaining structured and unstructured data from the given storage system.
- Processing the training data using normalization techniques like Log Transformation, Min-Max Transformation, etc.
- Training the different Models on the ingested Data as per the different problem statements (Anomaly Detection, Downtime Prediction) and improving the performance further.
- Evaluating and tuning the model.
- Deploying this model to Azure Container services.
- Creating Power BI Dashboard for the end user for overview and controls.
- Implementation of Role Based Access Control in Dashboard controls.
- Some of ML Models for Predictive Analytics:
    - Time-stamp of next downtime
    - Duration of next downtime
    - Fault Classification
    - Anomalist behavior of parameters for downtime of sites
    - Next Timestamp for Preventive Maintenance etc.

Digital Twin
Remote Monitoring/Simulation

Remote Monitoring & Simulation- Digital Twin

Demo

OEM Case Study – Remote Monitoring, CBM Platform

Business Challenges

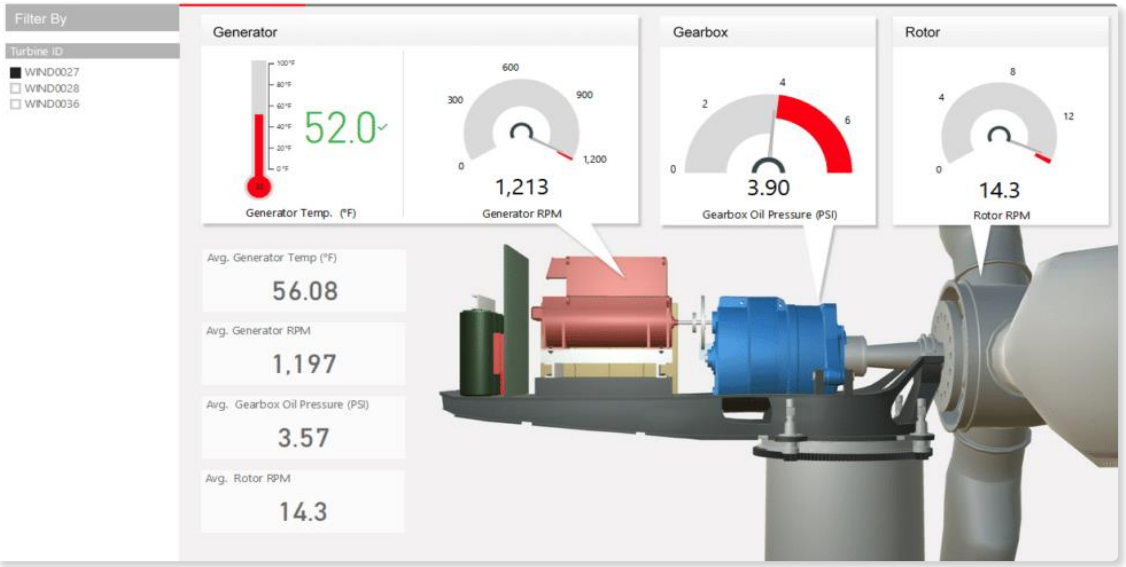
- Data streams generated from 100+ plant components.
- Accessing the data from these components requires a physical presence on the plant, as data is not allowed outside the plant network.
- There was no real time streaming to generate deep analytics from these data streams.
- Additionally, there were no dashboards at an aggregated layer from data across disparate data sources.
- Any use-case deployed on a plant specific data stream cannot be scaled upon as a solution for other geographies.

