

Our mission is to be
your electrification & digitization partner for sustainability and energy efficiency



etap[®]

Life Is On

Schneider
Electric

GTDMS 2.0

Unified Digital Twin Model Based Integrated GTDMS
Planning, Protection & Operation of **New-Grids**

Shaikh Sahid Hossain
SVP & Global Director

etap[®]

Powering the World

ETAP is a solution for **Design, Analysis, Protection, Optimization, Operation & Maintenance** of Electrical Systems.
Utilized by **10,000+ Companies Globally** across **HV, MV, LV Sectors**





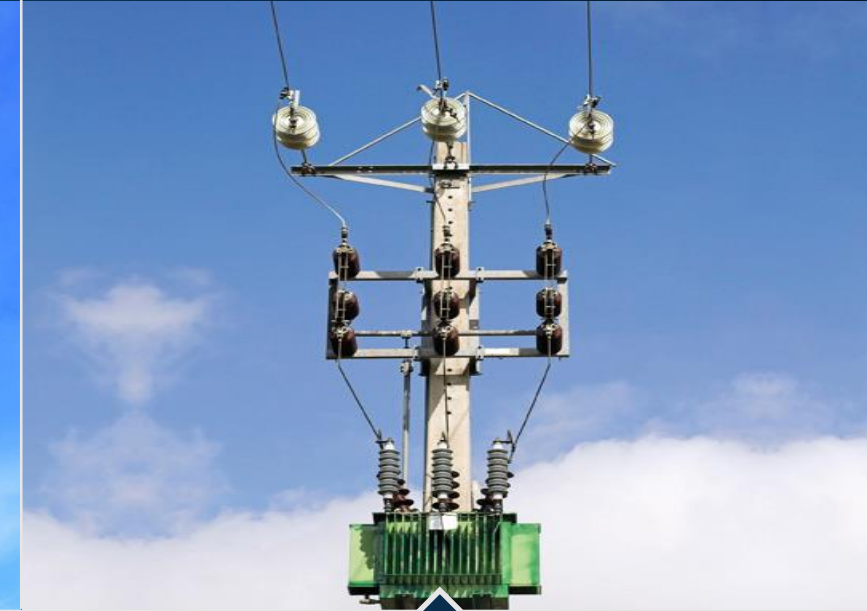
Generation

From Renewable to Nuclear, some of the world's most advanced power generation plants count on ETAP to help provide reliable, clean and cost-effective power to their customers.



Transmission

ETAP Grid™ transmission system software integrates transmission network planning with detailed substation models, network topology processing, transmission system analysis, electric SCADA and real-time transmission network energy management system.

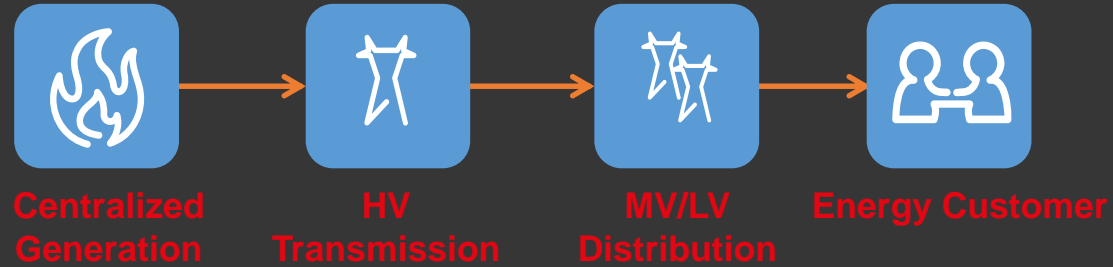


Distribution

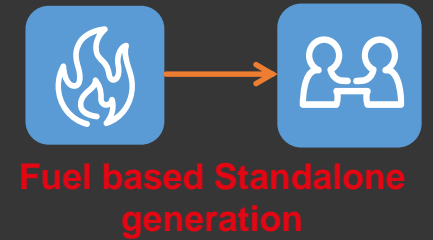
ETAP Grid™ offers an integrated distribution network analysis, system planning and operations solution on a progressive geospatial platform for simulating, analyzing, operating and optimizing the performance of Utility Smart Grids.

Changing Energy Landscape

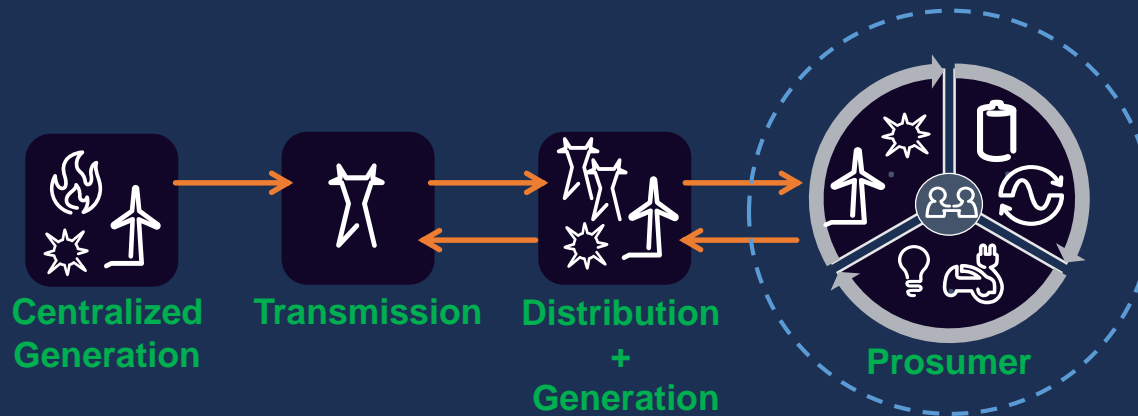
Traditional Energy Value Chain



or



The New Energy Transition



or



Connected from Plant to Plug

Decentralized



Flexible



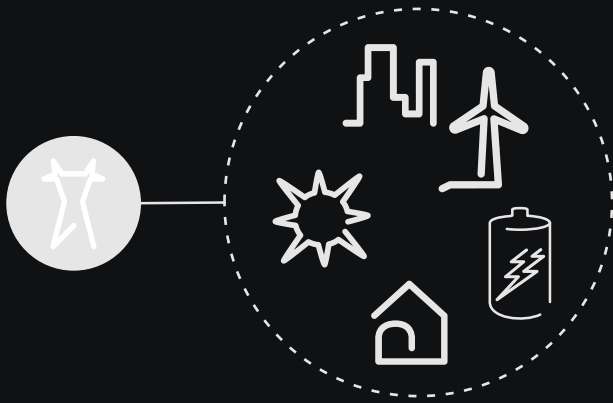
Connected

Consumer morphing in prosumer

New Grid Objectives

Optimize your electrical bill & sustainability footprint

Hybrid system: Grid + local generation/storage + load management



Grid-tied

Manage blackouts while optimizing efficiency & sustainability footprint

Hybrid system: Grid + local generation/storage + load management



Island-able

“Power on” with efficient and future proof power systems

Hybrid system: Diesel/Gas &/or renewable generation + storage + load management



Off-grid

Business Challenges in Grid Transition

Capital Costs & Time to Market

Renewable Energy being one of the pillar to reduce global CO2 emission, need to build and deliver faster with optimized LCOE

20x global Renewable installed capacity in 2050 with estimated \$3.4 Trillion

O&M Efficiency

Need to provide highly efficient new energy optimizing operations with a focus on people & asset safety, system reliability, operational efficiency and security

30% of LCOE is related to O&M Costs

Increase Revenue

Need to further improve capacity factor of Energy migration and generate new revenue streams

Spot Market forcing renewable assets to get monetized on energy markets

Grid Integration & Repowering

Need to prepare future power grids to integrate rising shares of clean Power is critical

Global share of variable renewables (wind and solar) would increase to **34%** by 2030 and **60%** by 2050

Gaps in Current Process of Munics

- No connectivity from design to project information
- Most of the models are not maintained and updated
- SCADA and operational systems are not available
- Protection, Planning & Design Model for asset would be independent
- Detailed Substation Asset Model would not be captured
- No Network Model Management from Planning, Design, Construction to As Built
- No protection data base and no integration with the devices
- Multiple Database, Different Model for same asset
- No training platform for real world scenario
- No Asset Integrated Model
- No Predictive Analytics for Operational Support
- No operational support platform
- No platform for future DER integration
- No Utility Management System for faster operation and control

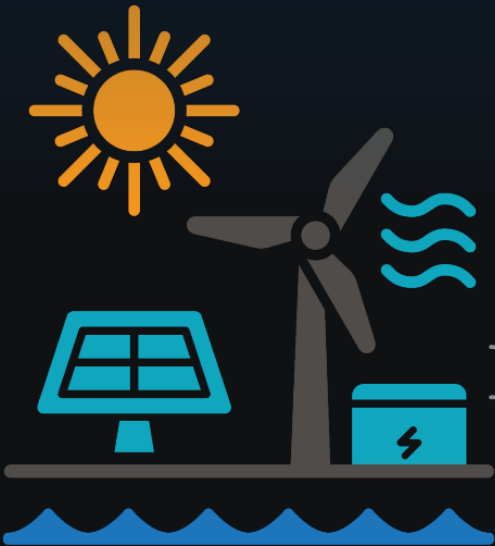


Grid Transition Risks

Power Plant

Planning & Integration Risks

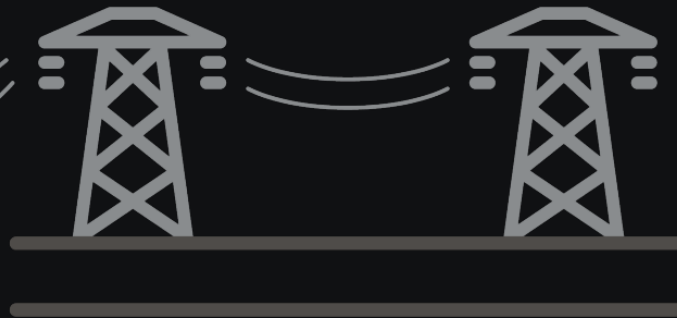
Variability & Uncertainty of RE
Impact to Fossil-Fueled Generators
Interconnection Complexities



Transmission Grid

Maintain Grid Resilience

Instability & Lack of Capacity
Congestion & Physical Limitations
Regulatory Compliance



Distribution Grid & End-Users

Engage Consumers

Demand Response
DERs & Distributed Storage
Microgrids & eMobility



3D+E equation redefining the energy world...

More ELECTRIC

48%

increase electricity demand in
2040 compared to 2020

Source : IEA WEO 2014

More DIGITIZED

10X

more increase connected devices
than connected people
by 2020

Source : Cisco, Internet World Statistics, Mc Kinsey

More DECARBONIZED

86%

of investments in Power
Generation till 2040 will
be in zero-carbon fuels

Of which 71% in Wind,
Solar and Hydro

Source : BNEF 2017

More DECENTRALIZED

12%

of generating capacity
from DG in 2025

65% of DG investments
will be distributed Solar PV

Source : Frost & Sullivan

We enable utilities to go for more sustainable electricity through digitization and technical innovations. More Energy, Less Carbon!

Optimize TCO

- Project delivery on time and on budget with digital twin
- Multi-sites supervision capabilities
- Preventive maintenance
- Augmented operator, immersive training simulation tools

Maximize DER integration

- Solution for grid code compliant connection to grid
- Solution for Distribution utilities to maximize DER rate in the network at an affordable cost with DERMS

Improve grid efficiency

- Reduce cost / kW – CAPEX & OPEX/ Customer
- Reliability of electrical power grid leading to decrease SAIDI, SAIFI, CAIDI
- Efficient transportation of electrical power across the grid, reducing T&D losses
- Efficient Maintenance operation

Support new energy services

- Microgrid solutions for better resilience and sustainability while allowing to monetize flexibility, integrating eV charging stations

We power the digital transformation through the lifecycle of Power & Grid companies, as key players of a sustainable, flexible and resilient New Electric World

Conventional Generation



Power & Process to facilitate transition to green generation (gas...)
Asset Management
Digital Services

Renewable



Connection to grid (wind and solar), both T&D
Wind farm management
• Integration with storage
• Capex optimisation + TTM

Transmission



• Digital substation and virtualisation
• Asset Management

Distribution



• E2E grid architecture for flexibility and resiliency
• Workforce + capex efficiency
• Asset Management
• Digital substation

Step-up towards a sustainable digital future
with the new Electrical Digital Twin !

