AVEVAWORLD
PARIS

Coromandel
FUTURE POSITIVE

murugappa

Harnessing AVEVA Advanced Analytics for Enhanced Quality Control

Powered by CONNECT at Coromandel International Limited

Coromandel
FUTURE POSITIVE

Agenda

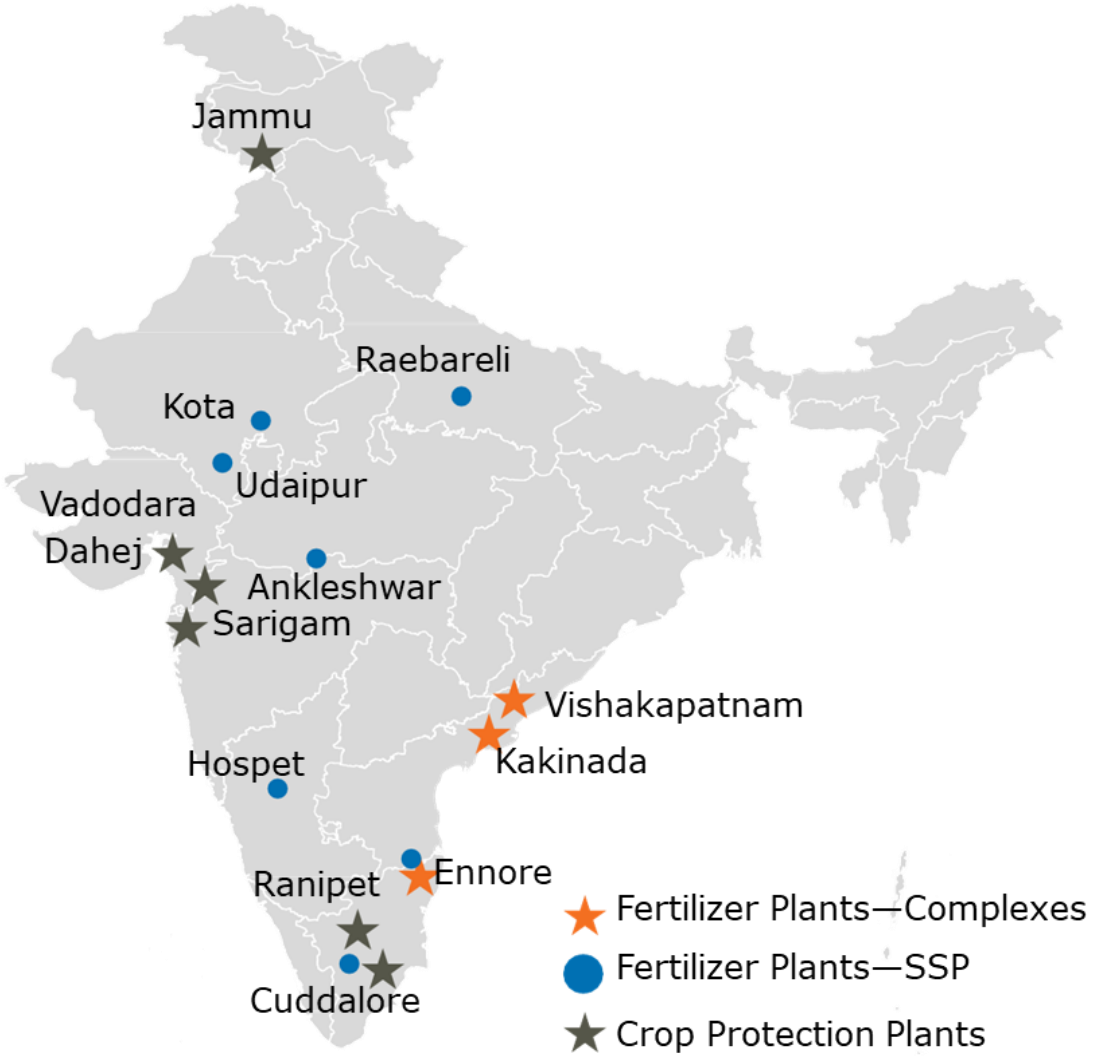
- About Coromandel
- Project Approach
- Use cases Implementation
- Realtime Dashboards
- Benefits

Coromandel
FUTURE POSITIVE

Coromandel Reimagined

Coromandel: India footprint

- India's largest private sector Phosphatic Fertilizer company
- Pioneers & market leaders in Specialty Nutrients
- India's largest Single Super Phosphate (SSP) company
- 5th largest Crop Protection Indian company
- Worlds' largest Neem based Bio pesticide manufacturer
- No. 1 Organic Manure player in India
- Largest Rural Retail Chain in India



- 17 manufacturing locations
- ~750 Retail centres
- ~20,000+ dealers
- Presence across ~81 countries
- ~ 2,000+ strong market development team

Revenue in 2022-23
₹ 29,628 crores

Over 13,650
employees worldwide

Partnering with over
2 crore farmers

murugappa

OUR VISION, MISSION and VALUES

VISION

To be the leader in farm solutions business in geography of choice, consistently delivering superior value to stakeholders through highly engaged employees, with a strong commitment towards sustainability and our values.

MISSION

To enhance prosperity of farmers through quality farm solutions with sustainable value for all stakeholders.

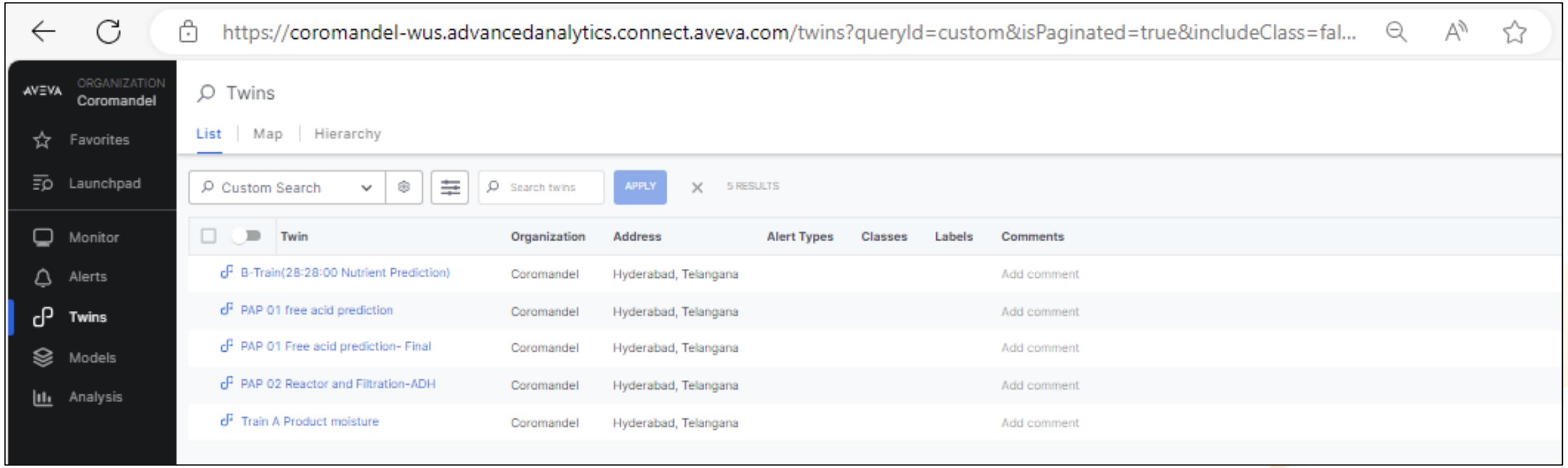
VALUES AND BELIEFS

The fundamental principle of economic activity is that no man you transact with will lose then you shall not.