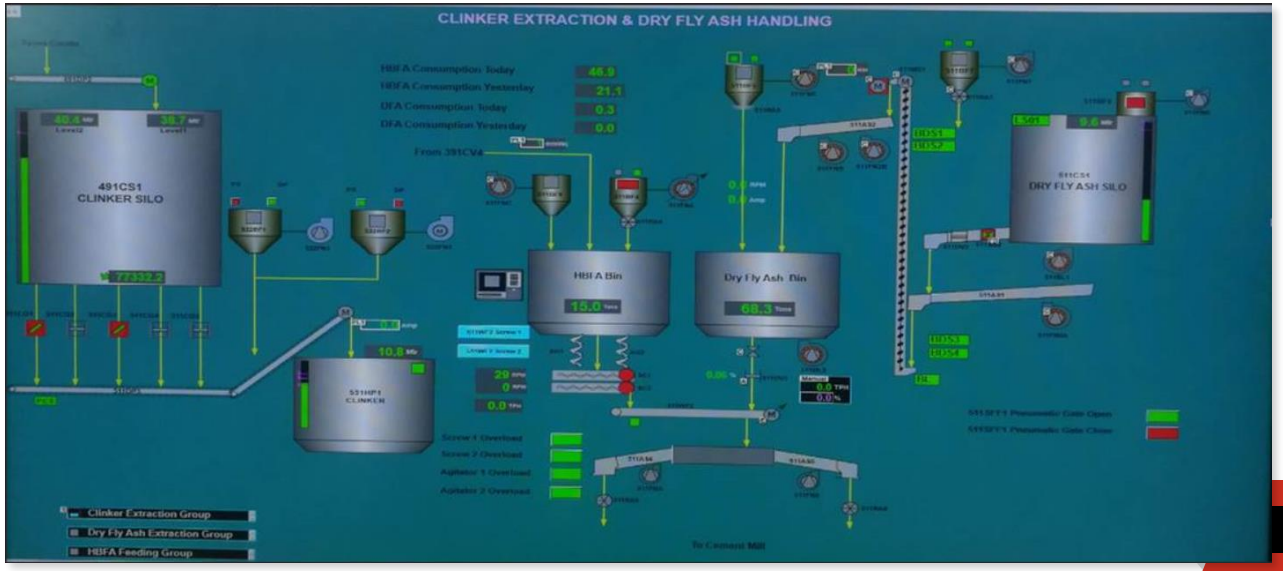
Solution

- Built and deployed a centralized UI, to display aggregated data from all 100+ plant components. All data streams were integrated with Azure Landscape using IoT Hubs.
- All data streams aggregated data to a single database system, hence allowing other users/applications to be able to cater their data needs from a centralized system, using role-based access control to create an identity driven secure landscape.
- Central control panel to observe all plant components at one place, detect anomalies, create predictions, prescribe actions.

Impacts

- Created a robust landscape to allow all created solutions to be scalable across multiple plants irrespective of the regions.
- The solution allows users to be able to access data streams from different geographies without being present on-prem.
- Using proper alerting system, any data driven anomaly detected provides efficient decision-making.
- Created solution allows integration with on-prem plant components and will enable the user to govern the components from the UI itself.





24x7 Renewable

24x7 Renewables

Future Scope

Phase 1 A — **Phase 1 B** — **Phase 2**

24x7/ RTC Contracting

- Performance modelling
  - Required resource mix (generation capacities, generation performance, energy storage)
    - Matching with demand-pattern of the customer
    - Modelling of contract fulfilment, revenues, costs, penalties, investments etc.
  - Help define acceptable or optimal contract conditions

24x7/ RTC Supply Management

Dynamic forecast for supply surpluses and deficits, based on plant conditions, weather, client demand, energy price models etc.

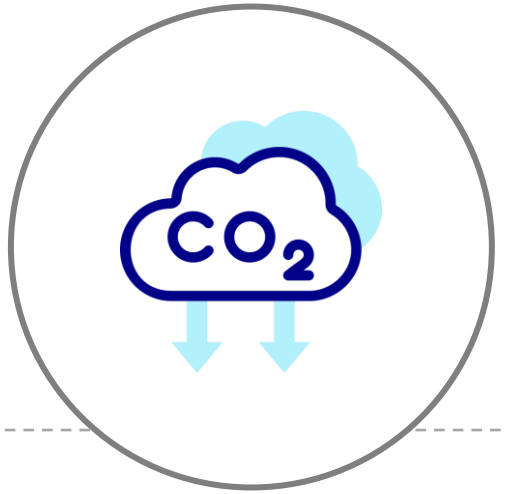
- Placement of surplus power on exchanges/ customers (Day Ahead, Term Ahead)
- Procurement of additional power (exchanges, others)
- Maintenance actions to support value optimization