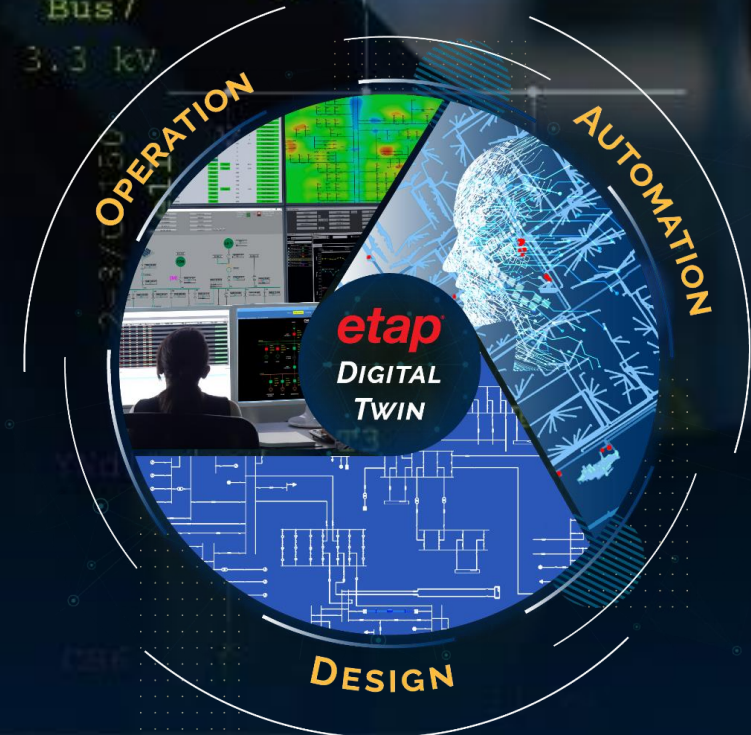
Electrical Digital Twin

Safety &
Compliance

Reliability &
Efficiency

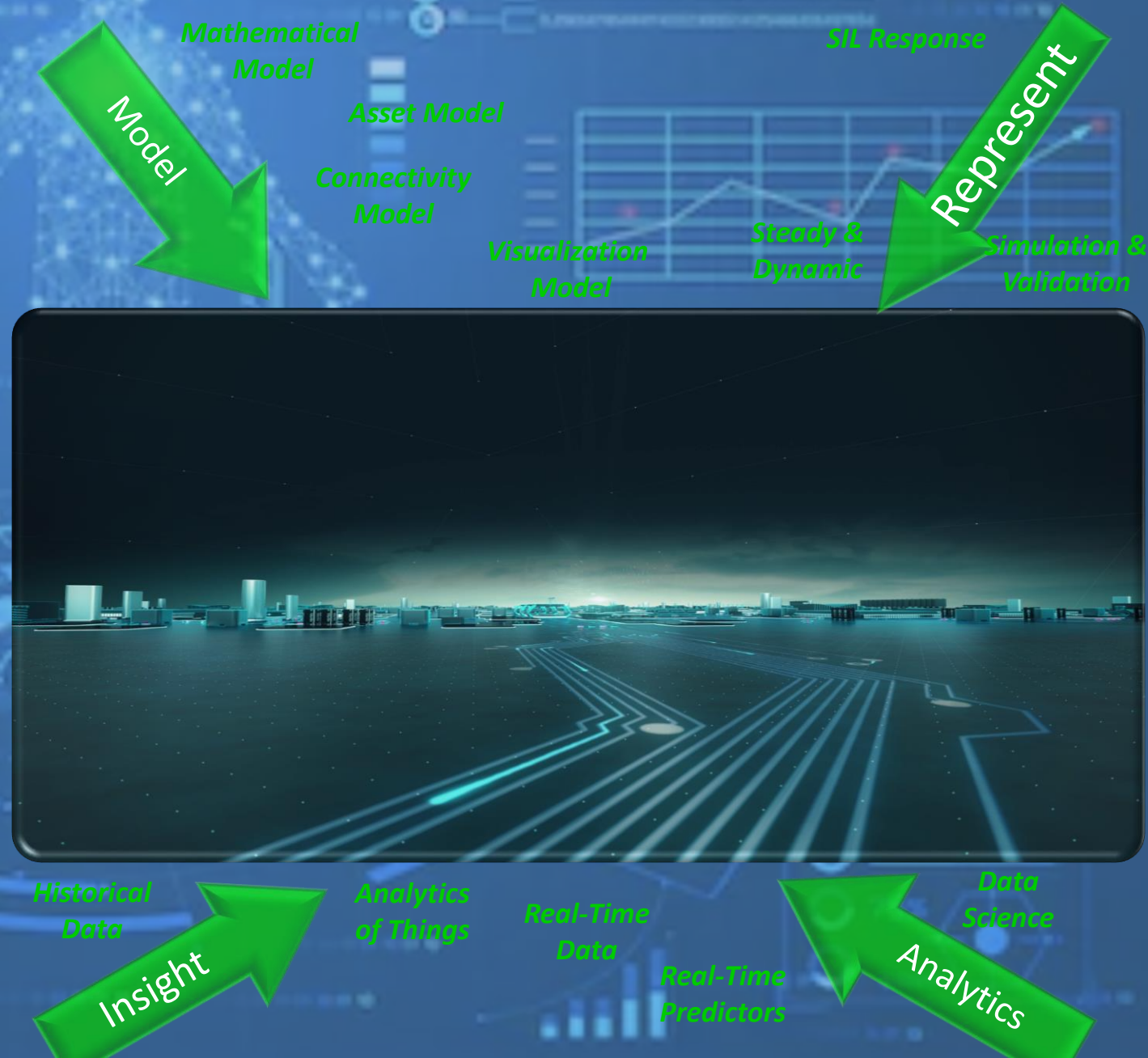
Sustainability

Operational
Efficiency

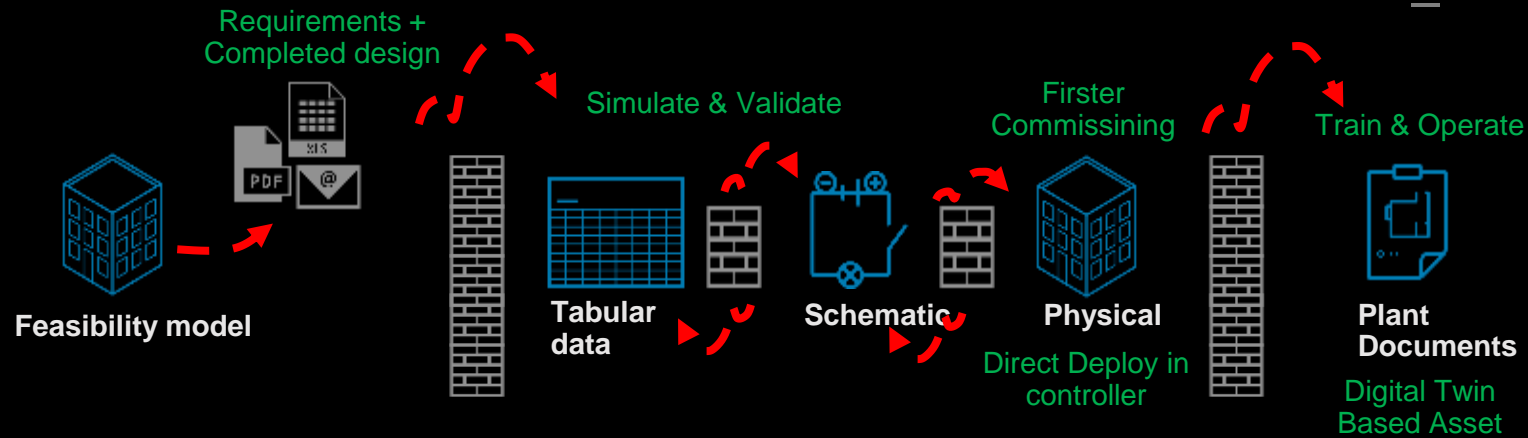
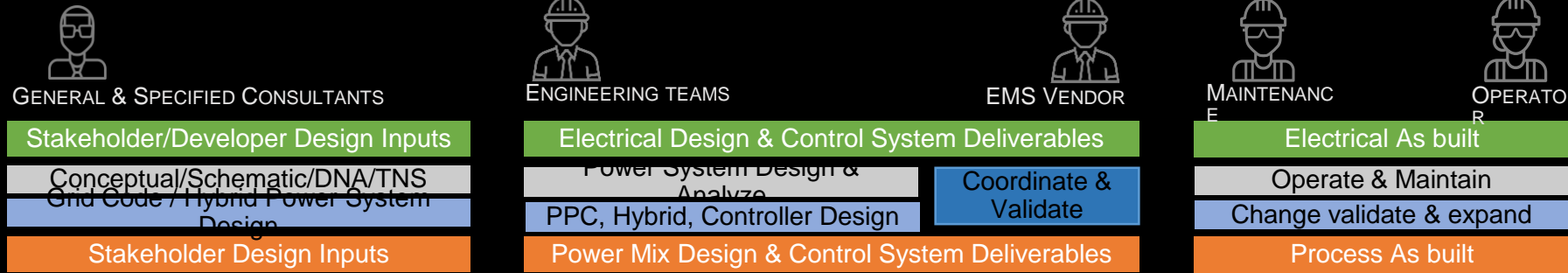


Digital Twin?

- **Digital Twins is an amalgamation of:**
 - Physical Assets
 - Connectivity & Properties
 - Asset Model
- **Digital Twin is continuous, digital representation of a physical asset**
 - Planning
 - Design
 - Construction
 - Operations.
- **It reflect the condition of an asset at any point in time, and respond accordingly:**
 - Present,
 - Past
 - Predictive for Future



Complete Life Cycle Engagement with Hybrid Power Digital Twin



Errors & omissions



Re-work



Lost time



Increased costs



Better execution



CAPEX optimization

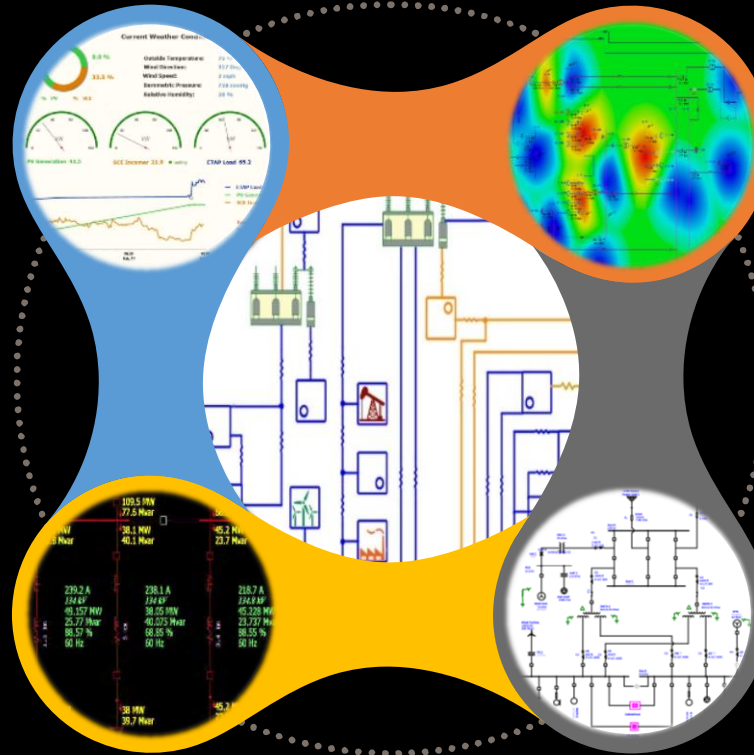


OPEX reduction

Integrated Model-Driven Approach

Real-Time
Operating Data ■

Historical Data ■



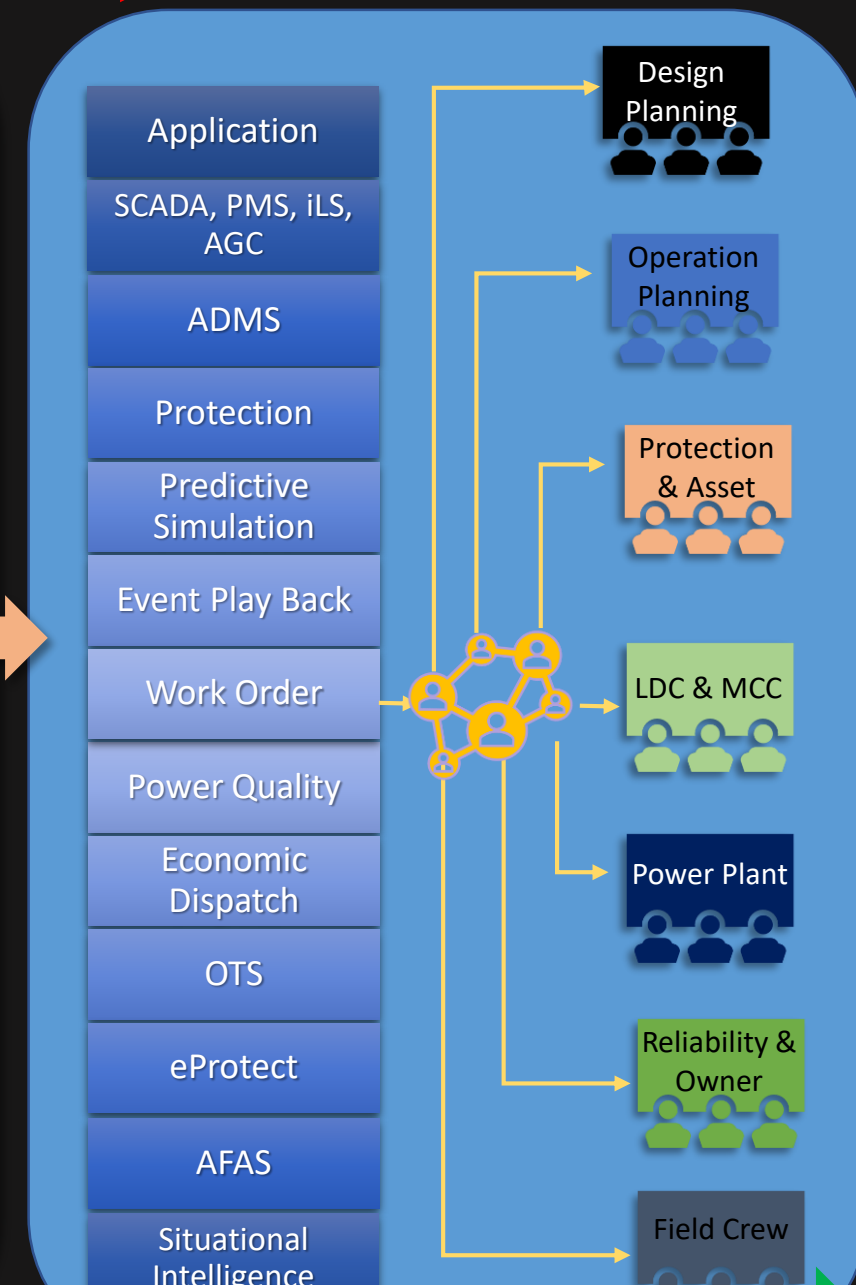
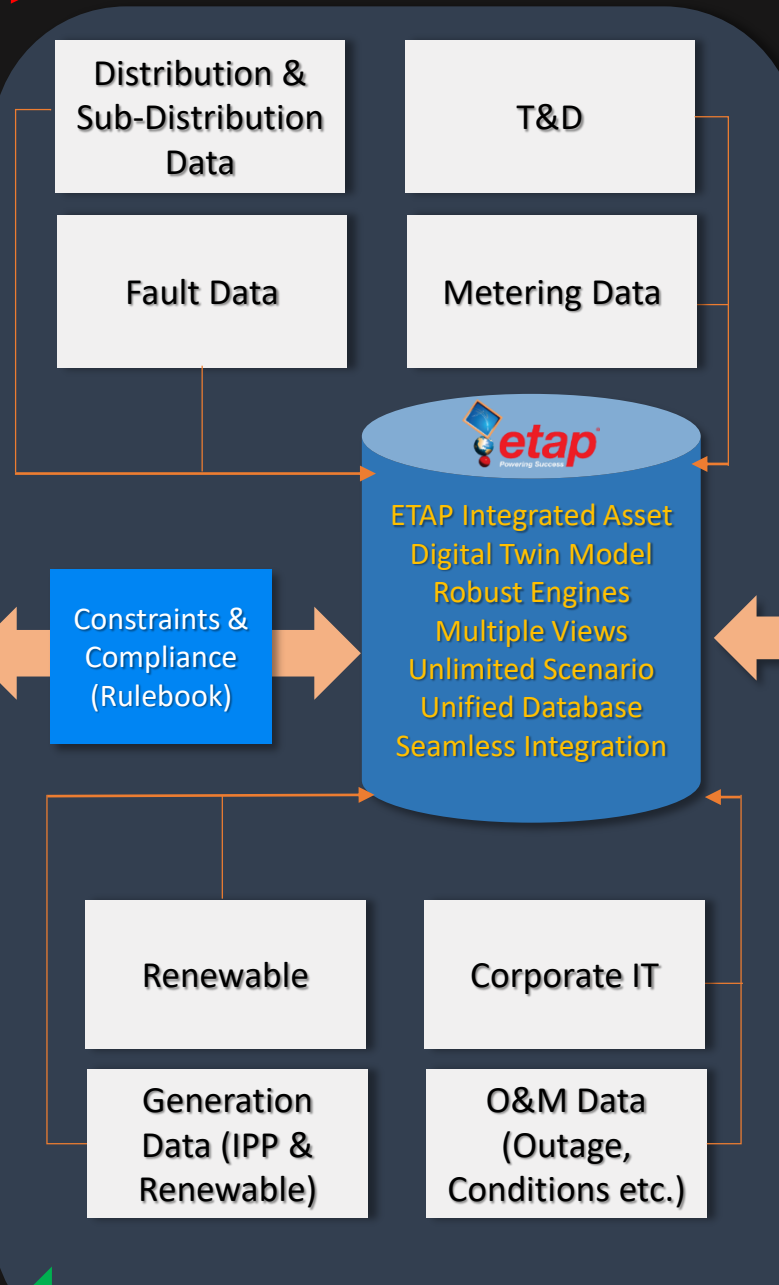
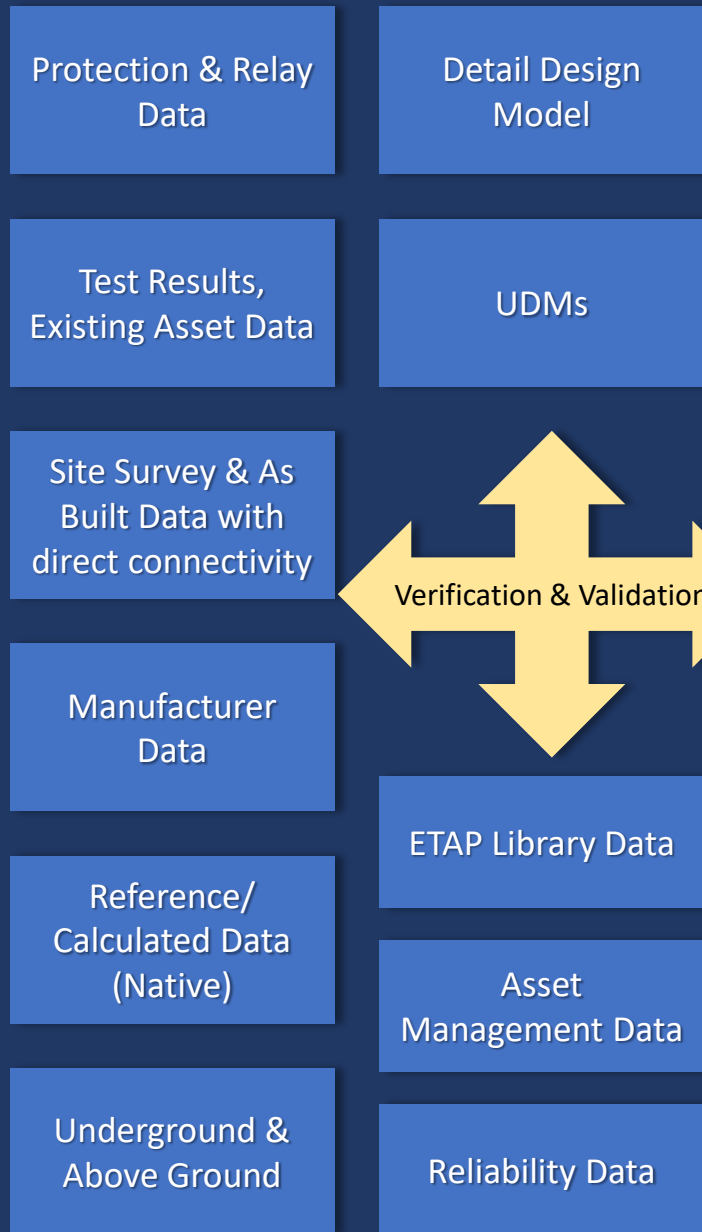
■ Network Model
Visualization