Coromandel Digitalization Journey

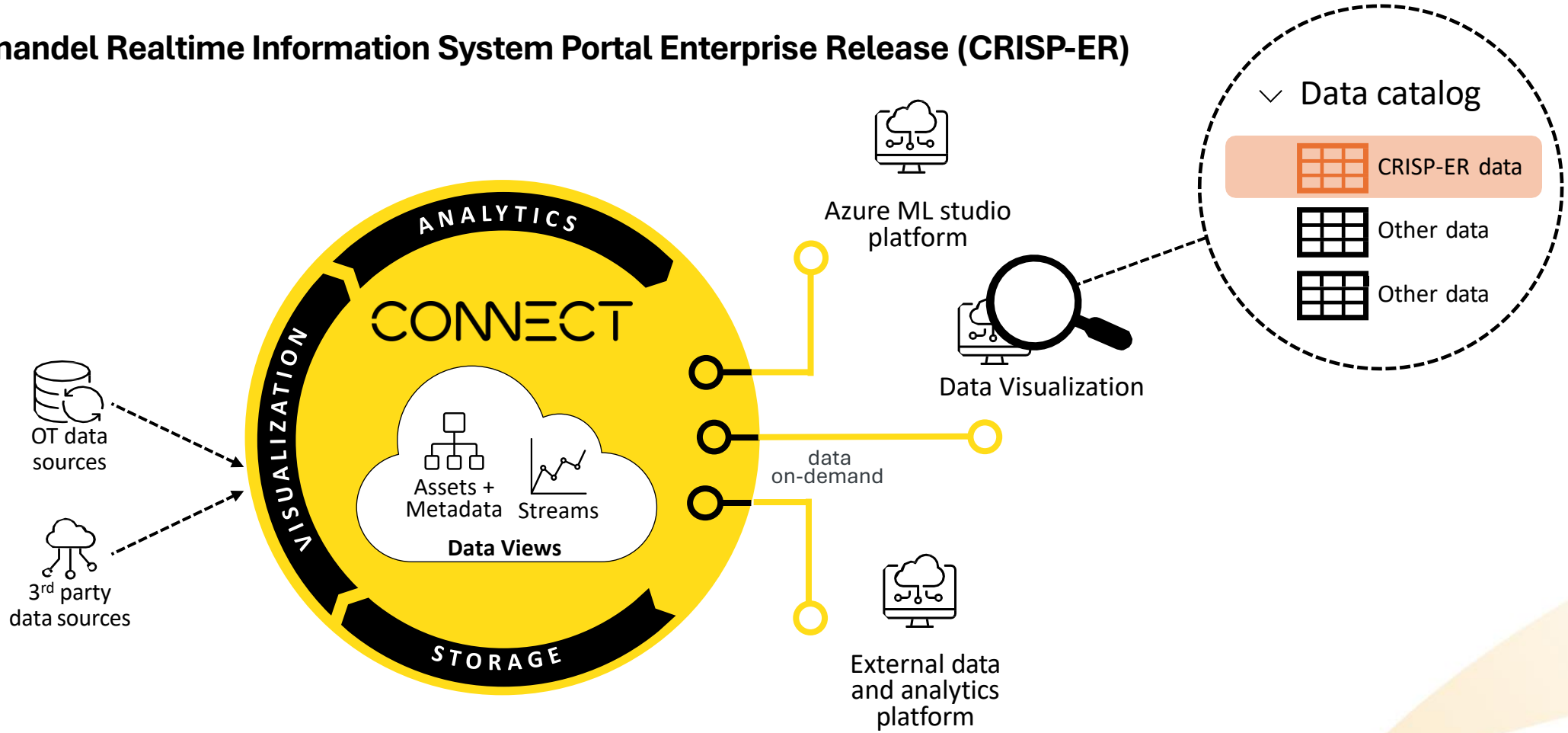
Project Summary:

- Nutrient prediction in 28:28:00 (N:P:K) grade fertilizer at Vizag plant - B train
- Prediction of P2O5 loss in gypsum at Vizag PAP-2
- Free acid prediction in PA reactor to improve rock efficiency
- Evaporator C2 availability improvement



Coromandel Digitalization Journey (OT/IT Integration)

Coromandel Realtime Information System Portal Enterprise Release (CRISP-ER)



Coromandel Digitalization Journey

Coromandel CoE – Centre of Excellence

Analytics COE: Enterprise Workbench

Enterprise Workbench

- Revenue growth
- Profitability
- Market share
- BU wise performance
- Performance of new products
- Farmer connects