24x7/ RTC supply Optimizations

- Decision. Support System for Optimized actions. Scenario, simulation tools
  - Sourcing of power – exchanges, short-term/long-term Contract with third parties, based on prices, availability
  - Choice of additional short-term customers to get flexibility
  - Additional resource capacities (e.g. RE Capacity energy storage)

Sustainability

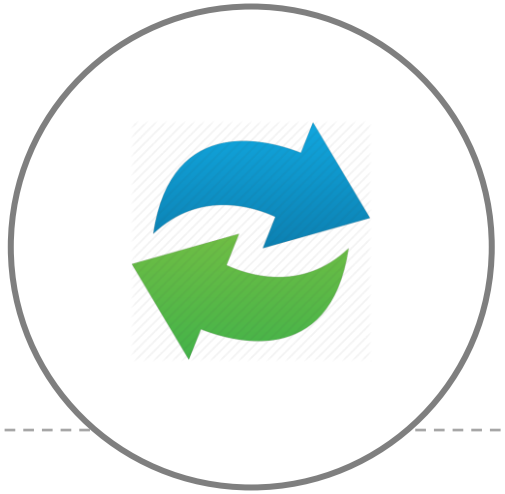
What is Net Zero?



Net Zero is supposed to be achieved when Green House Gas (GHG) emission measured in terms of CO2 equivalent are balanced by 'removals' in terms of CO2 equivalent, in a defined time period, normally a year

Net zero would mean :

- Making the operation's energy efficient
- Shifting to renewable energy
- Capturing carbon through technologies such as CCUS & natural sinks like plantation



Balanced emissions if any left can be offset by buying credits

Net Zero Strategies- Generic Framework

Emissions

3	**SCOPE-3** Indirect emissions caused in the 'supply chain' or 'value chain' (beyond the boundary of the operation)	**Reduction**	• Energy efficiency • Material efficiency
		Green Substitution	• Shift to zero emission electrical power (renewables) or thermal power (i.e., green hydrogen) • Use of green materials
2	**SCOPE-2** Emissions caused by the procured energy (electrical, thermal)	**Removal**	• Carbon sequestration (chemical, geological). • Natural sink- afforestation, oceans
1	**SCOPE-1** Emissions from operation of owned or controlled assets (stationary or mobile)	**Offset**	• 'Removal' or 'Reduction'. • By external agents

It is useful to define Scope – ideally, all 3 scopes should be covered but corporates often take up scope-1/scope-2 as they are under direct corporate control.

Inclusion of Scopes

SCOPE-1

Emissions in all owned/controlled assets of an entity

- Stationary assets (e.g., Plants, Offices, Warehouses…)
- Mobile Assets (Vehicles)

Process Emissions (emissions from materials other then fuels/energy in a process)

Fugitive emissions (e.g., HFCs having GHG potential leaking from refrigeration/air-conditioning) equipment

Emissions from own generated electricity sold to customers

SCOPE-2

Emissions outside the boundaries of the organization, linked to purchased energy

- Electrical Energy
- Thermal Energy (steam cooling, heating)

Emissions from fuels burnt for production of such energy are considered here.