■ Network Model
Analysis

ETAP's Design & Engineering

SCADA & Automation

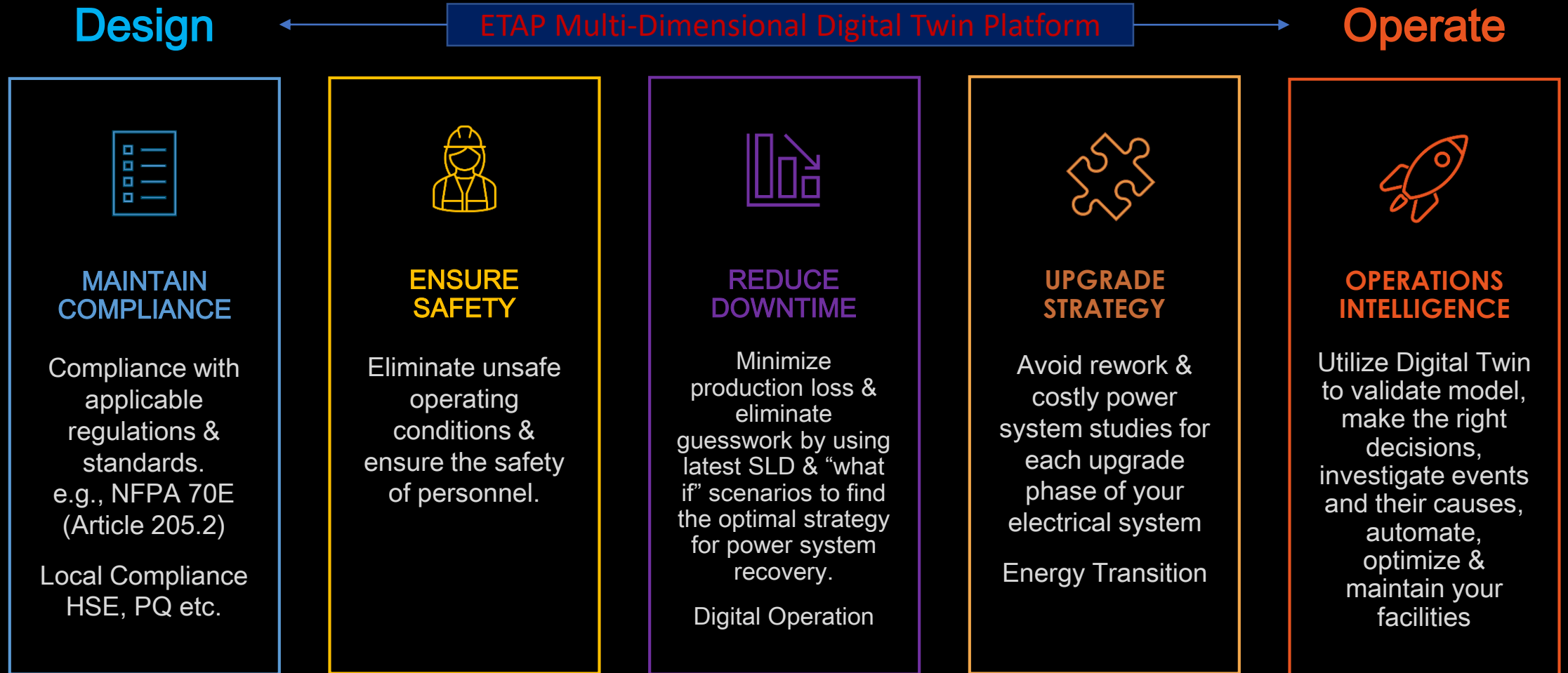
ETAP's Advance Function



Design, Engineering & Consulting

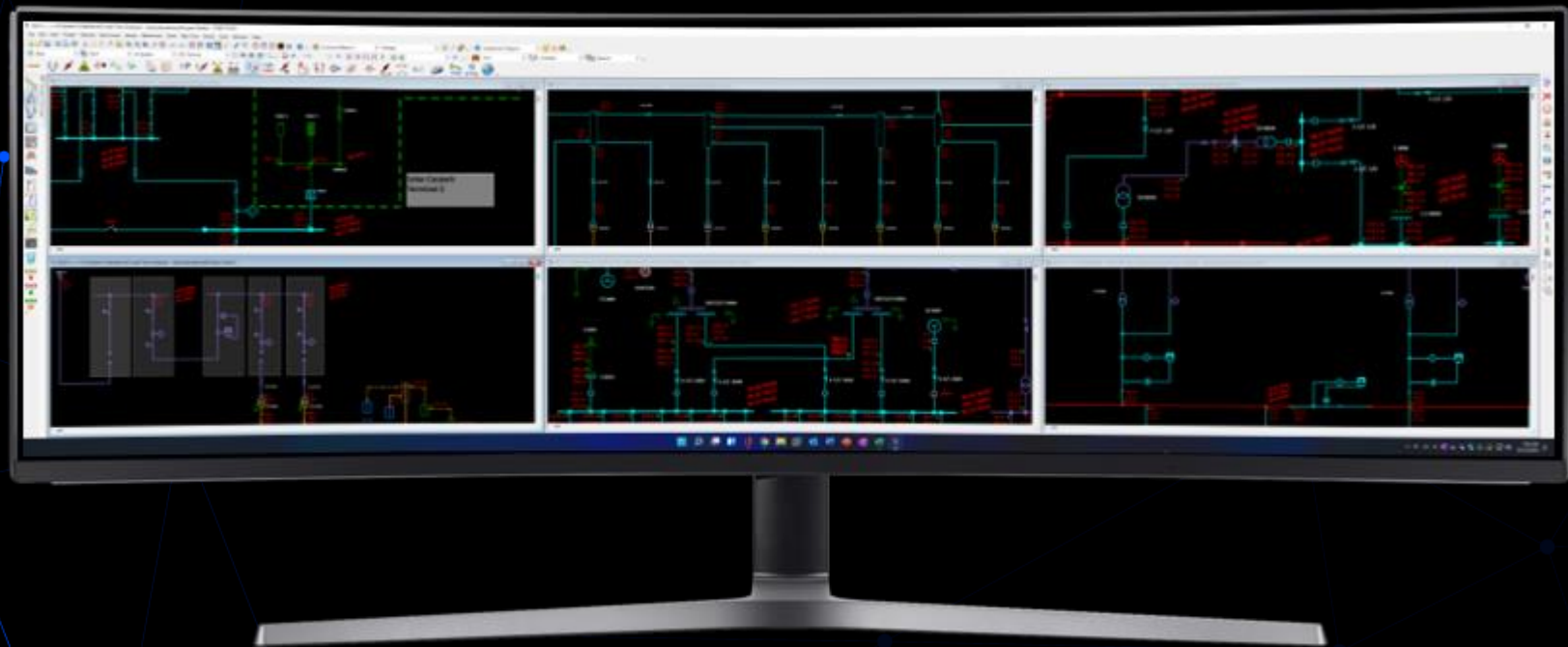
Operation, Maintenance & Extension

Keeping Digital Twin Current is Essential



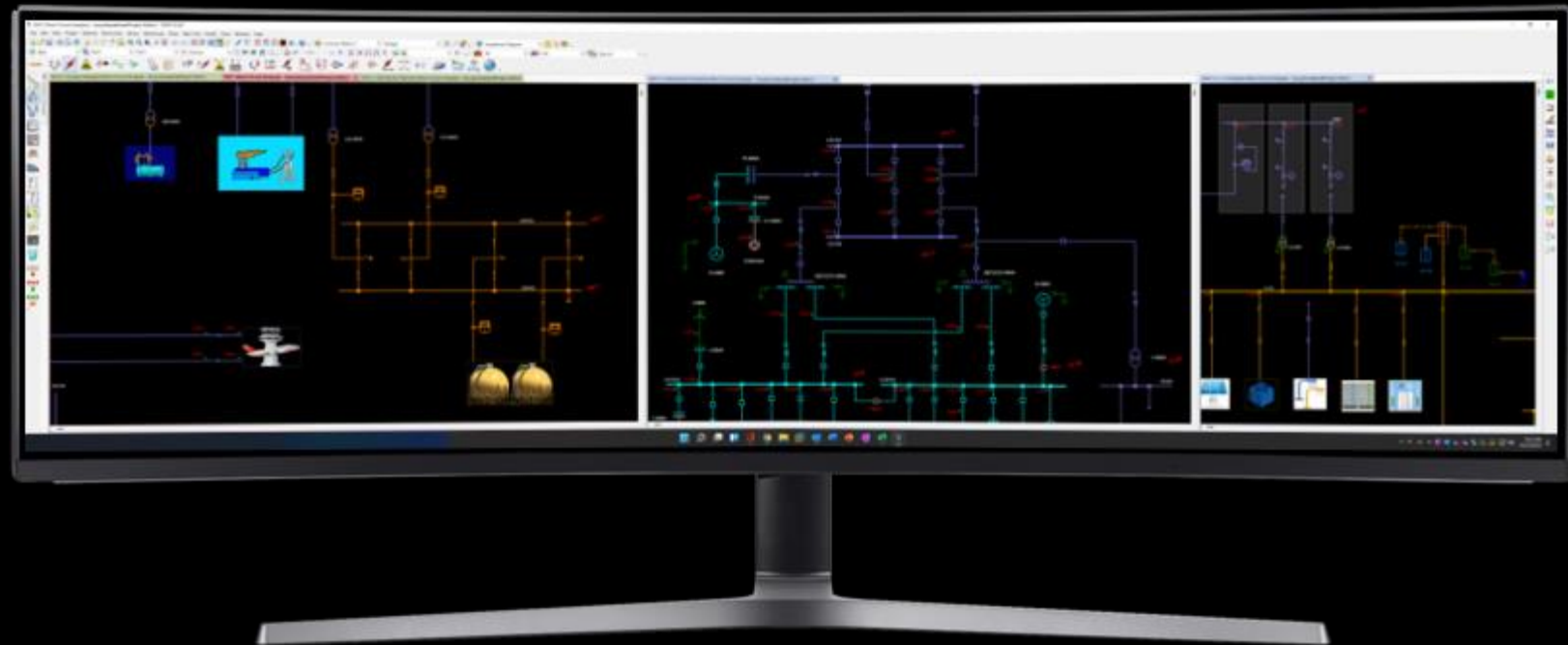
Digital Twin is Essential

- Utilized for preparing a critical response plan with validated model
- Enables personnel to understand design of the electrical distribution system
- Road map for future operation, testing, service & maintenance activities
- Digitized SLD is the foundation of the Electrical Digital Twin for Design & Operations

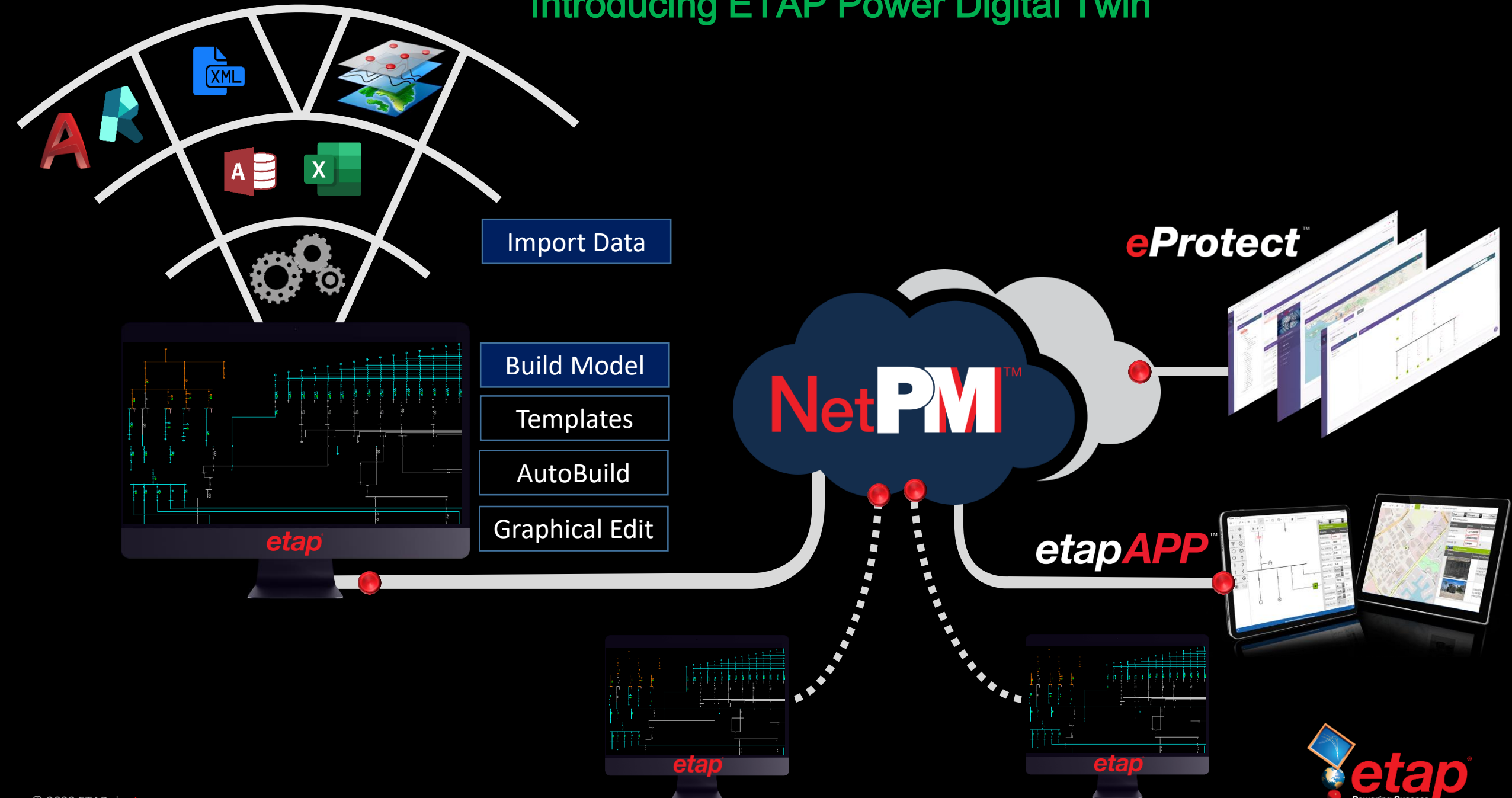


System Modeling (Digital Twin Foundation)

