
AVEVAWORLD

Accelerating Corporate Decision-Making with The Process Simulation Twin

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Introduction

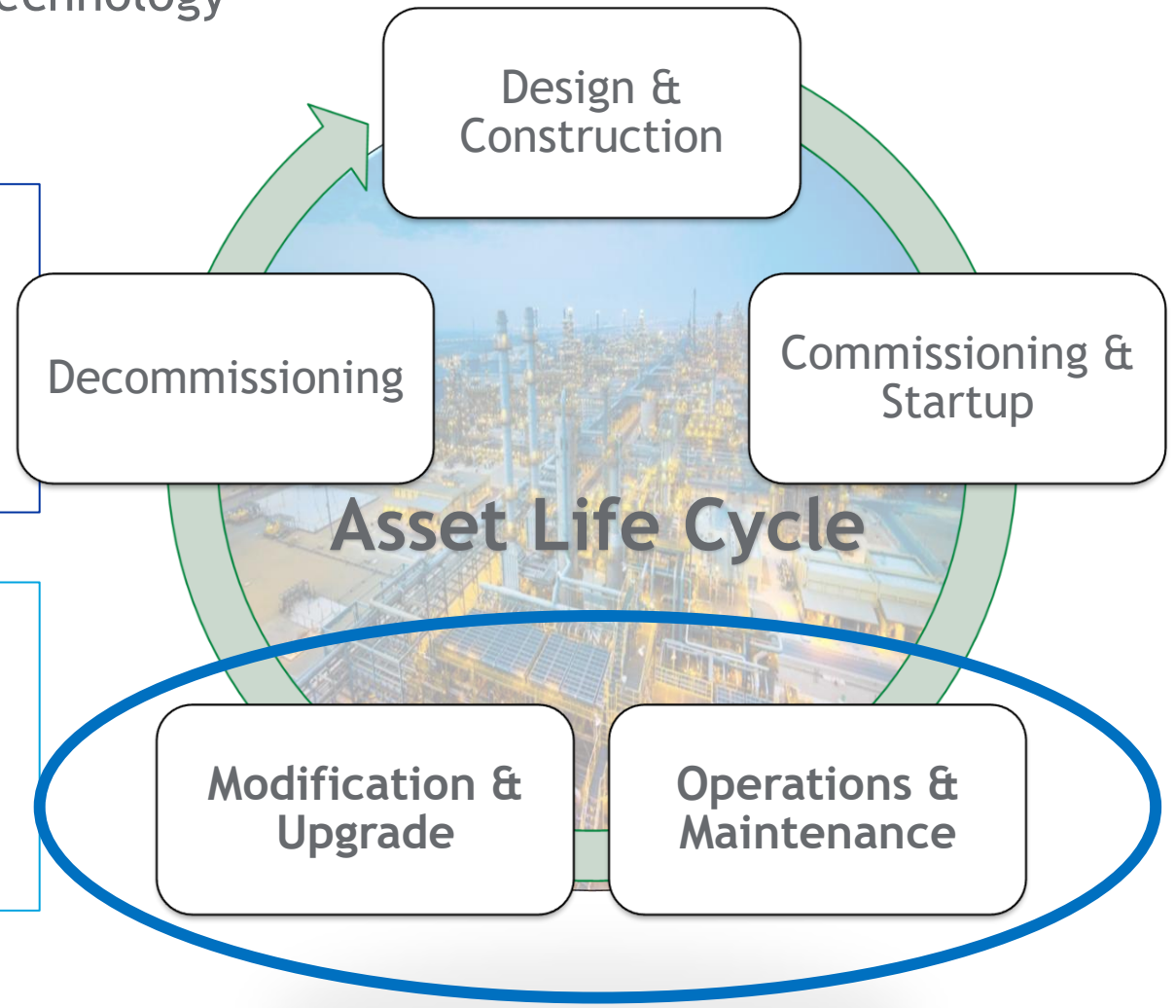
Enhancing Refining Operations with Digital Twin Technology

Aramco Digital Transformation Program

- Aramco's has developed an asset life cycle with respect to digital twins is a comprehensive and integrated approach that spans the entire life cycle of an asset, from design and construction to operation and decommissioning