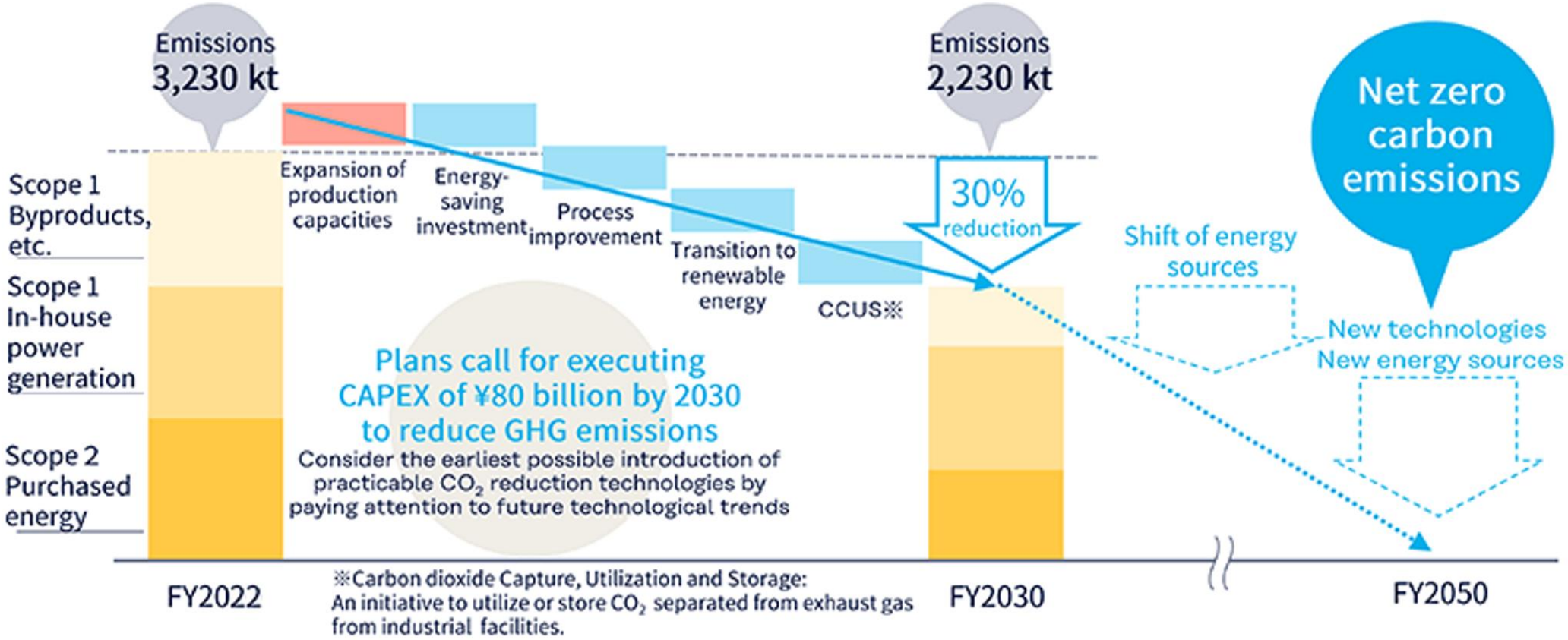
SCOPE-3

Emissions not directly controlled by the entity

- Purchased materials (cradle to gate) for 'process' or for support (e.g IT, HR)
- Emissions from sale of electricity purchased from third parties
- Emissions from activities upstream of electricity/energy providers
- Business Travel
- Employee commute
- Outbound logistics, warehousing
- Emissions at Franchisees
- Emissions in leased assets our outsourced activities
- Use of products or services(post sale)
- Capital goods used
- End of Life disposal of products , waste