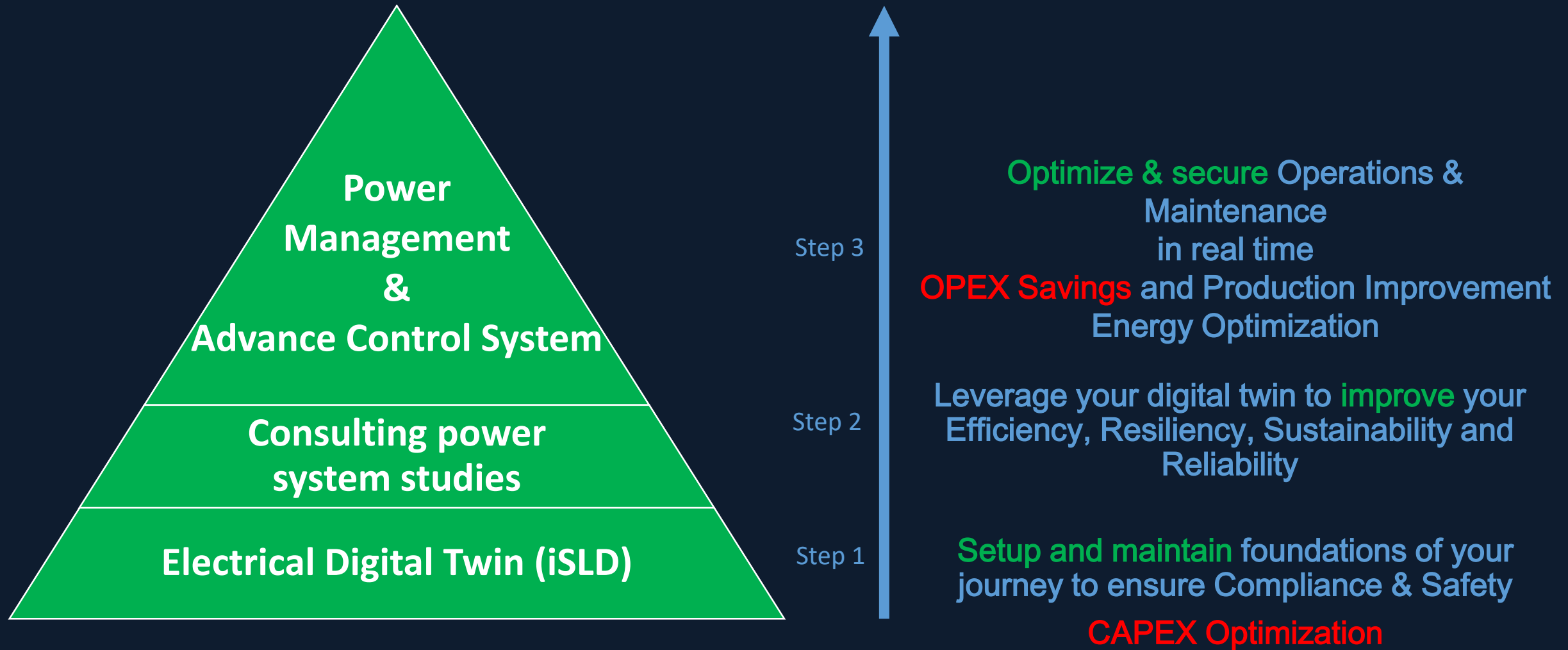
A single-line or one-line diagram is a vital representation or a blueprint of a multi-phase power system at every stage of Asset (Design-Expansion)



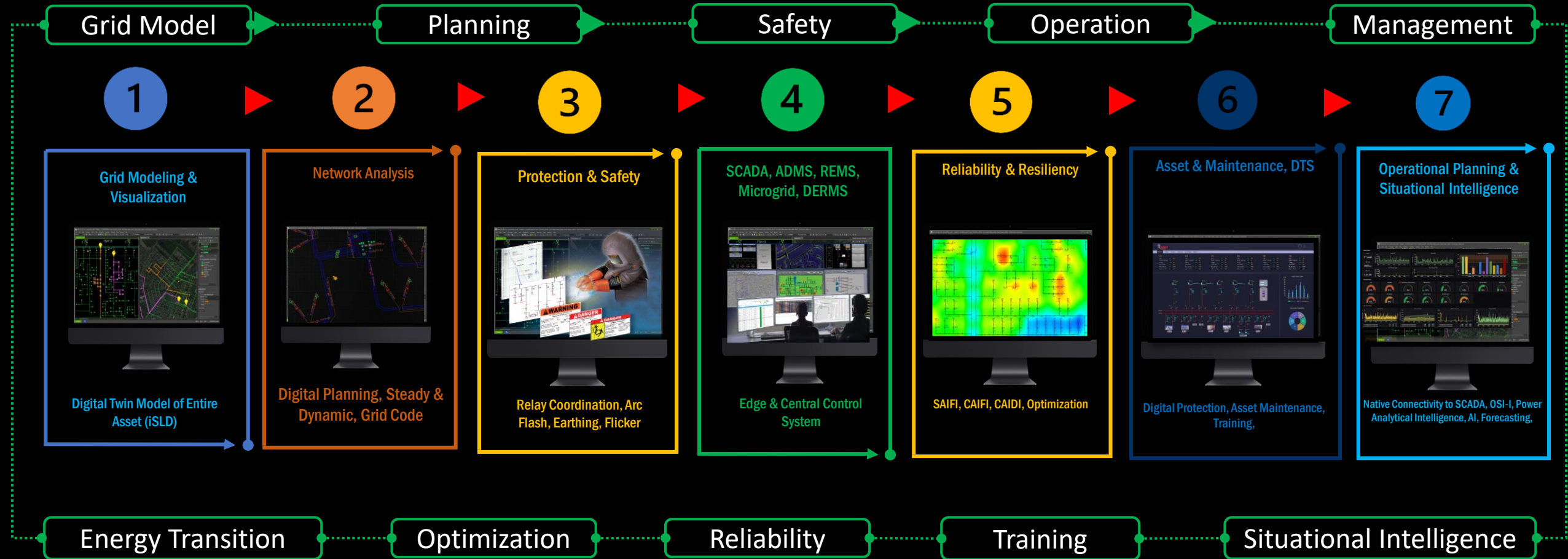
Introducing ETAP Power Digital Twin



Key takeaway: Partner with ETAP for your digitization journey



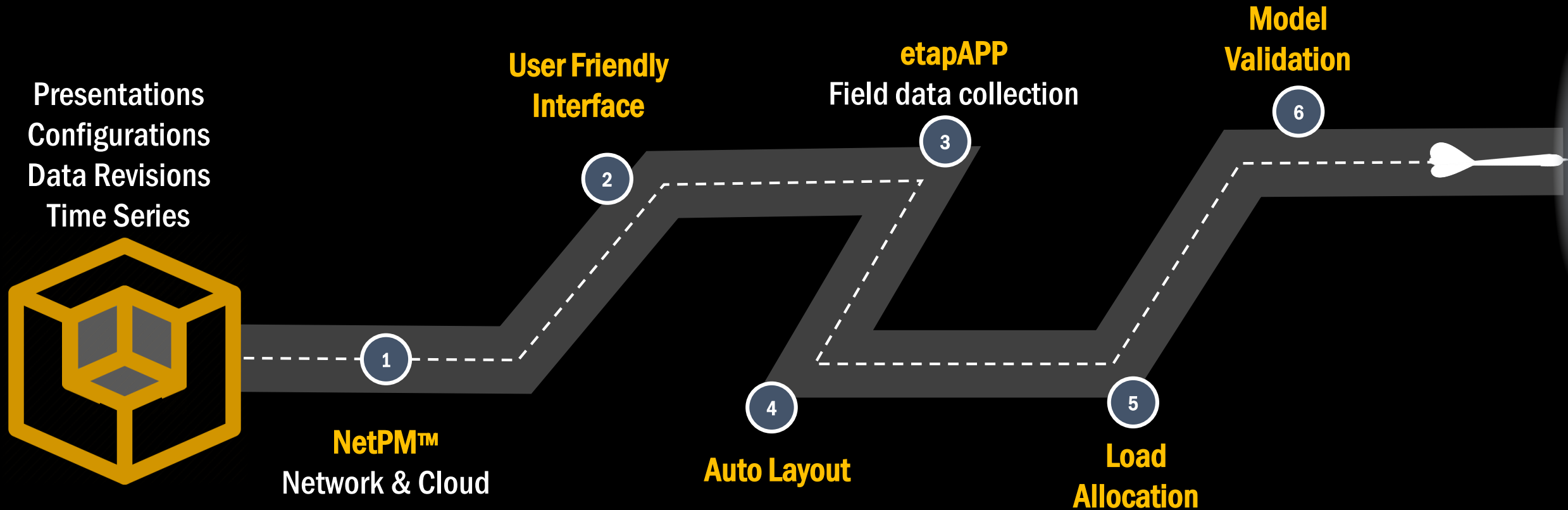
Digital transformation Strategy & Evolution



ETAP Intelligent Digital Twin with Unified Model & Database for complete Digitization of Utility at each phase with IT & OT convergence.