Operate

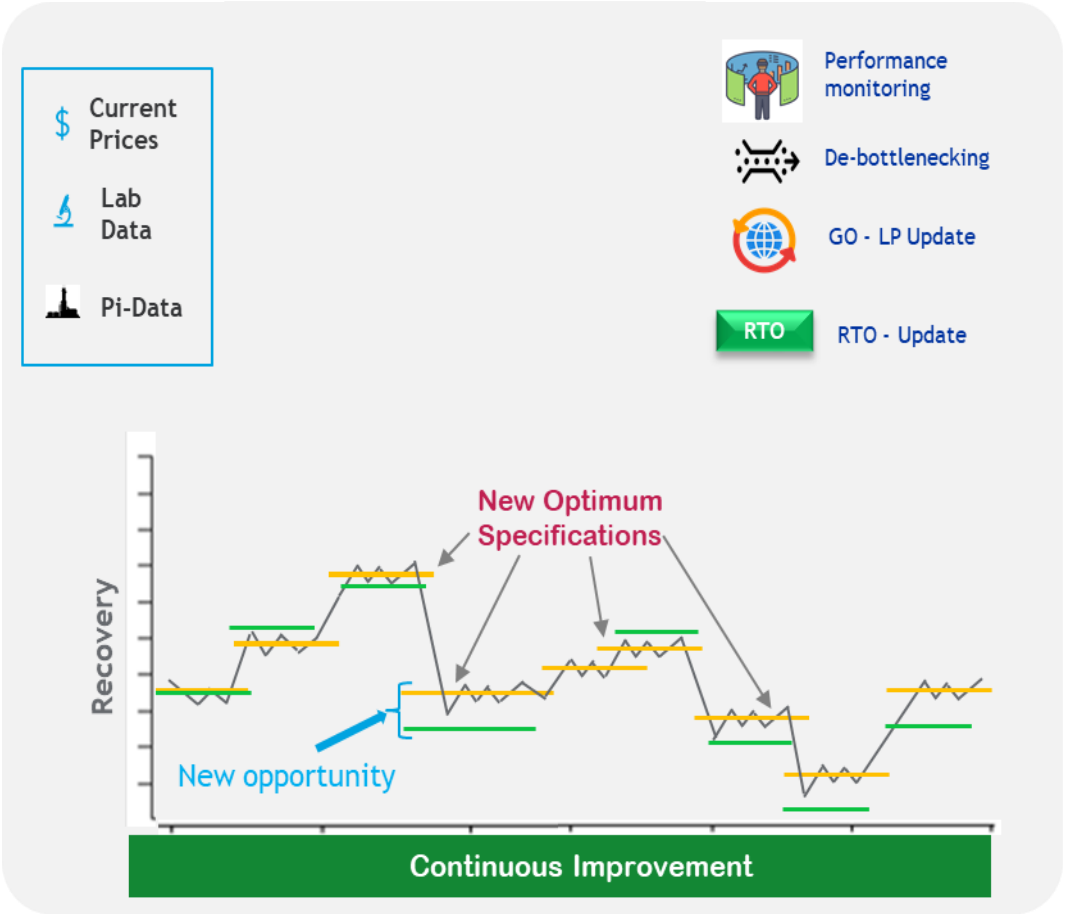
- Digital Twins enhance decision-making by providing predictability and increasing confidence in decisions, enabling informed choices for engineers, planners, and management



Timely Decision-Making in Refining

Why Timely Decision-Making is Critical in Refining

Complexity & Variability	Refining involves complex processes with many variables, such as feedstock quality, equipment performance, and market demand.
Time-Sensitive operations	Refining is a continuous process and delays in decision making can lead to reduced throughput, increased costs, and potential safety risks.
Improved Yield and Quality	Accelerated decision making can help refiners optimize their processes to improve yield and quality of products. By quickly responding to changes in feedstock quality, equipment performance and market demand, refiners maximize the production of high-value products.