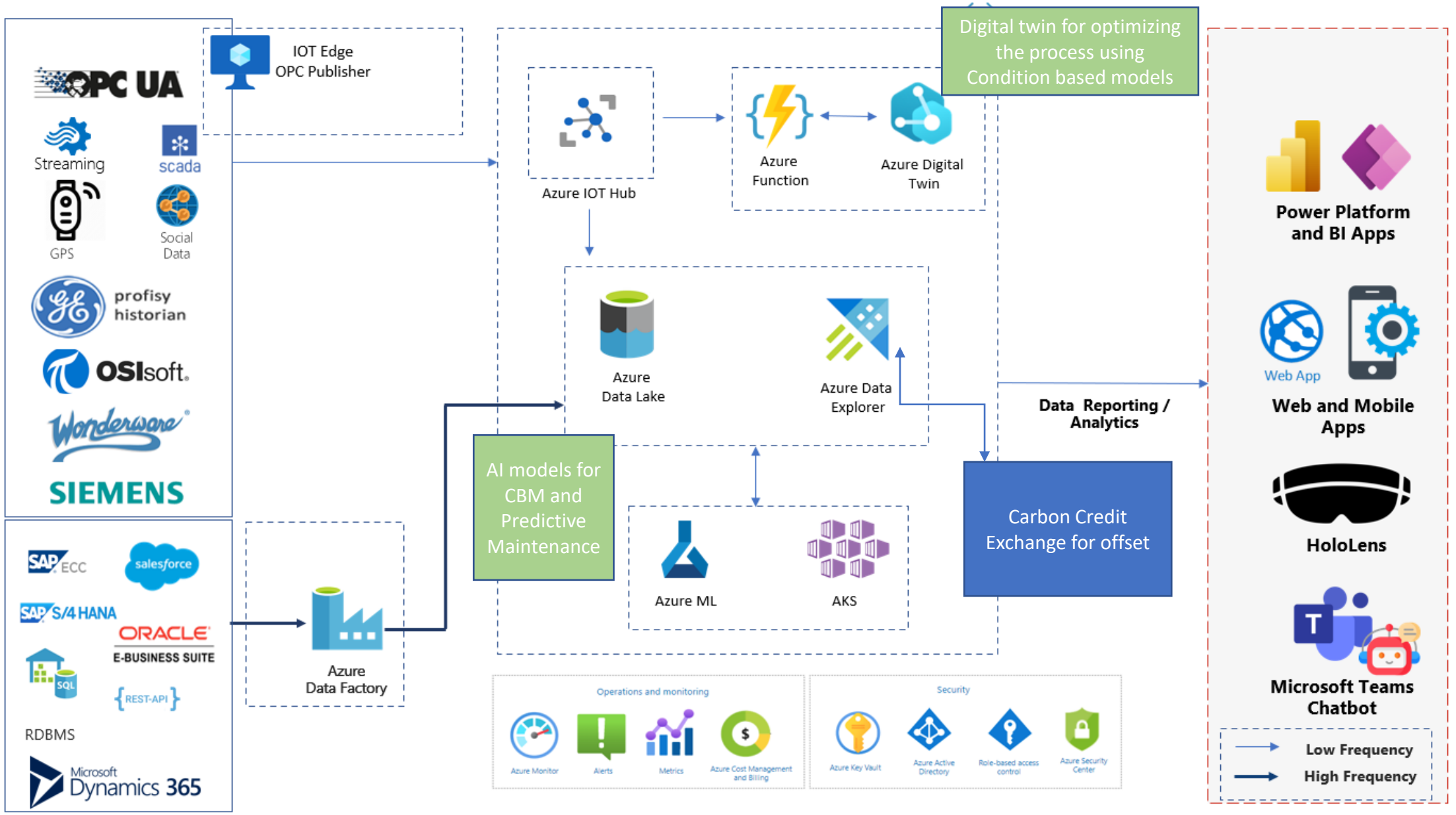
Usually, the analysis is focused on a few large GHG impact activities.

Net Zero Strategies- Generic Framework



Optimize using AI → Offset by carbon trading → Align with Net Zero Gradient

Reference Architecture



Our Approach
Envisaged Solution Designs

CELEBAL
TECHNOLOGIES

Sustainable
Solutions
for the
Planet

Carbon Trading Platform

Deals with all types of credits – CERs, VERs (GS, VERRA, GCC)

Would be extended to other types of environmental credits

Registrations	Trading Platform	Project, ERPA Tracker	Financing
Entity Registrations- buyers, sellers, aggregators	Portfolio presentations to Buyers	Tracks projects from concept stage to issuance stage- entire life cycle*	Development Project- presentation to investors
Project Registrations	Open Bids, Close/limited participation Bids	Transaction on Blockchain- issuance- trade- retire	…. To be introduced later- other green financing structures
	Auctions/ Reverse Auctions	ERPA/ Contract Trackers (Long term, forward purchase) for buyers and Sellers- to track pre and post ERPA conditions, till ERPA is satisfied	

All project related documents can be tracked (PDDs, Validation reports, Verification reports, ESG assessments etc) to a Carbon Credit, apart from transaction history.