ETAP Digital-Twin Journey

Unified Platform – Multi Dimension Modeling

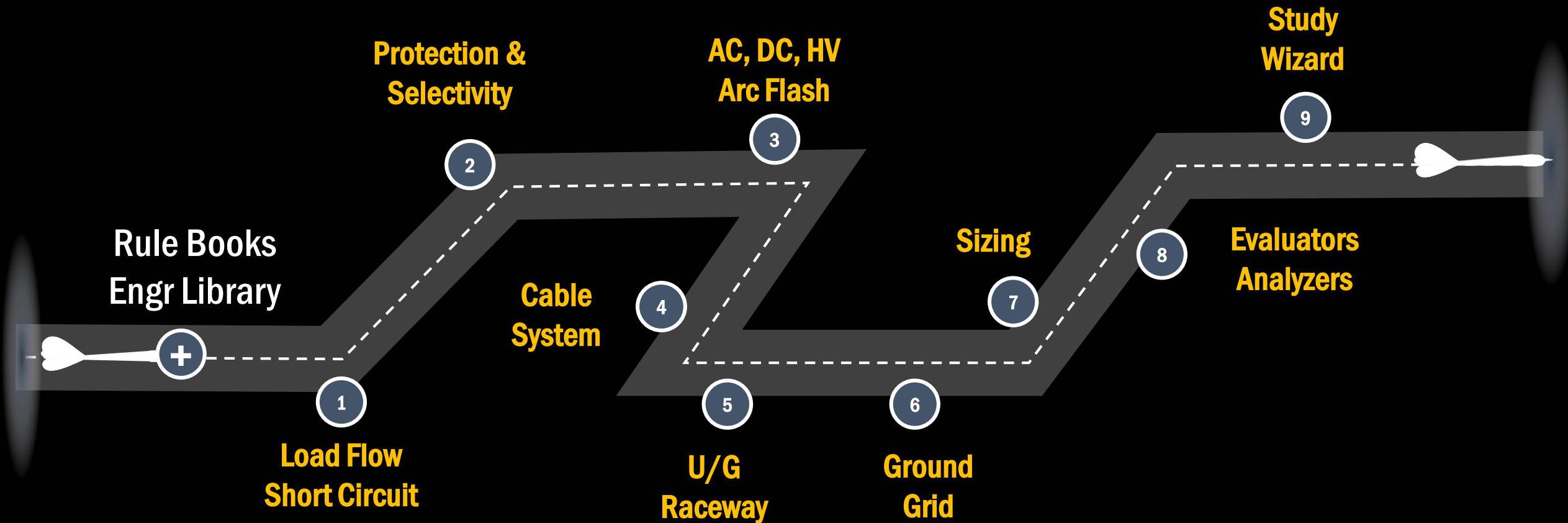


LV, MV, HV, AC, DC, Unbalanced Systems

ETAP Digital-Twin Journey

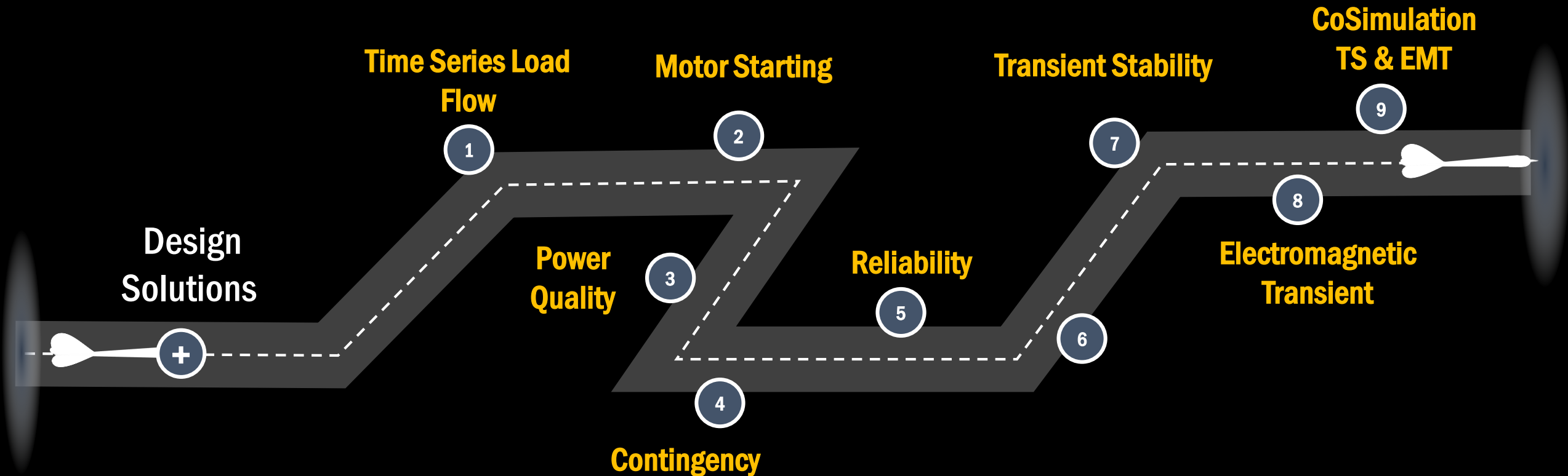
Design Solutions

Design with Confidence



ETAP Digital-Twin Journey

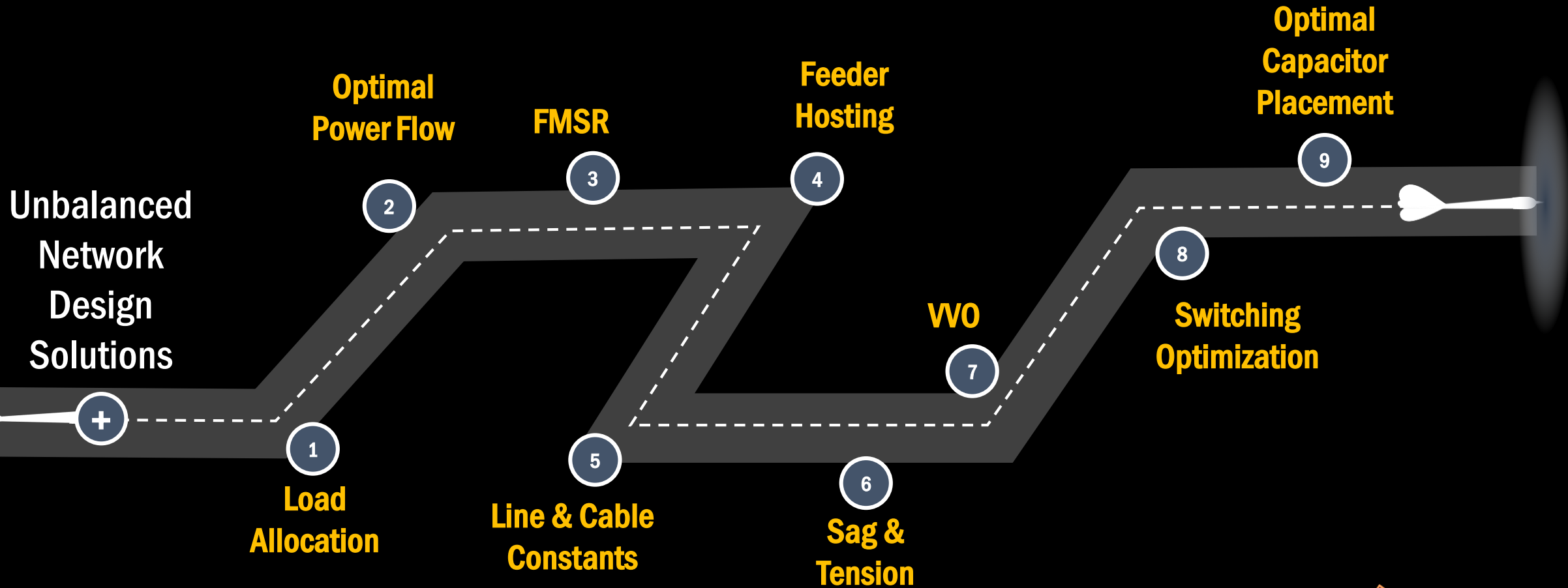
Advanced Design Solutions



Complex Analysis with Ease & Assurance

ETAP Digital-Twin Journey

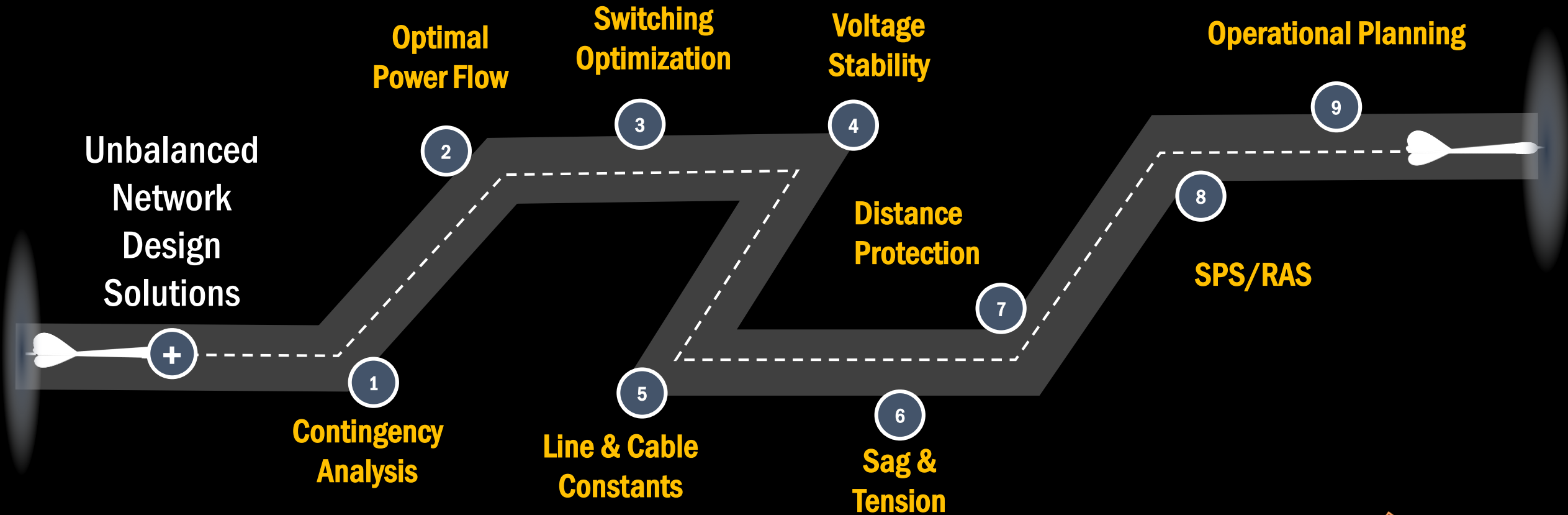
Distribution Network Analysis - DNA Solutions



Radial, Looped Configuration

ETAP Digital-Twin Journey

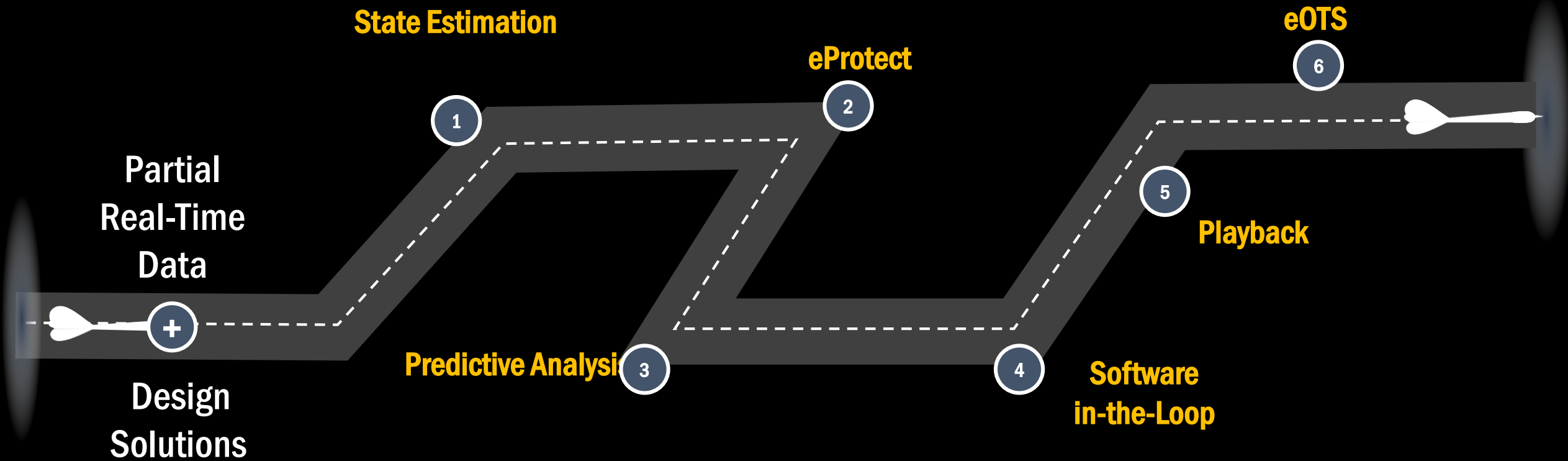
Distribution Transmission Analysis - TNA Solutions



Radial, Looped Configuration

ETAP Digital-Twin Journey

Commissioning Solutions

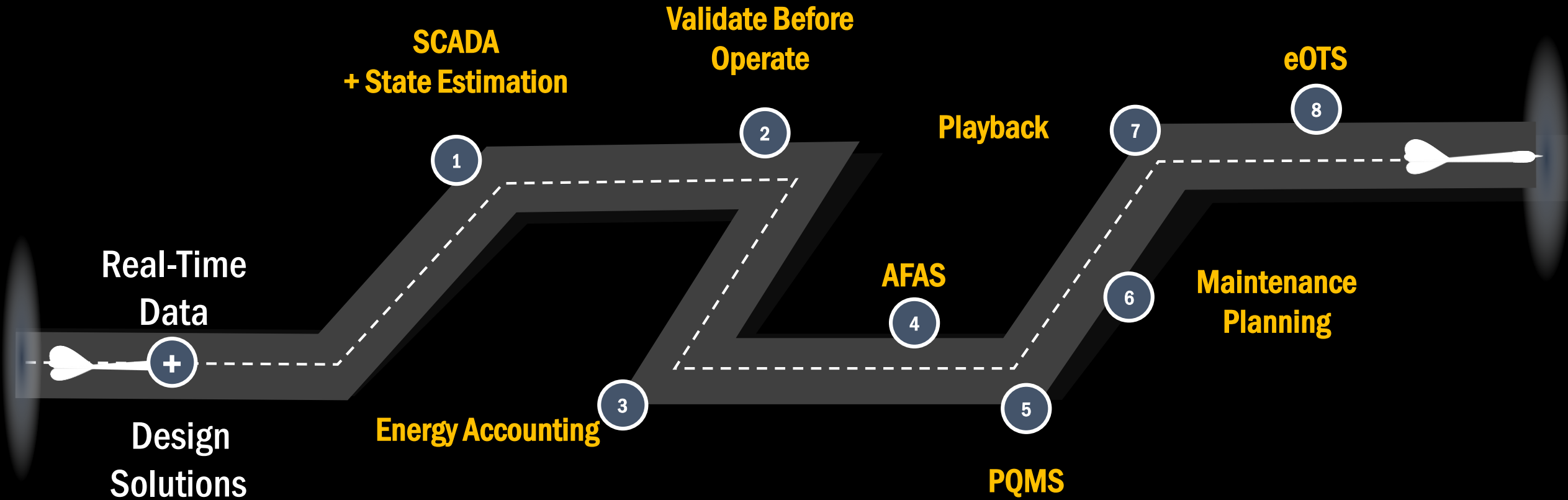


V&V Commission Actions +/- Real-Time Data

ETAP Digital-Twin Journey

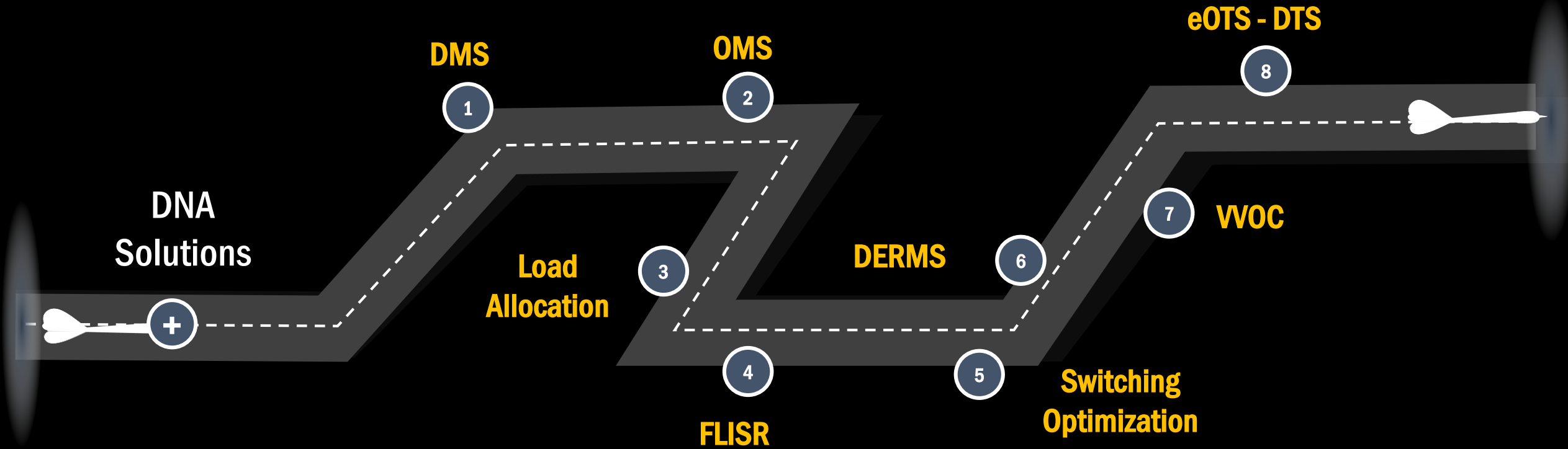
Power Monitoring & Management - PMS Solutions

Situational Intelligence



ETAP Digital-Twin Journey

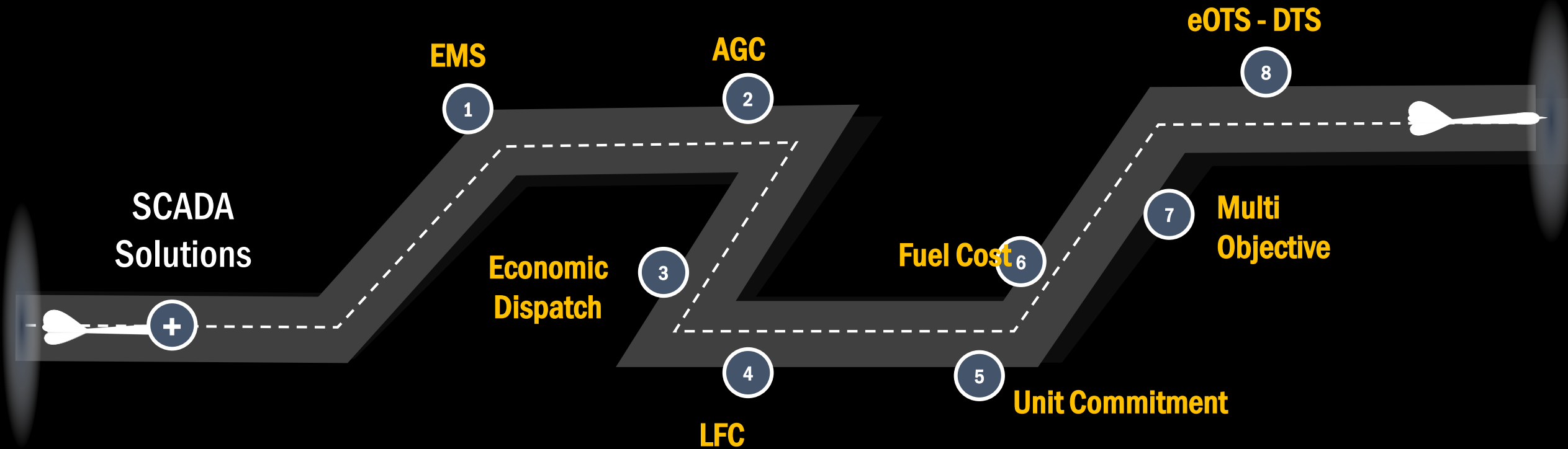
Advanced Distribution Management - ADMS Solutions