Challenges with Traditional Simulation

Limitations of Traditional Simulation

Static

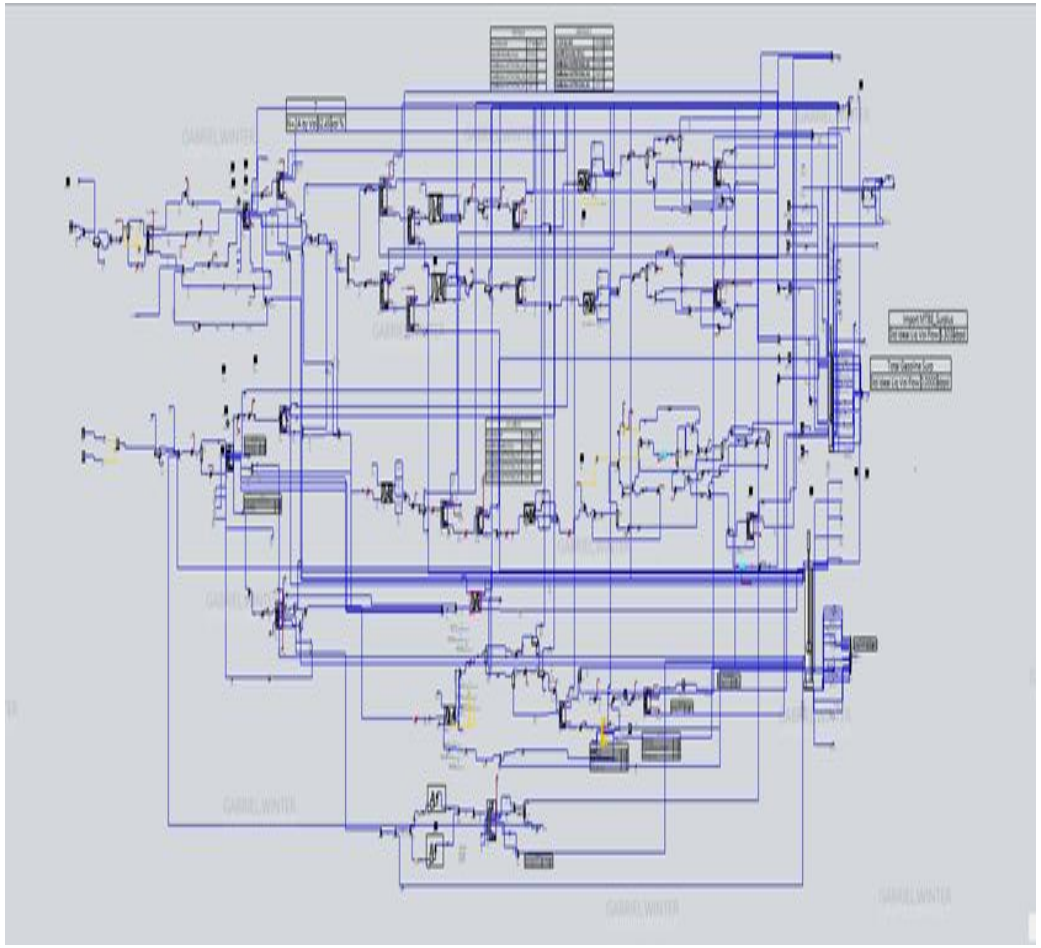
- Built on ad hoc basis only provides an accurate representation for a particular snapshot of time

High Maintenance

- Significant time required for data collection tuning and validation.
- Require frequent manual updates and maintenance to ensure models are accurate and relevant.