Analytics COE: Functional Workbenches

Sourcing Workbench

- Spend analytics
- Compliance analytics
- Price predictions

Production Workbench

- Production schedule optimization
- Sustainability measures

Data Analytics Workbench

- Data analysis on the on-going use cases

Automation Workbench

- Automation projects
- On-going
- Planned projects

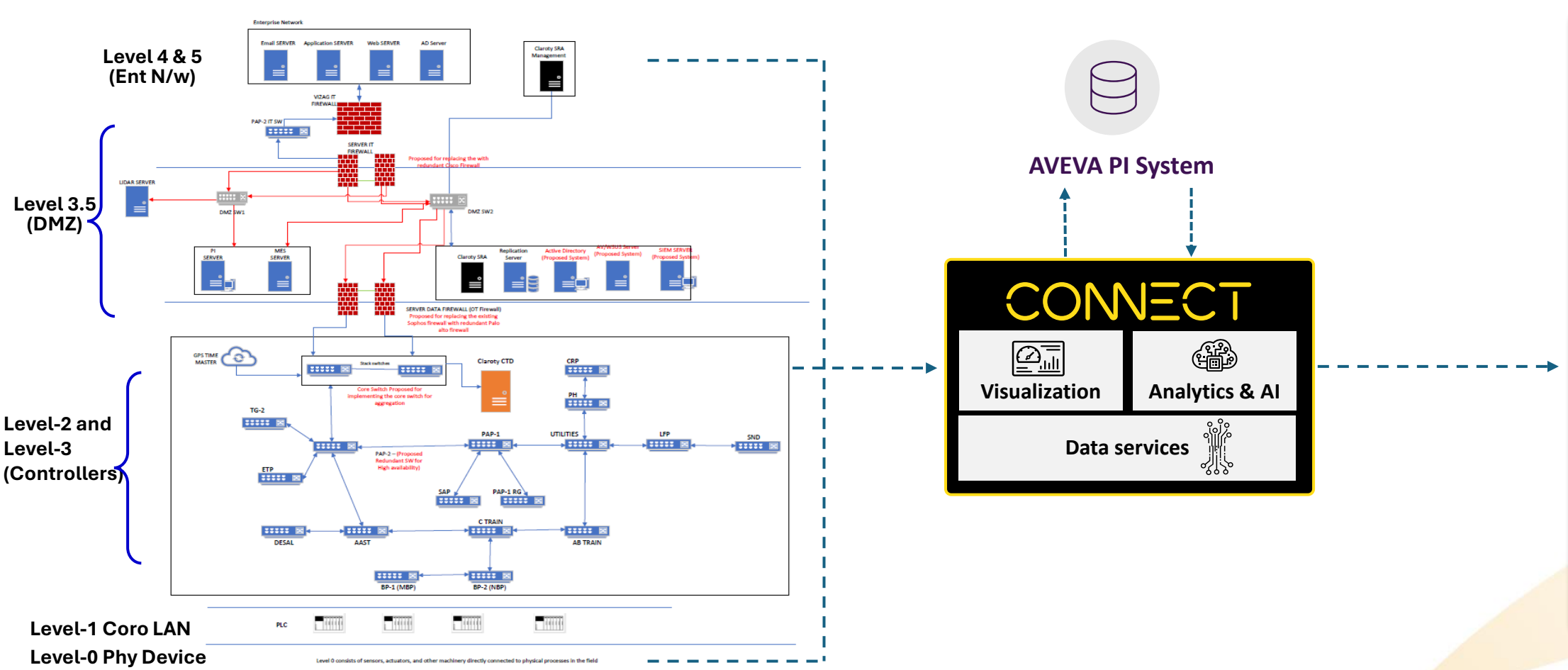
HR Workbench

- Attrition

EMS Workbench

- Over energy distribution
- Deviation analysis

CRISP-ER Architecture



Aveva PI System Implementation across CIL

01

OT – IT Network separation and Creation of DMZ

02

AVEVA™ PI System™ Integration

- Configuration of PI Interfaces
- Data Transition from Interface to PI Server
- Tag Creation

03

Asset Framework Configuration

- AF Hierarchy Creation
- AVEVA™ PI Vision™ Dashboard Creation
- Reports Creation

04

CONNECT

- Connected the data & asset servers with PI to CONNECT Agent.
- Exporting the Asset Framework to CONNECT data services.

05

AVEVA Advanced Analytics

- Projects exported from CONNECT data services to Advanced Analytics.

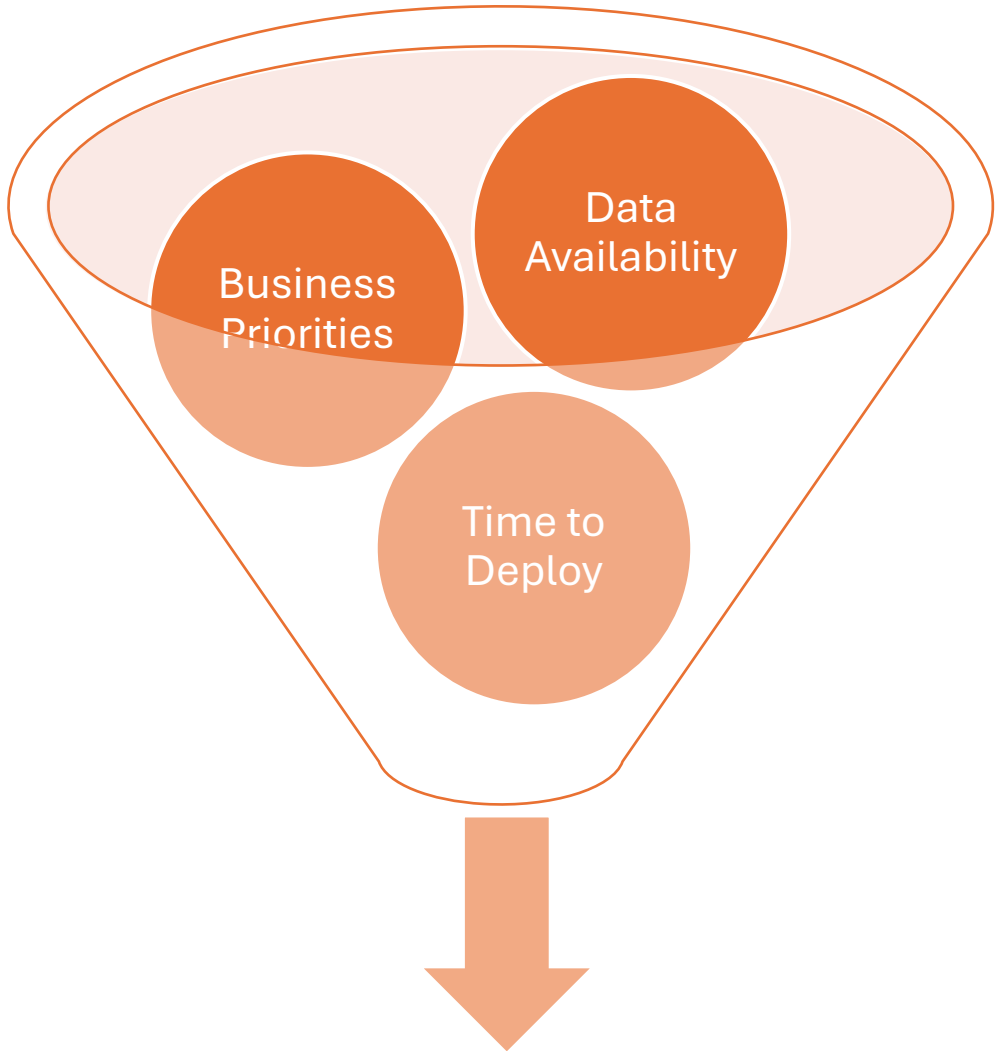
Coromandel Digital Projects selection criteria