Radial, Looped, any Configuration

ETAP Digital-Twin Journey

Energy Management - EMS Solutions



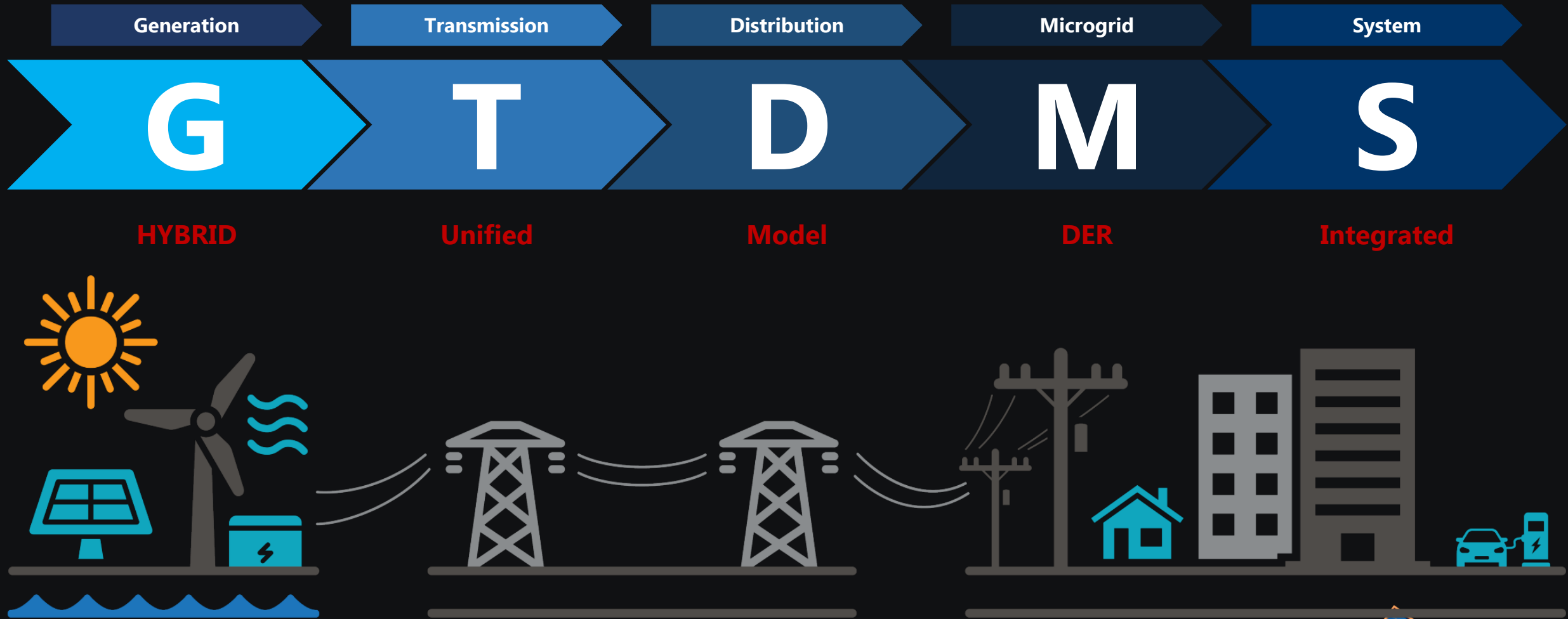
Radial, Looped, any Configuration

etap[®]GTDMs

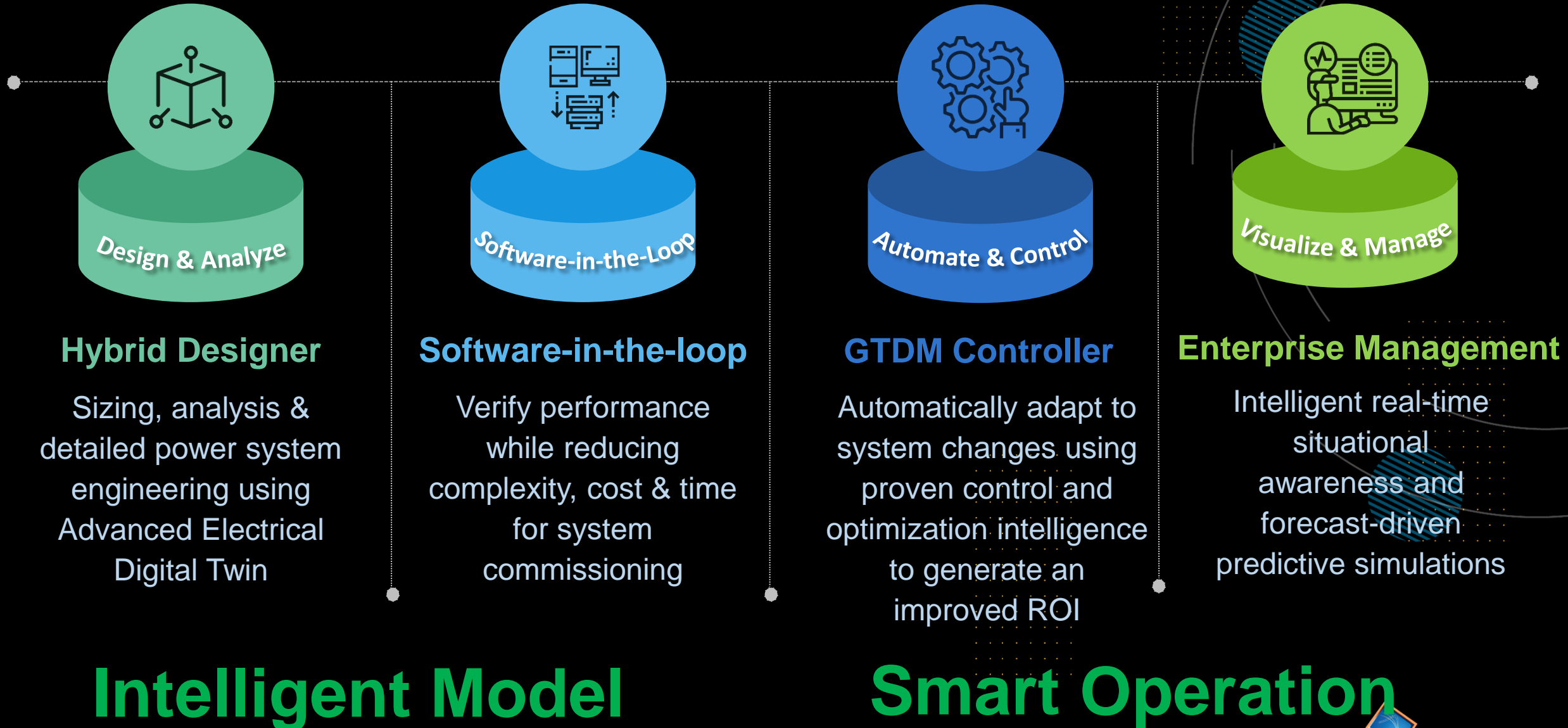
New Frontiers in Digital Transformation for a Sustainable Future



Introducing Connected *etap* GTDMS



End to End lifecycle: from Design to Operations



Building the 360 GTDMS Digital Twin (Engineering to Operation)

Power System Modelling (Design Twin)

Power operation, Planning, Maintenance, Management (Operation Twin)



Design & Build

"As designed SLD"



Operate & Maintain

"As operated Model"

Design & Construct

Network Model,
UDM, UGC, GGS

Transformer Sizing,
Arc flash, Distance
Prot., Unified SC,
Power Quality

Project
Management &
Network Modelling
(NetPM)

Power System Planning

Hybrid Network Model
(Digital Twin)

Steady & Dynamic
Analysis

Balanced &
Unbalanced Network
with renewable

EMTP Co-Simulation
with Electrolyzer Black
Box Model

Analyze

Electrical Network
Analytics

Microgrid Designer

PPC Designer

Protection, Safety &
Power Quality

Power Automation

Intelligent
Substation
Automation

RTDS

S/S Protection
Management

Switch Plan
Analysis & SOM

Real Time Simulate

Power System
Management
Simulation
(PSMS)

Operator Training
Simulator
(eOTS)

Predictive
Simulation

PPC, Microgrid,
BESS EMS &
Hybrid Control

Control Center

Central SCADA,
ADMS & EMS

Intelligent Load
Shedding

Energy Efficiency
& Management

Generation Mgmt.
AGC, ED, UC,

Central eProtect
AFAS

Management

Dashboards and
Reporting

Integration with PI
Vision

Real Time System
Planning &
Simulation

eRAMS/
Maintenance
Planning System

Feasibility

Pre-FEED/FEED

Engineering

Detailed design

Commissioning, Startup

Operate

Optimize

Training

Maintain

Expand

Integrated Power Data Twin (ArcFM integrated Geospatial & SLD Hybrid Model)

Situational Intelligence & Operational Awareness with PI-Vision

ETAP Digitalization for Electrification

etap

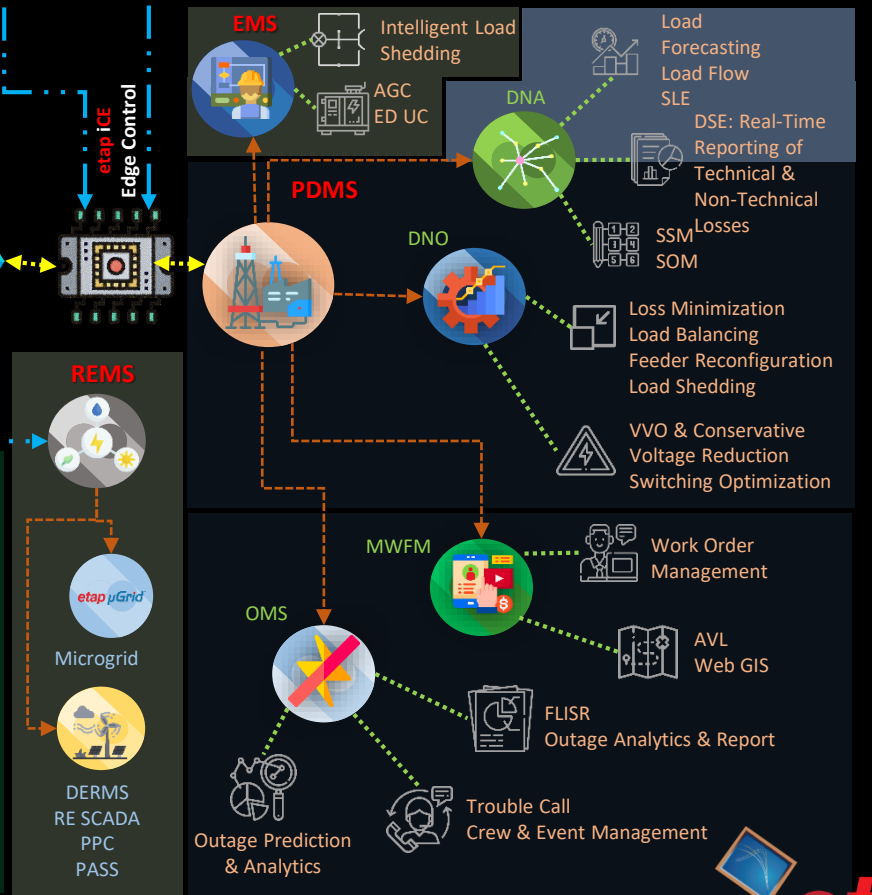
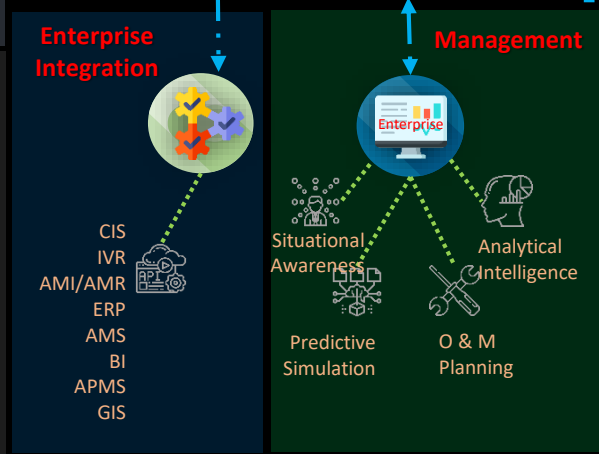
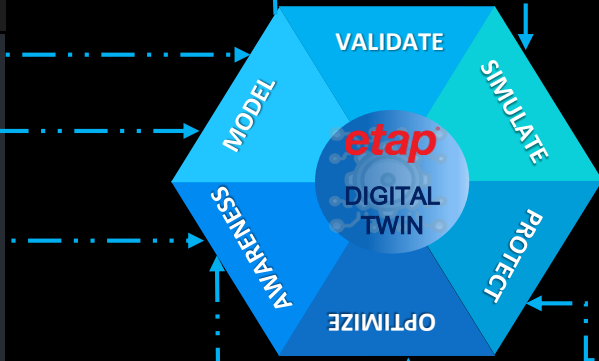
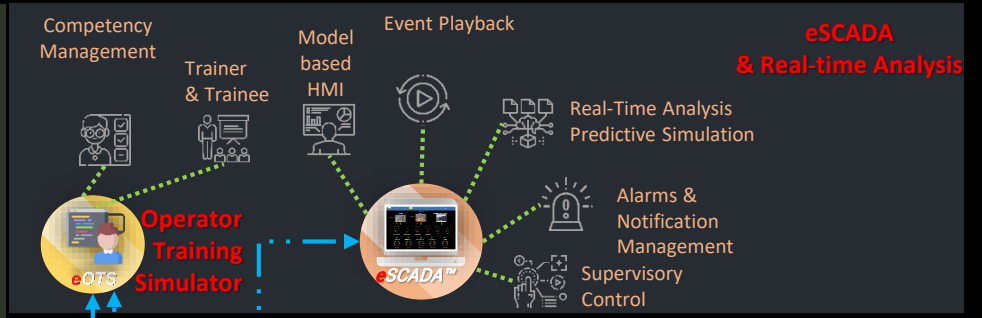
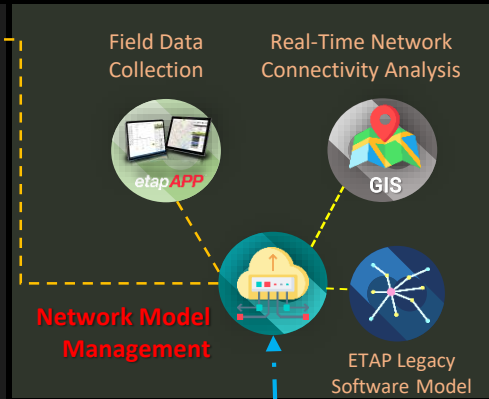
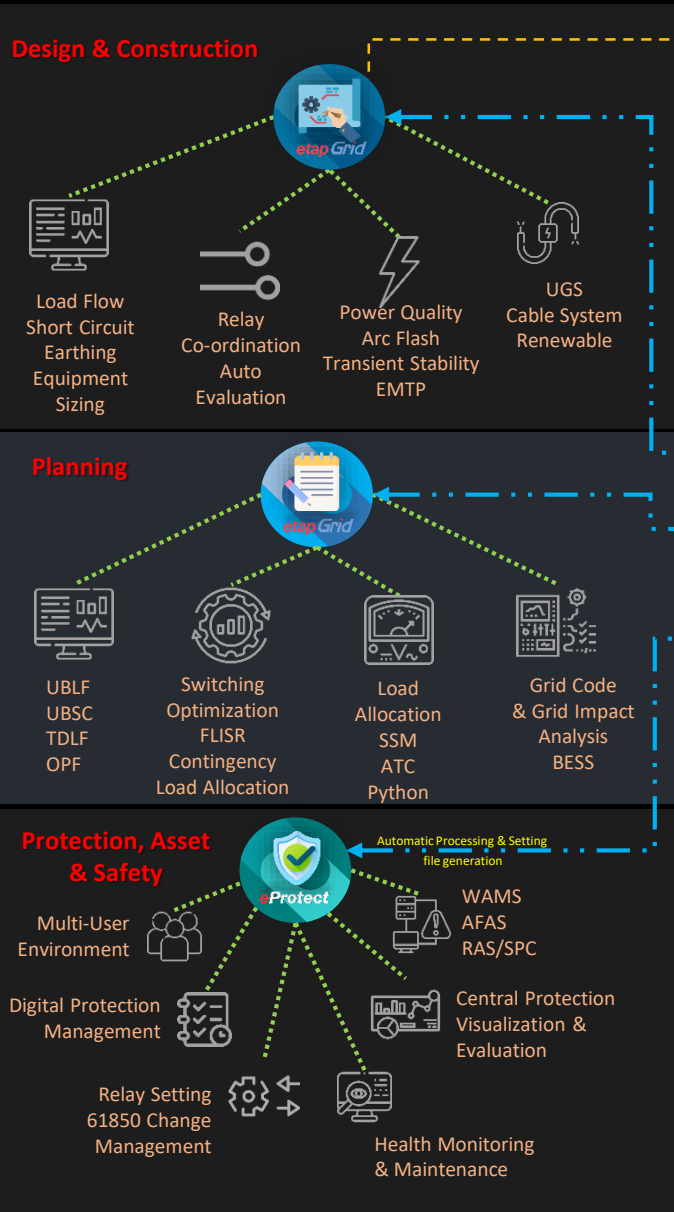
ETAP Digital Power System Services