Steep Learning Curve

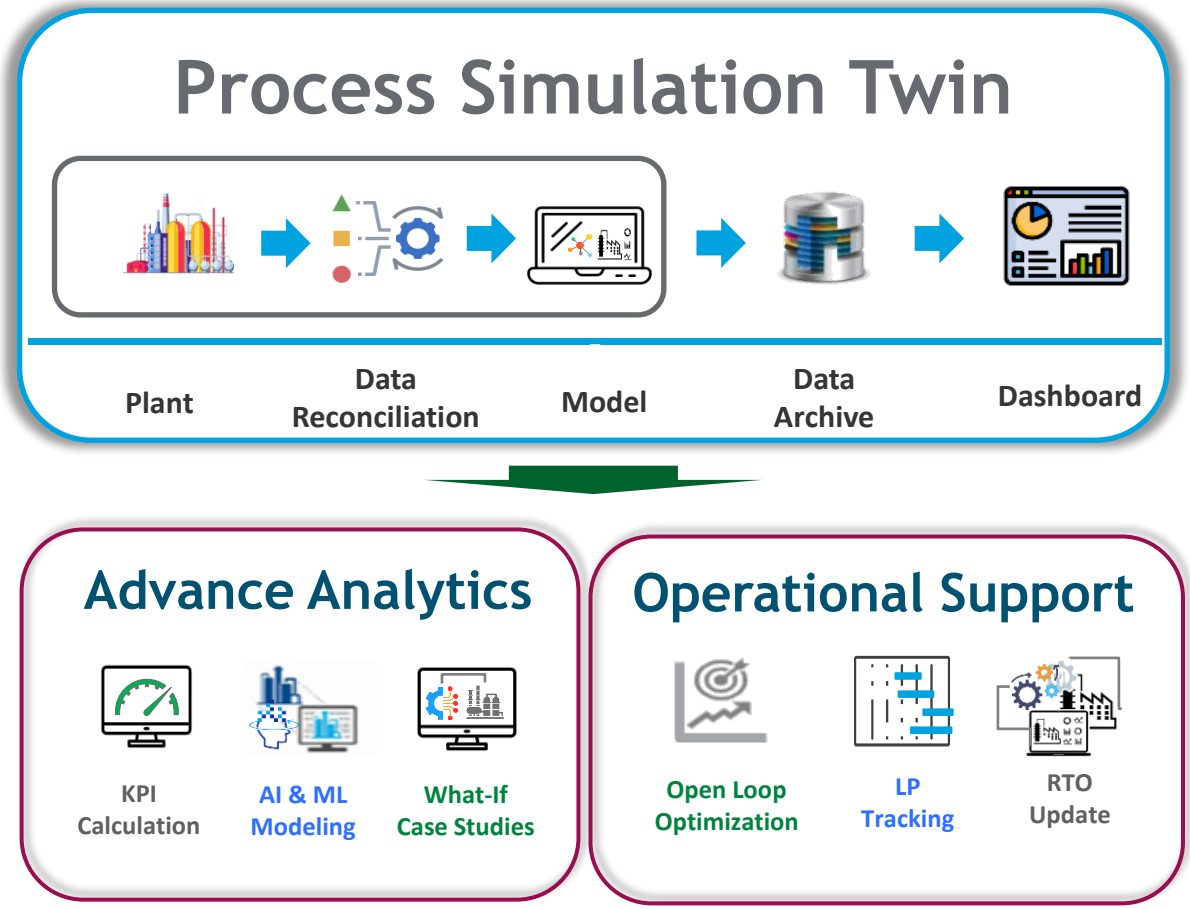
- Traditional simulation methods can require significant expertise and training to use effectively, which limits adoption and utilization.



Introducing the Process Simulation Twin (PST)

A Solution to Traditional Simulation Challenges

Process Simulation Twin Requirements
Automate data collection, reconciliation, and model calibration
Monitor planning model accuracy & provides regular planning model updates
Provide up-to-date models of individual units allowing Engineers focus on higher-value activities
Offer consistent, real-time key performance indicators (KPIs) for unit monitoring
Provide a refinery-wide model for techno-economic studies



Introducing the Process Simulation Twin (PST)