Total Potential use cases: 36

Data Availability : Identifying the parameters to build the shortlisted use cases and analyses the quality to further refine the potential use cases

Business Priorities : Understanding businesses and underlying process along with the pain areas to identify the potential Analytics use cases that could support the business to improve efficiency, time or cost

Time to Deploy : Finally, design a solution framerwork for the use cases to understand the complexisites and time to deploy and identify those use cases that will be quick wins for the businesses



2 shortlisted & 1 Finalized for implementation

Analytics Use case Categorization		
Process Optimization	Quality Improvement	Asset Utilization
7	14	15

Business Priorities

Analytics Use case Categorization		
Process Optimization	Quality Improvement	Asset Utilization
4	10	8

Data Availability

Analytics Use case Categorization		
Process Optimization	Quality Improvement	Asset Utilization
3	6	5

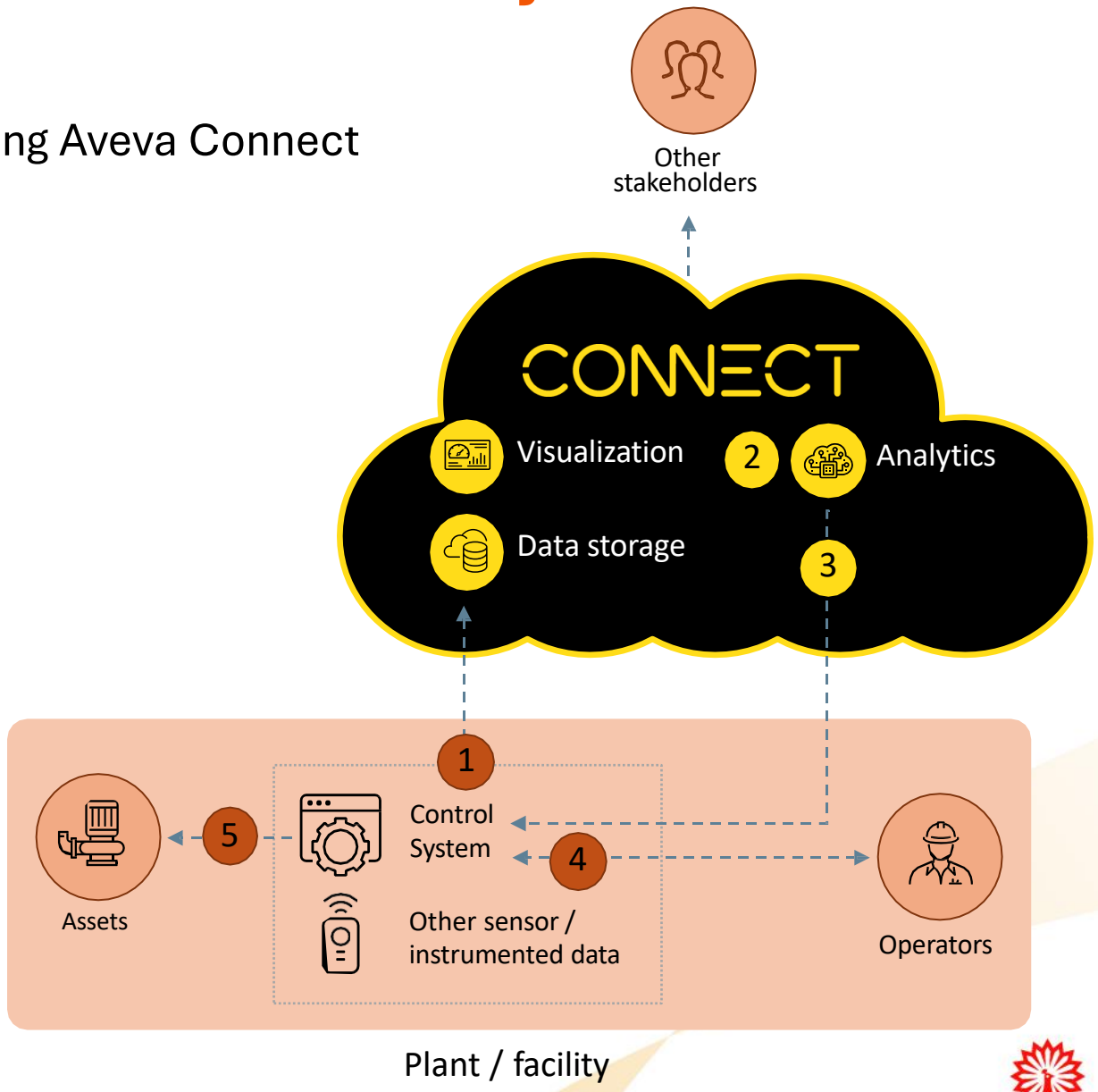
Time to Deploy

Analytics Use case Categorization		
Process Optimization	Quality Improvement	Asset Utilization
2	1	2

Coromandel Digitalization Journey

➢ Use case : Prescriptive setpoint optimization using Aveva Connect

1. Aggregate control system and other instrumented data into CONNECT data services
2. Predict operations performance and propose set point adjustments using AI/ML models to achieve desired performance targets
3. Suggested set point adjustments provided to the control environment
4. Accept set point guidance or make your own adjustment
5. Adjust assets at preferred cadence to maintain performance balance