Contracts (single transaction, long term) , payments etc. managed through the platform.

Clean Energy Solution - Phase wise approach

Phase 1: Forecasting	Phase 2: ONM	Phase 3: 24x7 renewables	Phase 4: Sustainability
Minimised penalties, Meeting delivery commitments	*Improved PLFs, Improved plant life*	*Optimised revenues, costs, and lower O&M costs*	*Optimising processes for sustainability, carbon prices*
Generation Forecast	Predictive Maintenance (PdM)	Integrated O&M PdM + PvM + BdM	Process Optimisation
Weather Forecast	Digital Twin Simulation	24x7 Demand, Supply & Price Model	Market Operations (Carbon, Energy)
Penalty Analysis-Optimiser	Machine Health Index	Decision Support for Contract and RE Asset Management	Reporting Tool
			Sustainability Projects

Sustainability Manager

Process Optimizer	Energy and Credit Manager	ESG Trakcer	Sustainability Project Manager
Predictive Maintenance of Process - machine health, residual time to fail…	Calculates Off Set Requirements: actual emissions vis-à-vis net zero trajectory	ESG Goals- v/s achievements; facility wise	Tracks Sustainability Projects Undertaken in the community • Impacts • Feedbacks
Process Optimizers - AI/ML/DT used to find optimal process conditions • Minimize Emission/unit of throughput • Minimize Direct Cost+ Emission Cost/unit of throughput.	Bids for Green Energy purchase- exchange, long term contracts	ESG Index – operations, supply chain	
	Buys carbon credits from exchanges- long term contracts	ESG Assessment Reports Sustainability Reports	

Sustainability Manager- Functionalities

Energy Manager

AI for optimization.
Contract management- Blockchain?

Tracks energy consumption (electricity, fuel, procured/produced in the facility boundaries at all premises)

Calculates energy mix

Based on carbon intensity targets, calculates Credits to be purchased

Organizes fresh bids/offers for green energy/brown energy procurement from Open Access/ Exchanges- includes virtual PPAs.

Buys /sells Credits

Process Optimizer

Digital Twin
VR
AI/ML

Captures process operational data

- Quality
- Output
- Process conditions
- Material Conditions
- Fuel consumptions
- Electricity consumptions
- Environmental conditions (temp, humidity, precipitation……)
- Water consumption
- Est emission levels
- Waste generation (solid, air, liquid)
- Waste disposal

Using AI Optimizes Process Conditions for best production ; fuel consumption; energy consumption; pollution levels (indexed)

Process/machine health-index
Maintenance module- BD, Predictive, Preventive

Impact Tracker

Facility ratings
- Internal v/s external benchmarks; v/s commitments

Facility wise

Energy Consumed/unit output

Water consumed/unit output

Waste generated/unit output

- Solid
- Liquid
- Air
- Other gases

Green Mix of energy consumed

ESG index of the company/Facility

Supplier – ESG (index- e.g IFCPS)- FDCO- DFID tool

Transformative/pioneering sustainability innovation (ESG)

Sustainability Maturity Levels?