Details

Main Components

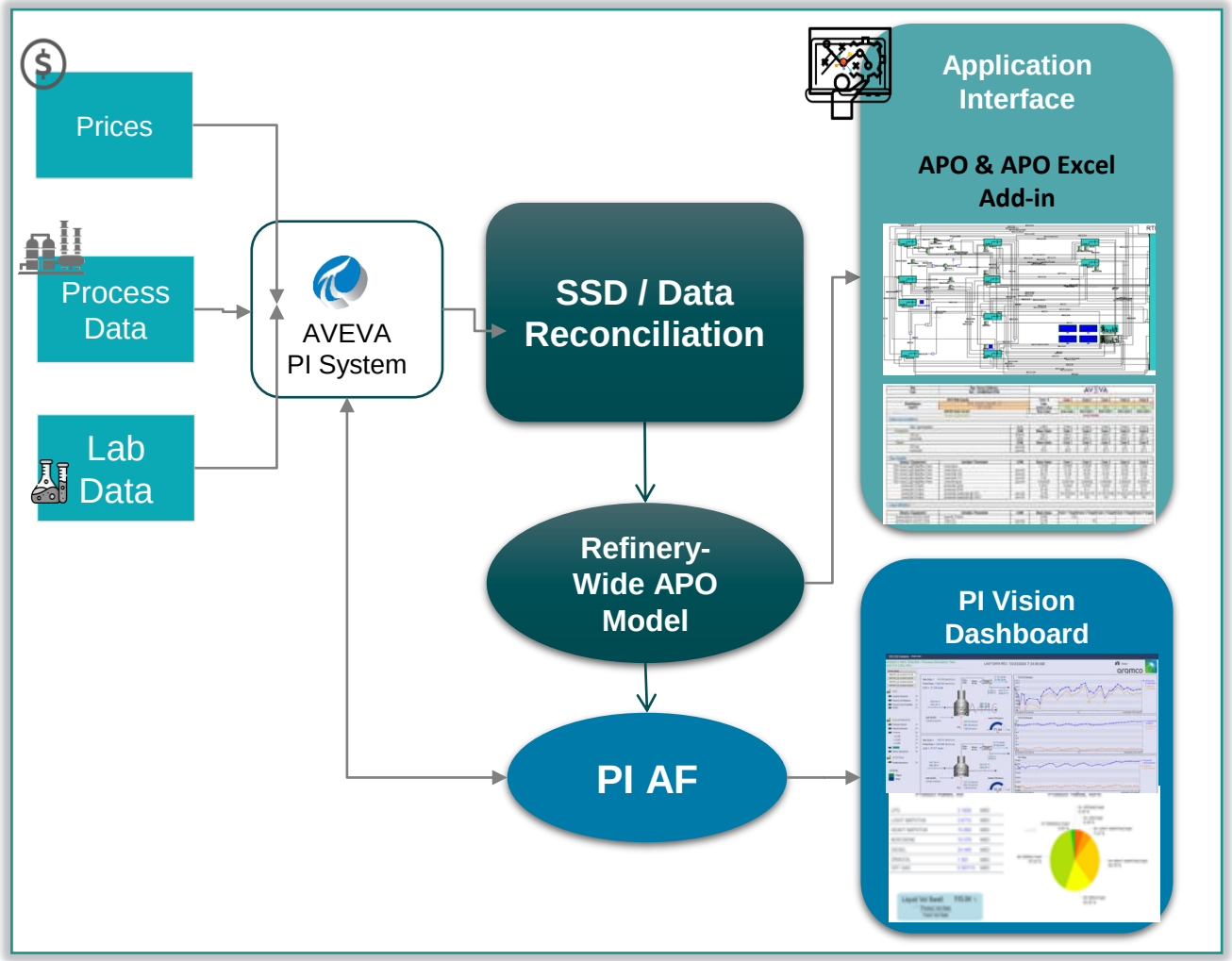
Data Source: PI data (Incl' Process Lab Data Prices)
Data collection: AVEVA™ Real Time System (RTS)
Data Rec' & Tuning: AVEVA™ Process Optimization (APO)
Dashboard: AVEVA™ PI Vision™
AVEVA PI Asset Framework

Application Dashboard

Model Status including bad actors
Reconciled **Mass balance**
Equipment monitoring plant vs model
Key equipment KPI's including Heat exchangers, Columns, Heaters etc.

Case Studies:

Excel interface for individual units
APO for refinery-wide Techno-economic studies



Introducing the Process Simulation Twin (PST)