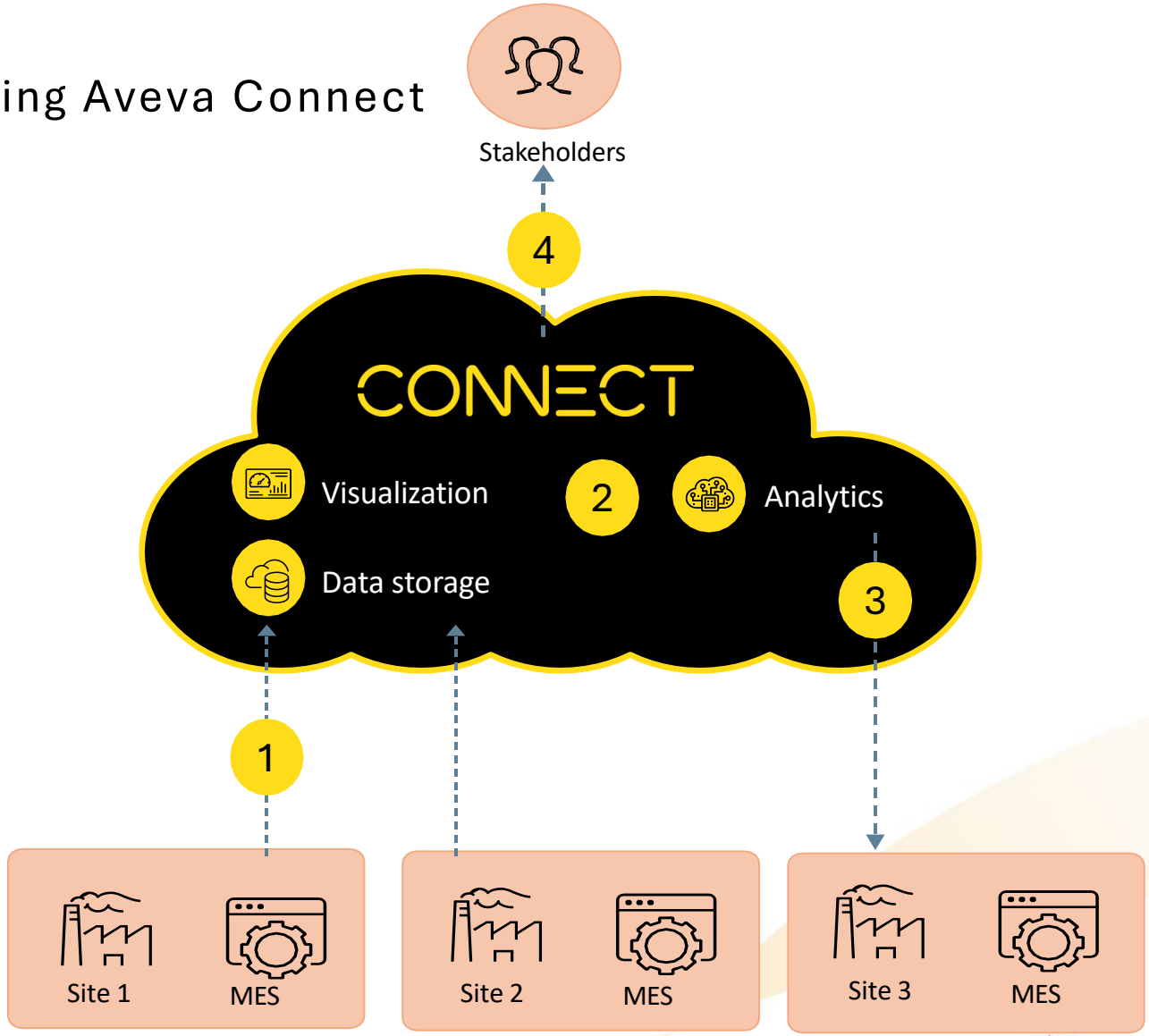
Results:

- Proactively manage energy use, performance parameters, product quality and other metrics through analytical guidance to operations
- Monitor and view data, trends and performance outcomes through CONNECT visualization or 3rd party tools

Coromandel Digitalization Journey

➢ Use case : Predictive downtime alerts using Aveva Connect

1. Aggregate MES production data and other lab data into CONNECT data services.
2. Train AI/ML models on previous production runs to detect potential downtime causing conditions when producing a specific product.
3. Suggested corrective action to operations teams based on detected conditions.
4. Provide stakeholders with greater visibility to recommendations to avoid downtime when producing this product.



Results:

- Proactively manage production through analytical guidance to operations. Real-time alerts to and recommendations for avoiding downtime events.
- Monitor and view data, trends and performance outcomes through CONNECT visualization or 3rd party tools

Coromandel Data Analytics Use-case

Nutrient Prediction in 28.28.00 Grade

Problem

- Needed to predict the hourly N&P nutrients in 28.28.00 grade based on critical operational parameters
- Needed proactive action by operators to avoid quality rejection

Measures undertaken

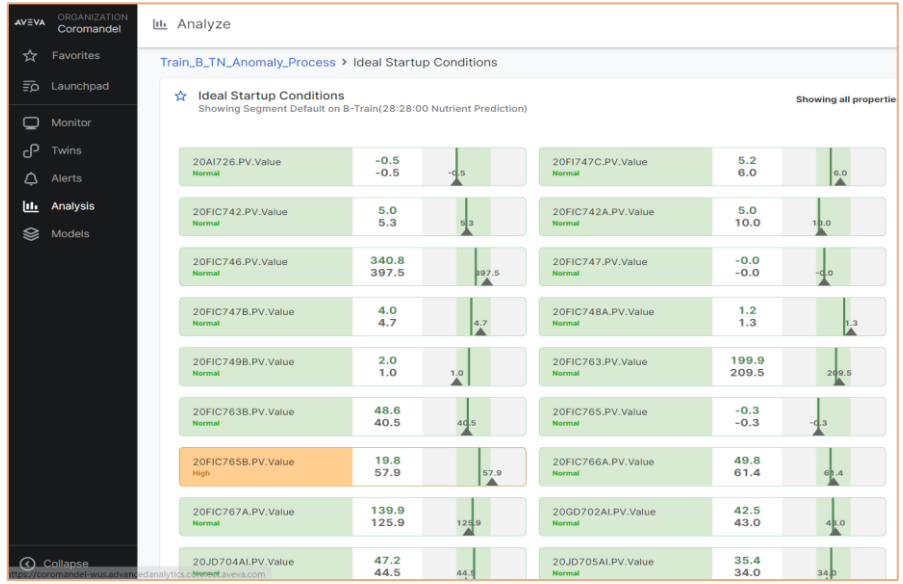
- 8 months data collected from November 2023 to June 2024.
- Critical process Parameter considered for model building.
- Considered plant stabilisation period i.e Ammonia flow > 3 TPH.
- Best Operating ranges and Alarm limits considered for better accuracy.
- Model training done and implementation under progress.

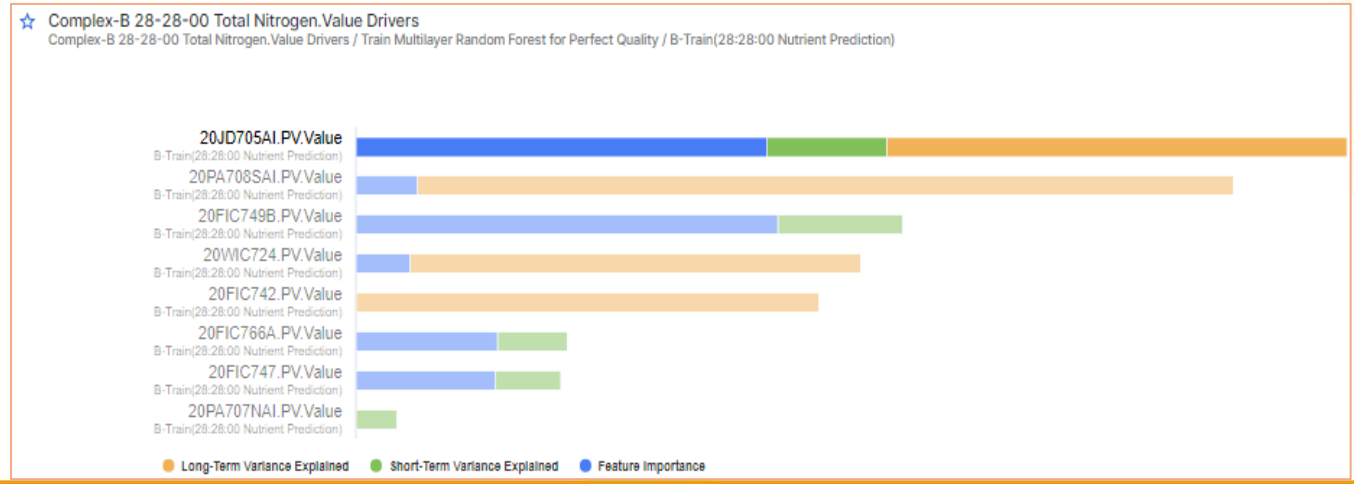
CONNECT data services → Add data → Set timing → Evaluate model → Start Training → View Results