Sustainability Project Manager

Tracking news (AI)
Tracking Projects

Facility wise

Projects undertaken

- Investments
- Governance
- Goals
- Achievements
- Videos
- Annual reports

Surveys/feedback received from the community

Reports in the external world

Sustainability Reporting Tool

Prepare Sustainability Report

The Digital Asset Management Platform and its Value Proposition

Value Propositions

Impacts: ● High ● Moderate ● Low

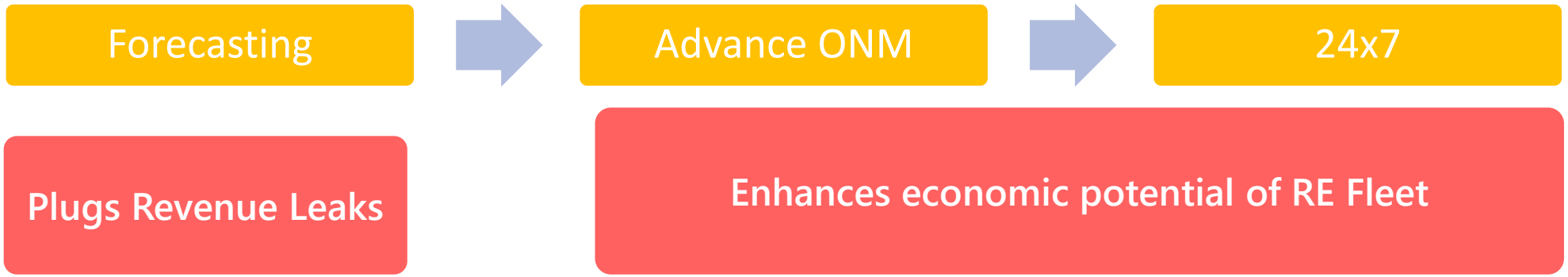
To deliver a strategic mission - A dedicated digital team to Support Initiatives.

Value Propositions	Forecasting	ONM	24x7	Sustainability
Ability to meet emerging forecasting regulation	●		●	
Ability to participate in emerging 24*7 bids	●		●	
Optimizing vis-a-vis Dynamic Pricing (emerging regulations in Malaysia, other regions)	●		●	
Plant RoC's - Create operating and maintenance related decisions		●		
Cost optimization - Operations		●	●	
Improving equipment and overall Plant efficiency		●	●	
Improving PLF and Plant life		●	●	
Revenue maximization & cost optimization	●		●	
Minimizing penalties and delivery commitments	●	●	●	
Scenario analysis - what if scenarios e.g.. storage vs trading, vs capacity enhancements	●		●	
	●	●	●	
Optimizing process for sustainability- improved sustainability scores				●
Monetizing carbon value				●

Utilizing framework developed by MS engineering team as a base model

Monetization

The proposed Digital Asset Management platform immediately impacts 'profitability' as well as prepares the 'foundation for the 'future'



- Reduced penalties {1-5% of sales}; penalties may increase with time
- Improved ability to meet dispatch regulations

- Improved uptime (1-5%) -
- Improved PLF (2%-10% of generation)
- Improves operation costs (5-10% of costs ~1% of sales)
- Improved life- less degradation with time

- Improved revenue realization (~10%+)
- Ability to participate in 24x7 contracts
- Capacity planning (Re+ storage)

Monetization – RE Assets

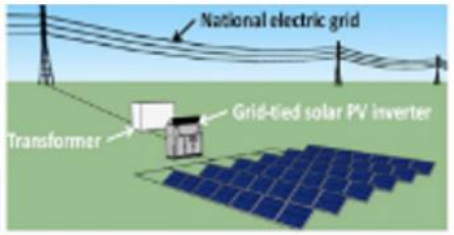
High Operating Leverage for RE assets means small changes in revenue result in large profitability impacts

High CAPEX(~$1B/1GW)

Upfront & Sunk for 25-30 Years
Finance Crucial)
(varies for wind vs solar)

Low OPEX

~1-2% Capex/year (varies for wind vs solar)



Sales

COGS (10%)

Gross Margin (90%)

Fixed SG&A (20%)

Operating Margin (70%)

Fixed: Interest & Depreciation (60%)

Net Margin (10%)

10% **Revenue Uplift=90% increase in net margin** & cash flow

5% **Revenue leakage** (penalties) **= 45% drop in net margin** & cash flow

High Operating leverage
=>
Revenue Upside/downside Risk have big effect on ROCE, Cash flow Profit Margin

Improvement in forecasting & O&M capabilities have a much larger effects on economics

Monetization via Software will be key differentiator


CELEBAL
TECHNOLOGIES
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