ETAP Digital Twin & Network Model Management

ETAP Power System Designing



End to End Cybersecurity



Unified Digital Twin Model based Enterprise Platform

CYBER SECURITY STANDARDS – NERC, X.509, NIST, IEC 62443, IEC 62351



Best in class GTDMS Enterprise



Helping to unlock breakthrough capabilities at Edge Control level...

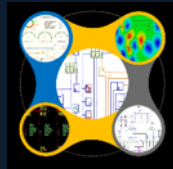
Apps,
Analytics &
Services

Edge
Control

Connected
Products



End to End Cybersecurity



iSLD Digital Twin



Power Advisor



SSM, Safety &
Work Order



Situational Awareness



Power Operation



User Interface



ETAP
eOTS & PSMS



Power Monitoring Expert



MTZ



SMTB



ION



Easergy



PLCs



SMD



Okken MCC



Gutor UPS



Transformer



GHA/MCSET/PIX



T & Ambient Sensors

Power System Design & Analysis Model



Any OEM

Digital twin Model Electrical Distribution Monitoring & Alarming

Power Events Analysis

Power Source & Load Control

Intelligent Load Shedding

Generation Management

Energy Modeling & Verification



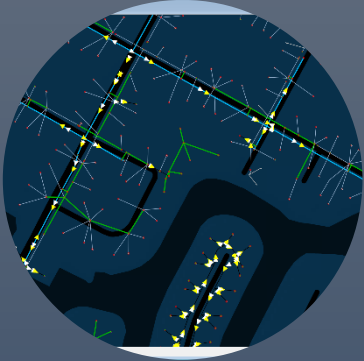
Predictive Simulation & What-if Analysis

Operator Simulation & Training

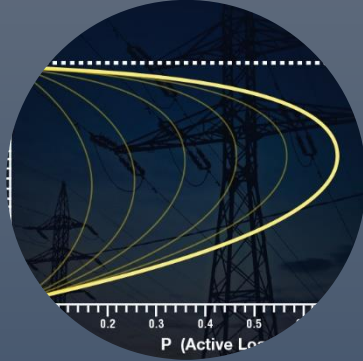
Switching, Safety Management & Work Order

Digital Protection Management & AFAS

Integrated Network Analysis



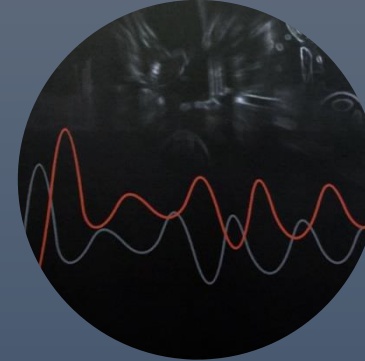
**Geospatial
Intelligent
Diagram**



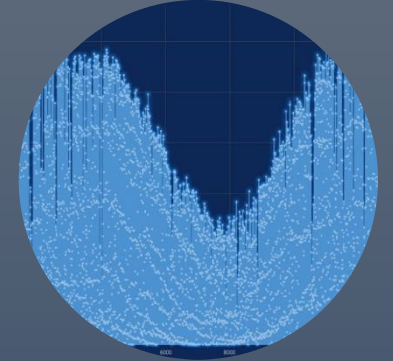
**Voltage
Stability**



**Renewable
Energy**



**Dynamics &
Electromagne
tic Transients**



**Unified
AC & DC
Power Flow**

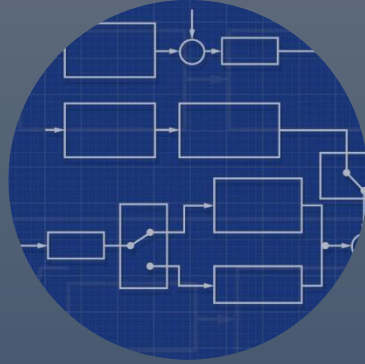


Integrated Network Analysis



**Transmission
Modeling
Compliance**

DPET

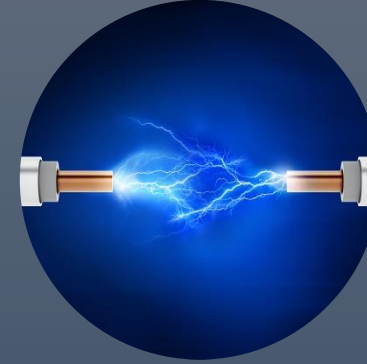


**User-Defined
Dynamic
Models**

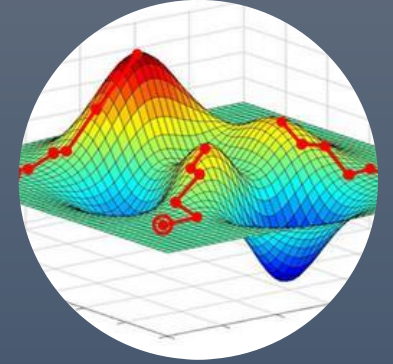
UDM



**Contingency
Analysis**



Short Circuit



**Optimal
Power Flow**



GIS Based Solution for Distribution Network

GIS Model

The GIS software development or enhancement with the complete network Model connectivity, properties, tracing, data warehousing using ESRI Arc-FM GIS Platform

GIS Integration

Further provide the CIM for Integration with ETAP as well as real time SCADA, DMS for analytical visualization



Distribution Network Model (ETAP)

Integration with GIS and creation of detailed distribution network model with feeders and SLD as an electrical digital twin

ETAP Network Planning, Analysis and Optimization

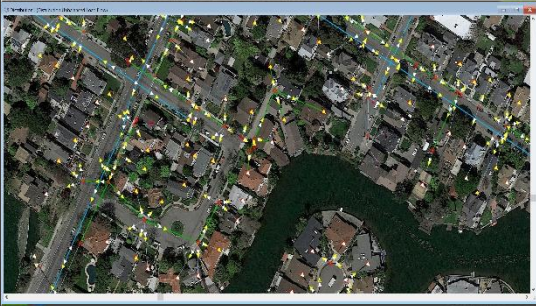
Connecting to MDM, SCADA, ADMS for performing below application:

- Distribution Planning
- Protection
- Network Analysis
- Network Optimization

ETAP Distribution Analysis Solution

Forecast, Analyze, Optimize

Grid Modeling & Visualization



Distribution Network Analysis



Distribution Capacity Planning
DG Interconnection Location & Impact
Improve System Reliability
Optimize Grid Efficiency

Network Model Management

Energy & Demand Forecasting

DER Placement & Forecasting

Power Quality Assessment

Loss Identification – Technical & Non-Technical

Loss Minimization / Reduction

Feeder Routing & Resizing

Reactive Var Reinforcement

Network Protection & Safety

Techno-Economic Planning

Time Series System Dynamics

System Optimization

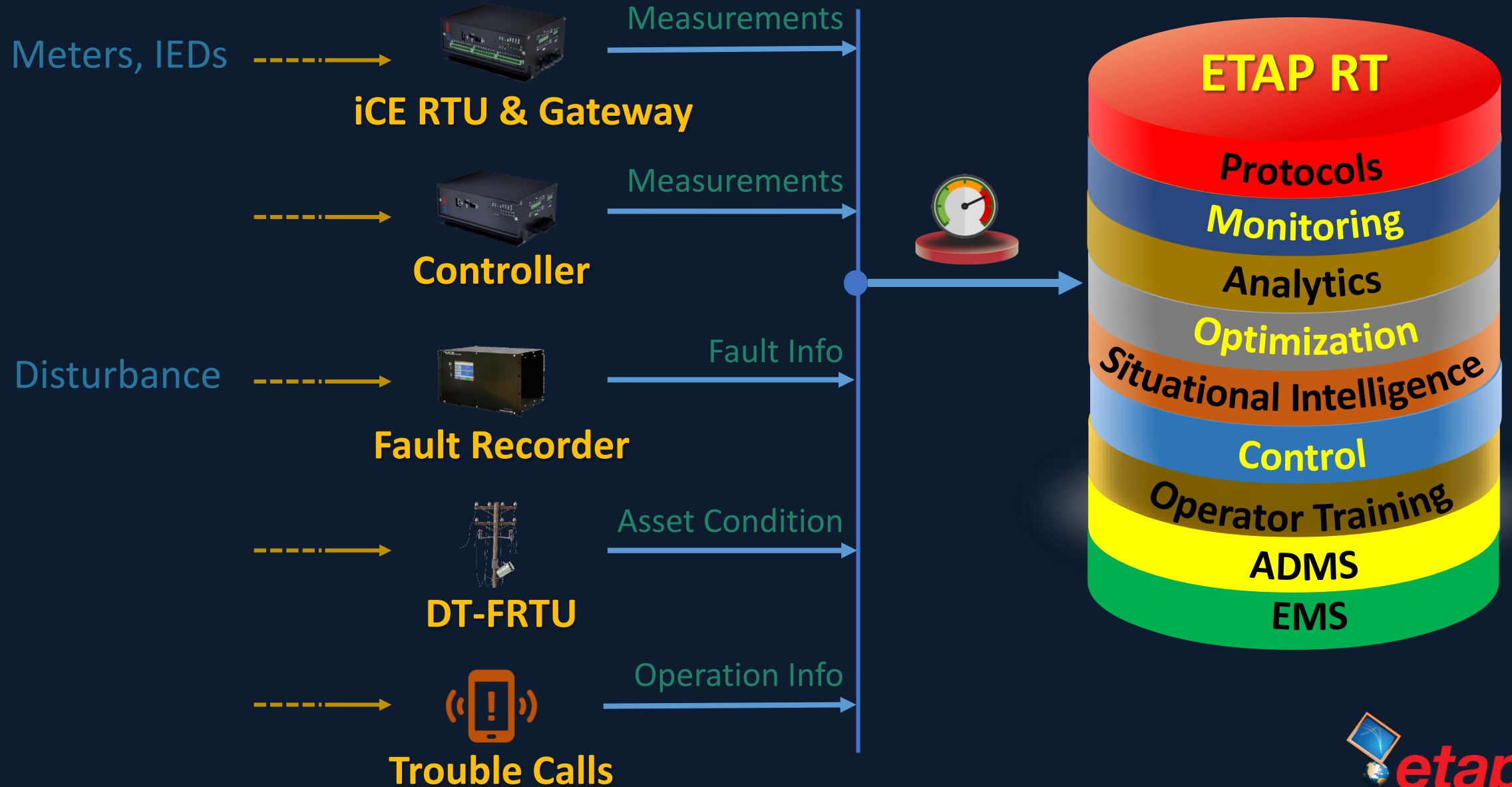
Fault Location Isolation & restoration

Equipment Libraries & Study Automation

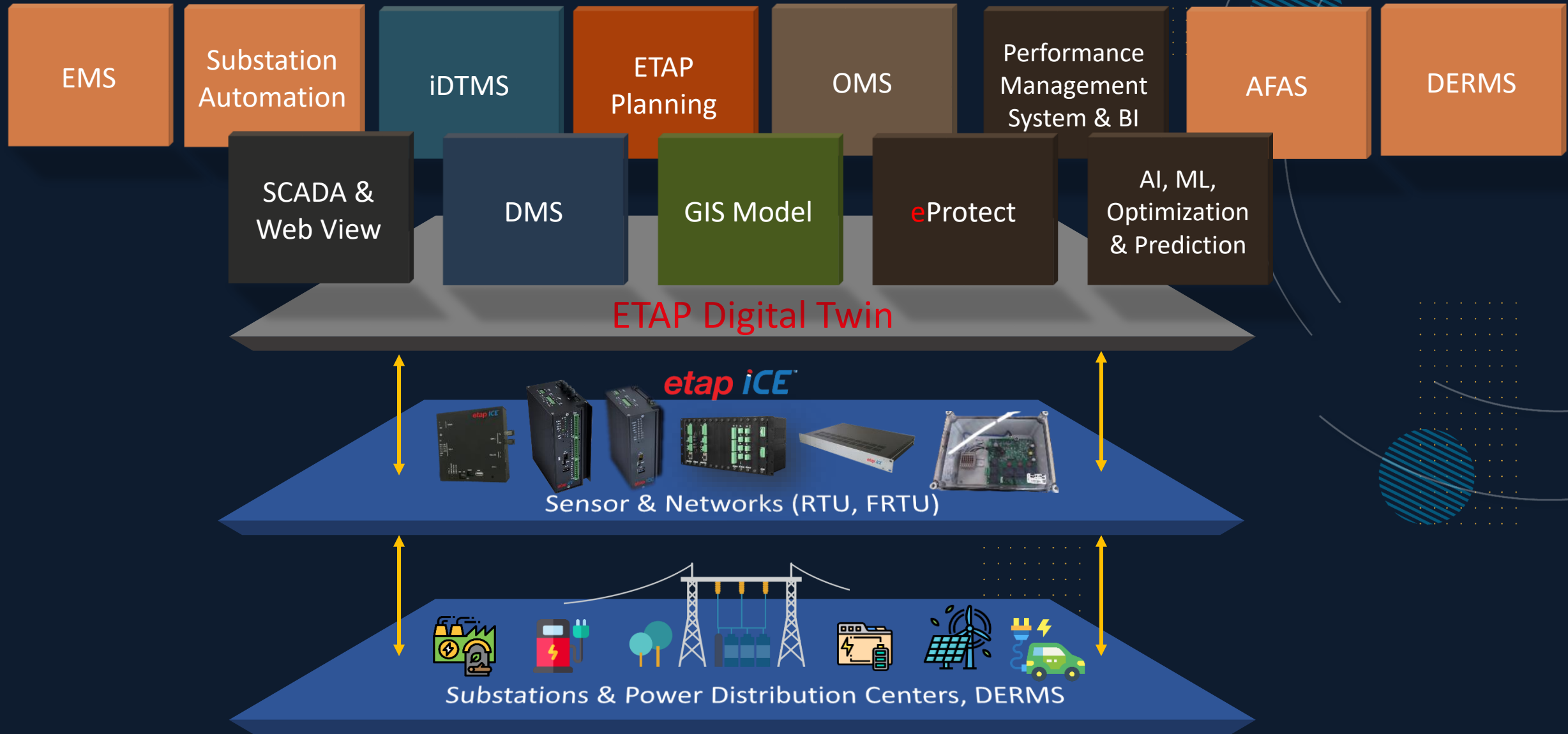
eSCADA & ADMS

The background of the slide is a dark, textured surface with a complex network of thin, light-colored lines and small dots, resembling a digital or neural network. The lines and dots are more concentrated in the lower half of the image, creating a sense of depth and connectivity.