Results

- Potential benefit 2.75 CR/year

CONNECT data services





Coromandel Data Analytics Use-case

Prediction of Free Acid in Reactor Slurry of PAP1

Problem

- Needed to predict the free sulphate in the reactor slurry based on process parameter performance
- To avoid process upsets which ultimately lead to long shutdowns and impact phosphoric acid production and more P2O5 losses.

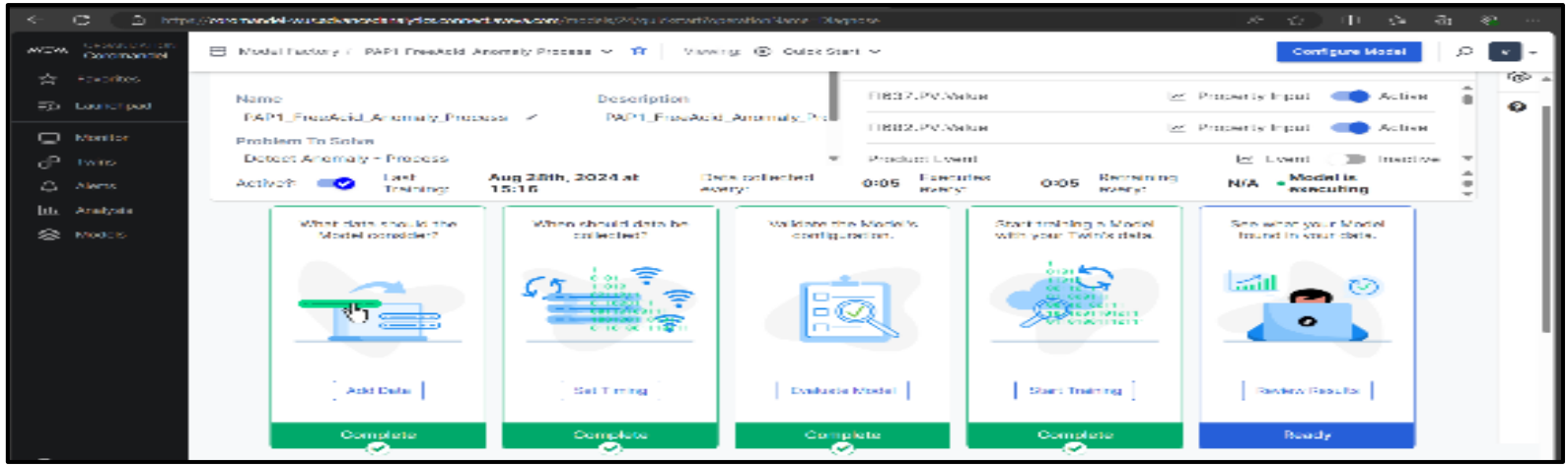
Measures undertaken

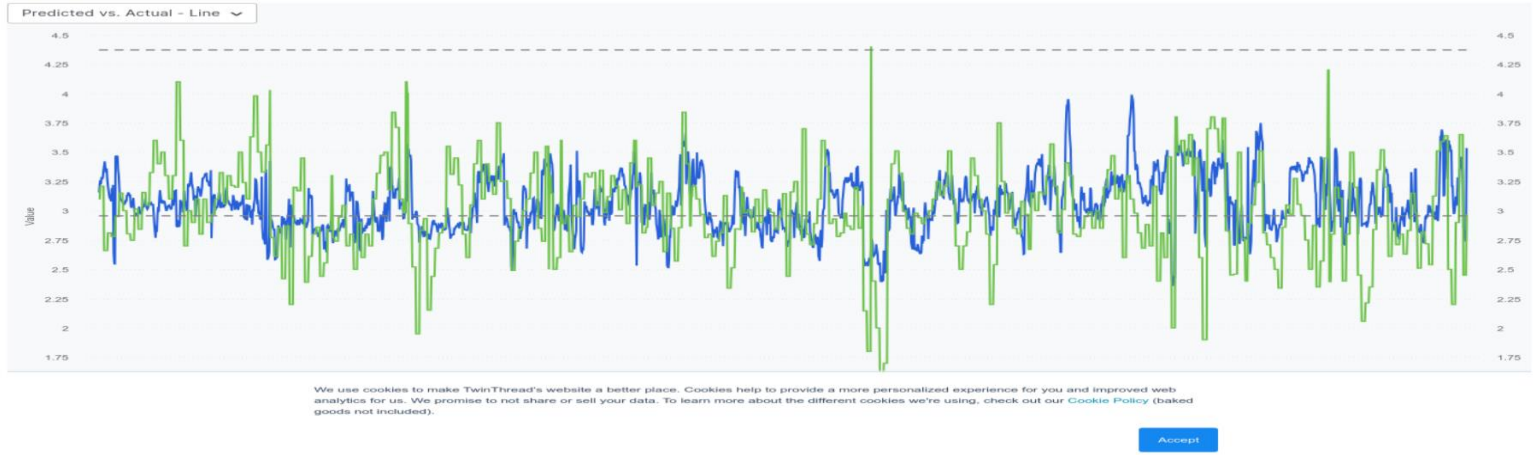
- Model developed with AVEVA Advanced Analytics
- 6 months data collected from July to Dec-23.
- 10 No's of influencing parameter considered for model building.
- Considered plant stabilisation period i.e SA flow > 550 LPM.
- EDA performed and feature engineering applied.
- Correlation heatmap analysis done.
- Linear regression accuracy – 9.6%
- Decision tree regression accuracy – 49%
- **Random Forest regression accuracy – 92%**
- Model training completed and implementation under progress

Results

- Potential benefit of 1.76 Cr/year

CONNECT data services & AVEVA Advanced Analytics template PAP 01 free acid prediction





Coromandel Data Analytics Use-case

P2O5 efficiency improvement in PAP-2

Quick Wins Initiative

- Steam and Power balance dash boards in PI Vision
- Power Factor Dashboard in PI Vision.