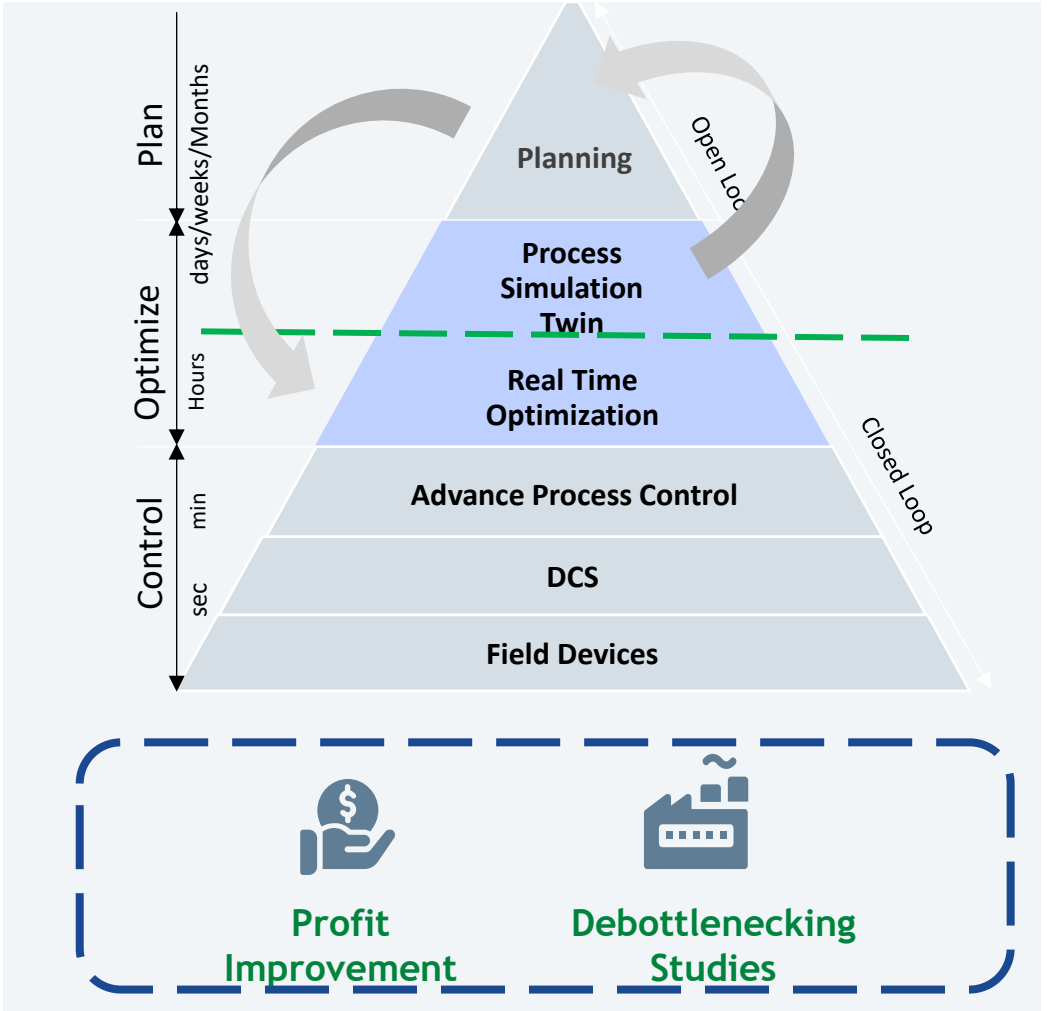
Key features

Auto-tuned model

- Feed Characterization
- Equipment Performance
- Reactor Performance
- Flows, Temperatures, Pressures etc

Key Features

- APC configuration limits
- Engineering limits
- Measured and predicted equipment KPI's such as HX fouling, Column flooding, CO2 emissions
- Fully optimized blend recipe calculation
- Auto-execution of pre defined case studies for LP Model Updates and open loop optimization handles



Introducing the Process Simulation Twin (PST)

Use cases

Unit Monitoring

- Automated Unit Monitoring
- Intrinsic KPI Calculation
- Sustained Benefits via open loop Advisory

Profit Improvement

- Opportunity Identification & Evaluation
- Facility wide Economic Evaluation
- Opportunity Implementation