Short Term Initiative

- Installation of Steam flowmeters in Unaccountable places.
- HP to LP make up line PCV replacement.
- Linear Programming on Different scenario for optimum Power generation at given scenario

Medium Term Initiative

- VAM installation in AHU for SAP-1&2,SAP-3, TG-2 Control Rooms.
- Study on Extraction and Steam redistribution of networks on different scenario.

Long Term Initiative

- Surplus power export to grid during stoppage of internal plants like TG, Complex etc..

Project Tracker

Project Tracker : P2O5 efficiency improvement in PAP-2 : Vizag

S.NO	Milestone		Timelines: May-24 W1	W2	W3	W4	Jun-24 W5	W6	W7	W8	Jul-24 W9	W10	W11	W12	Aug-24 W13	W14	W15	W16	Sep-24 W17	W18	W19	W20
1	Brainstorming with Plant Operations team/OIT&TECHNOLOGY/TSD	P	Ball Mill				Reaction				Filtration											
		A																				
2	Preliminary Data analysis with Different Rock combination Vs Throughput,P2O5 Concentration, Gypsum losses	P			Ball Mill		Reaction		Filtration													
		A																				
3	Historical data collection (Laboratory and real time process parameters)	P			Ball Mill		Reaction		Filtration													
		A																				
4	Segregation of measured and unmeasured parameters	P				Ball Mill		Reaction		Filtration												
		A																				
5	Data cleaning	P					Ball Mill					Reaction					Filtration					
		A																				
6	Process correlations	P						Ball Mill					Reaction					Filtration				
		A																				
7	Validation of process correlations with practical and Theoretical basis	P							Ball Mill					Reaction					Filtration			
		A																				
8	Identification of Controlled and Uncontrolled ,resultant paramters	P								Ball Mill					Reaction					Filtration		
		A																				
9	Preparation of models with different intervals	P							Ball Mill					Reaction					Filtration			
		A																				
10	Building asset Analytics and Model Deployement in AVEVA-PI	P									Ball Mill			Reaction					Filtration			
		A																				
11	Dashboard creation in PI vision	P									Ball Mill			Reaction					Filtration			
		A																				
12	Creation of Events and Notifications	P									Ball Mill			Reaction					Filtration			
		A																				
13	Automation initiatives	P																				
		A																				
14	Budget Proposals	P																				
		A																				

Abbrevaitions	Plan	Acual In Progress	Completed	Completed with Over run

PAP 02 Golden batch Monitoring

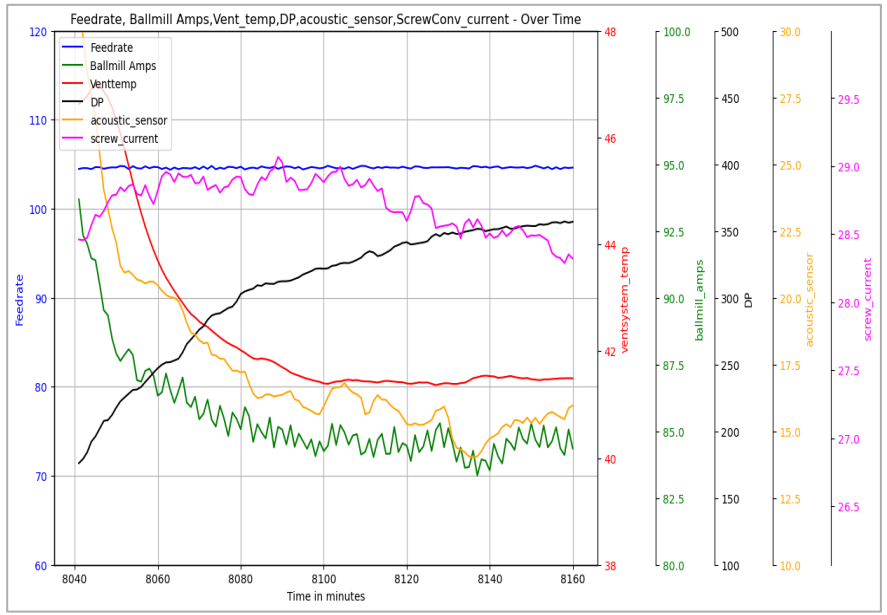
Coromandel Data Analytics Use-case

P2O5 efficiency improvement in PAP-2 : Ball mill-Descriptive Analysis

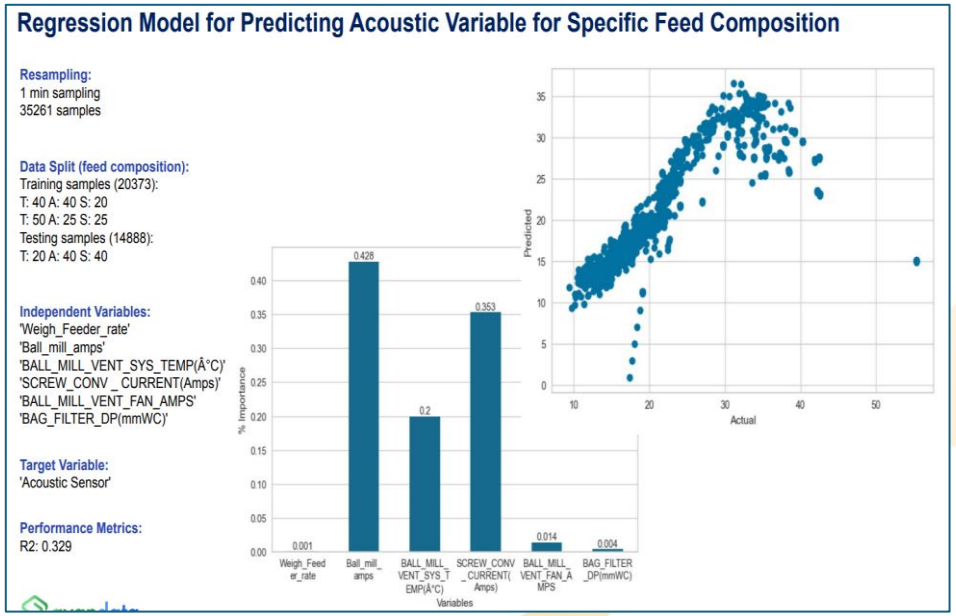
Results

Ball mill – Descriptive analytics shown that

- Developing a ball mill efficiency improvement model and based on historical data after segmented to rock ratio wise found strong cross corelation between
  1. <200micron size Vs Ball mill vent fan amps
  2. Ball mill vent system temperature Vs Ball mill amps
  3. Ball mill vent fan amps Vs Screw conveyor amps
- At a constant feed rate ,observed different patterns of critical parameters Ball mill Amps, Vent system temp, Acoustic sensor, Bag filter DP ,Screw Conveyor Current.
- Potential benefit 2.98 Cr/year



Critical parameters behaviour at constant feed rate



Critical parameters behaviour at constant feed rate

Coromandel Data Analytics Use-case

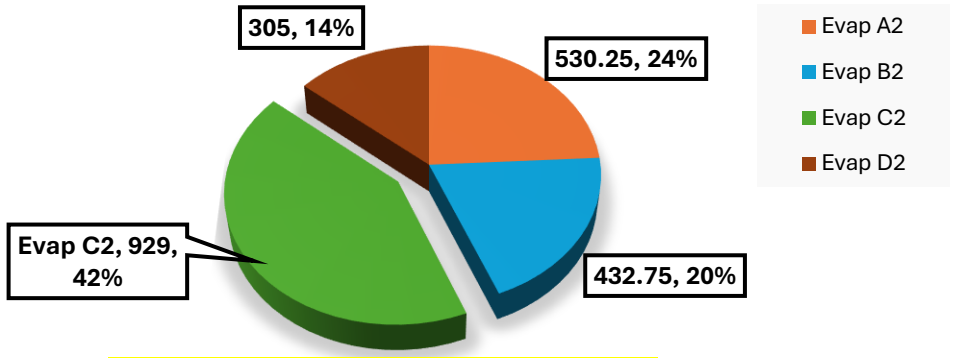
Evaporator Availability improvements

Problem

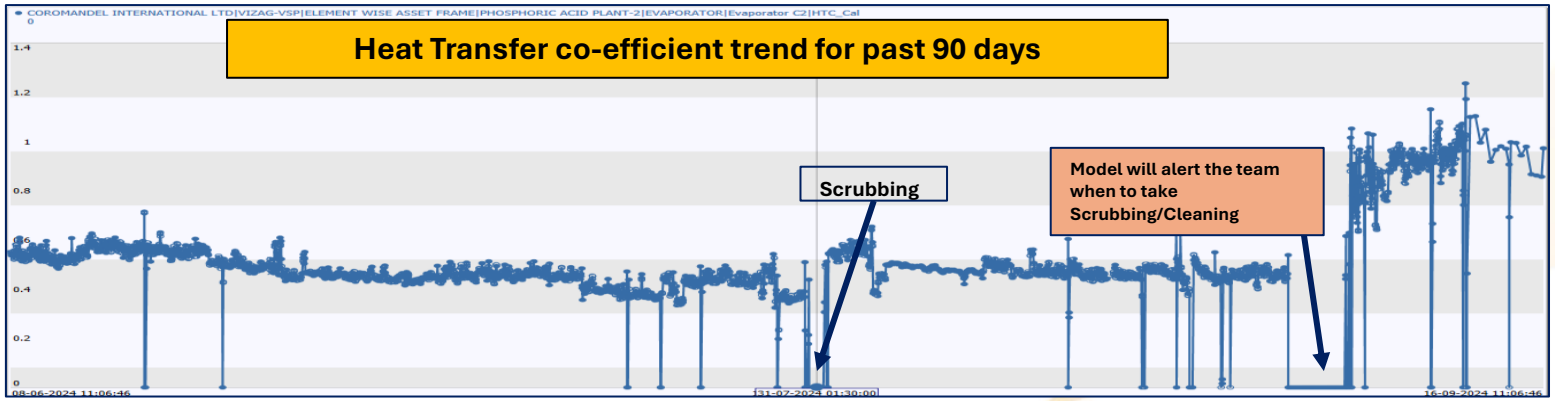
- Evaporator downtime FY 23-24 is almost 42% of the entire plant.

Measures undertaken

- Overall heat transfer coefficient has been calculated to monitor the rate of heat transfer to give anomaly on scrubbing.
- Carried out analysis for incorporating scrubbing date info dashboard for easy monitoring. Collected operational parameters and meta data from critical equipment and configured an asset framework (AF) template in AVEVA PI System.
- Developed Dashboards for Plant Operations Maintenance team to enable real time monitoring of KPIs and for data insights.
- Incorporated Heat transfer coefficient and various KPIs into dashboard for ease in decision making and performance monitoring.
- Created event frame notification for various KPIs alerts levels.



FY 23-24 PAP-2 Evaporator Downtime



Coromandel Achieves Potential benefits of 3.7 M$ through Process improvement

3.7 M$

Challenge

- Process upsets leading to long shutdowns and impacting phosphoric Acid production and more P2O5 losses
- Evaporator downtime FY 23-24 is almost 42% of the entire plant.
- Loss of product produced due to non maintenance of target quality parameters

Solution

- Development of advanced analytics models on enterprise data management model to process production and process anomalies using AVEVA PI system, AVEVA AAA and CONNECT Platform

Results

Sl.No	Use Cases	Target	Business Impact/year- Current Scope- Under Vetting
1	P2O5 Efficiency Improvement & P2O5 loss reduction	Rock Efficiency Improvement by 0.3%	4.09 Crores
2	Quality Prediction & reduce rework	900 MT	5.4 Crores
3	Digital Twin for Evaporator C2	Reduction of 50% downtime of past 3 years yearly average downtime of 750.67 hrs	2.05 Crores
		Total Business Impact(Rs Crores/Year) =	Rs 11.54

Coromandel
FUTURE POSITIVE

Thank You

Digitalization Partners

AVEVA

CEREBULB

Questions?

Please wait for the microphone.

State your name and company.

Please remember to…

Navigate to this session in the mobile app to complete the survey.

Thank you!

© 2024 AVEVA Group plc and its subsidiaries. All rights reserved.

Chemical / India

Coromandel Achieves Potential benefits of 1M$ through Process improvement

Challenge

- Process upsets leading to long shutdowns and impacting phosphoric Acid production and more P2O5 losses
- Evaporator downtime FY 23-24 is almost 42% of the entire plant.
- Loss of product produced due to non maintenance of target quality parameters

Solution

- Development of advanced analytics models on enterprise data management model to process production and process anomalies using AVEVA PI system, AVEVA AAA and CONNECT Platform

Results

- **Reduced Asset downtime by 50%.**
- **Reduction Raw material usage by 10%**
- **Improved non compliance of production batches through real time monitoring of quality parameters and timely corrective direction.**

© 2024 AVEVA Group Limited or its subsidiaries. All rights reserved.

Coromandel
FUTURE POSITIVE

Coromandel
Reimagined

THANK YOU

murugappa