Planning Support

- LP Accuracy
- LP Model Updates

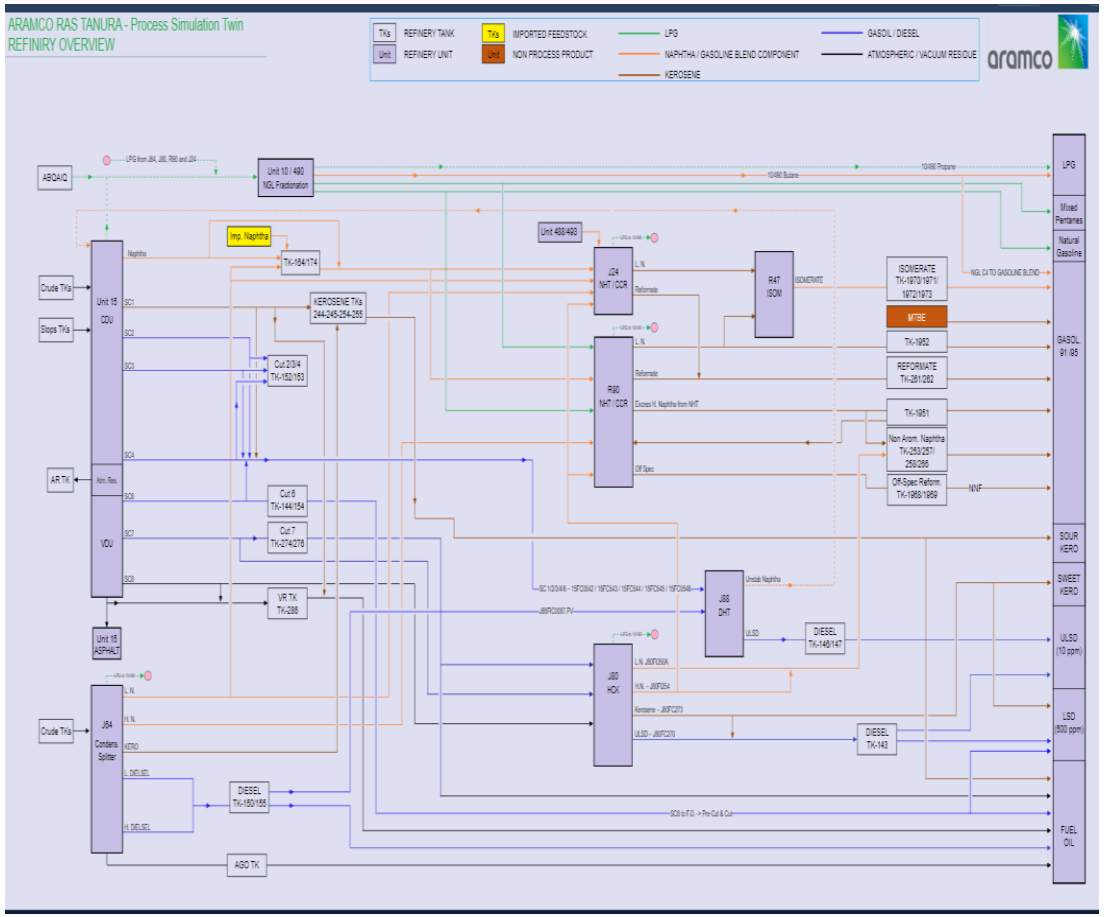
Engineering support

- Trouble Shooting
- Plant Debottlenecking
- Revamp studies

Introducing the Process Simulation Twin (PST)

Implementation Challenges

- Full refinery-wide scope including blending
- Changes in refinery operation during the project
- Cyber security restrictions
- Maintenance & Update
- Training – EO Model



Conclusion and Path Forward

Solution

- Deployed a Refinery-wide simulation twin using AVEVA and PI System
- The PST enables real-time simulation on the corporate network via Online UpToDate rigorous refinery-wide model
- Drives continuous improvement and accelerates opportunity implementation

Results

- 13 profit improvement opportunities evaluated during the project
- Dashboard for monitoring unit performance, model performance, and planning model performance

Path Forward

- Profit tracking dashboard for open loop opportunities
- Work process to continue opportunity identification evaluation and implementation.
- PST lays the groundwork for integrating Artificial Intelligence (AI) and Machine Learning (ML) techniques, including reinforcement learning and predictive analytics,

Final Thoughts

The Process Simulation Twin is a powerful tool for accelerating decision-making and enhancing refinery operations allowing focus on higher-value activities, unlocking sustainable value creation across the organization