Real-Time Data



ETAP T&D Automation



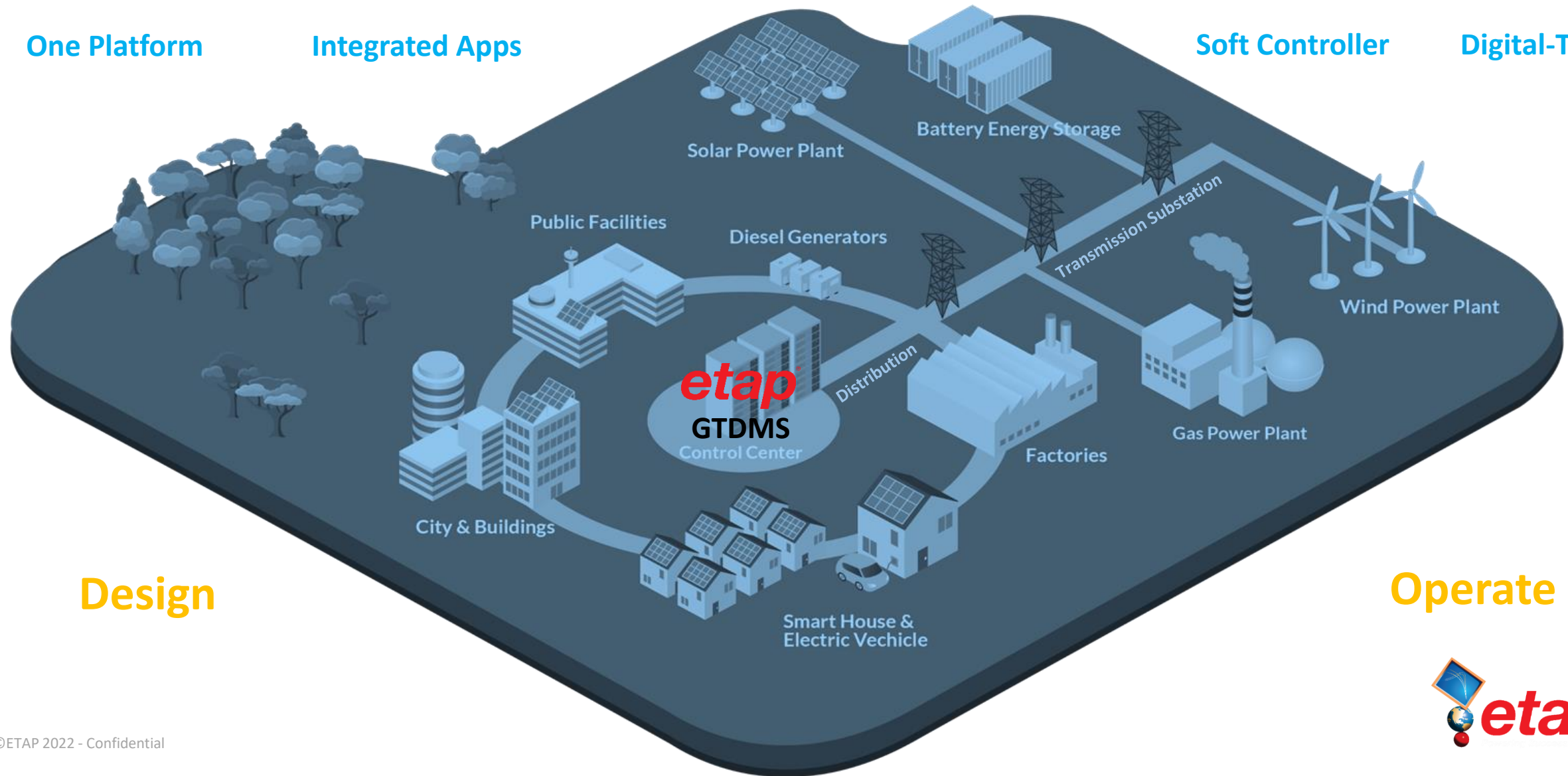
Innovative & Sustainable Transition with *etap*

One Platform

Integrated Apps

Soft Controller

Digital-Twin



Design

Operate

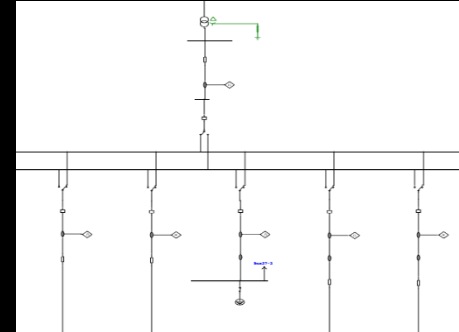
The background is a dark, almost black, space filled with a complex network of thin, light gray lines. These lines connect numerous small, white, circular nodes, creating a web-like structure that resembles a molecular model or a data network. The nodes and lines are more concentrated in the lower half of the image, with some lines extending upwards towards the text.

eProtect

eProtect

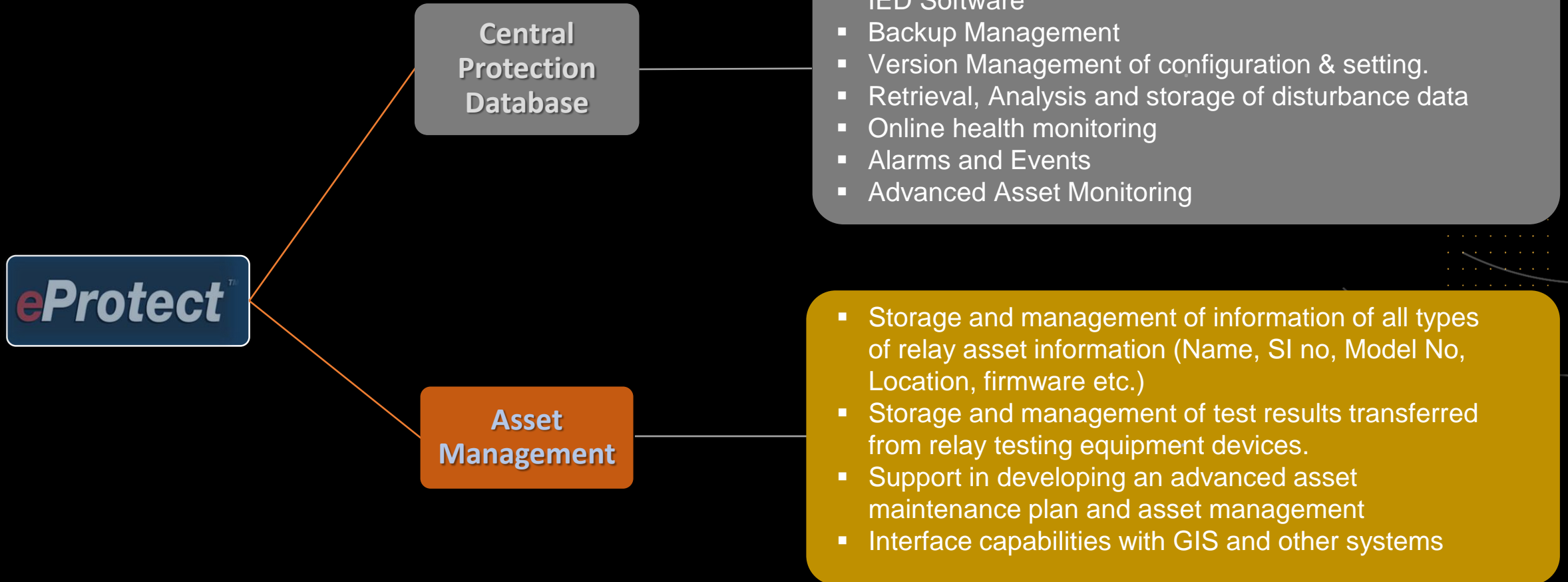
Centralized Web-Based Protection & Asset Management

eProtect is an Enterprise Asset Management Solution for Design, Engineering, Maintenance & Operation of Industrial & Utility Power Systems



- ❑ Increased data quality and access management
- ❑ Automatic processing and relay settings file generation
- ❑ Protection setting sync between a physical relay and ETAP Star PDC
- ❑ Integrated with Advanced Fault Analysis System, AFAS

eProtect Offerings

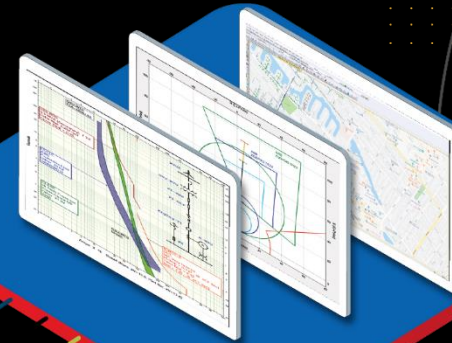


eProtect™

Protection
Relays



Design & Analysis
Workstations



eProtect
Web Clients



- As-Found
- As-Optimized
- Fault Waveform
- As-Designed
- Fault Location
- As-Operated Seq. of Operation

Operator Training

The background of the image is a dark, almost black, field. Overlaid on this field is a complex, abstract network of thin, white lines. These lines connect numerous small, white, circular dots or nodes. The network is more densely packed in the lower half of the image and becomes sparser towards the top. The overall effect is one of a digital or technological landscape, possibly representing a data network or a complex system.

eOTS *Operator / Dispatcher Training Simulator*

Scalable • Proven • Predictable

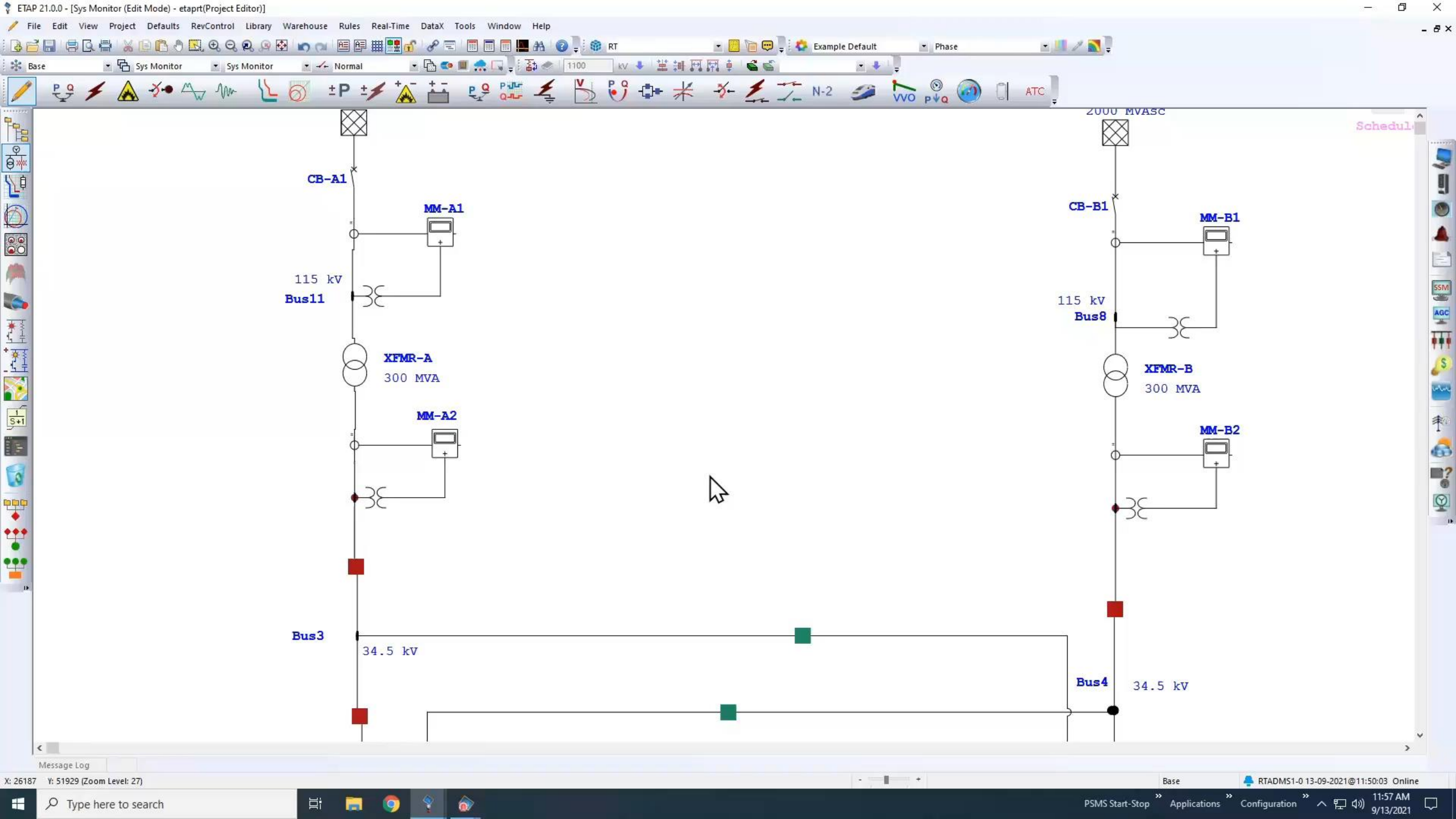


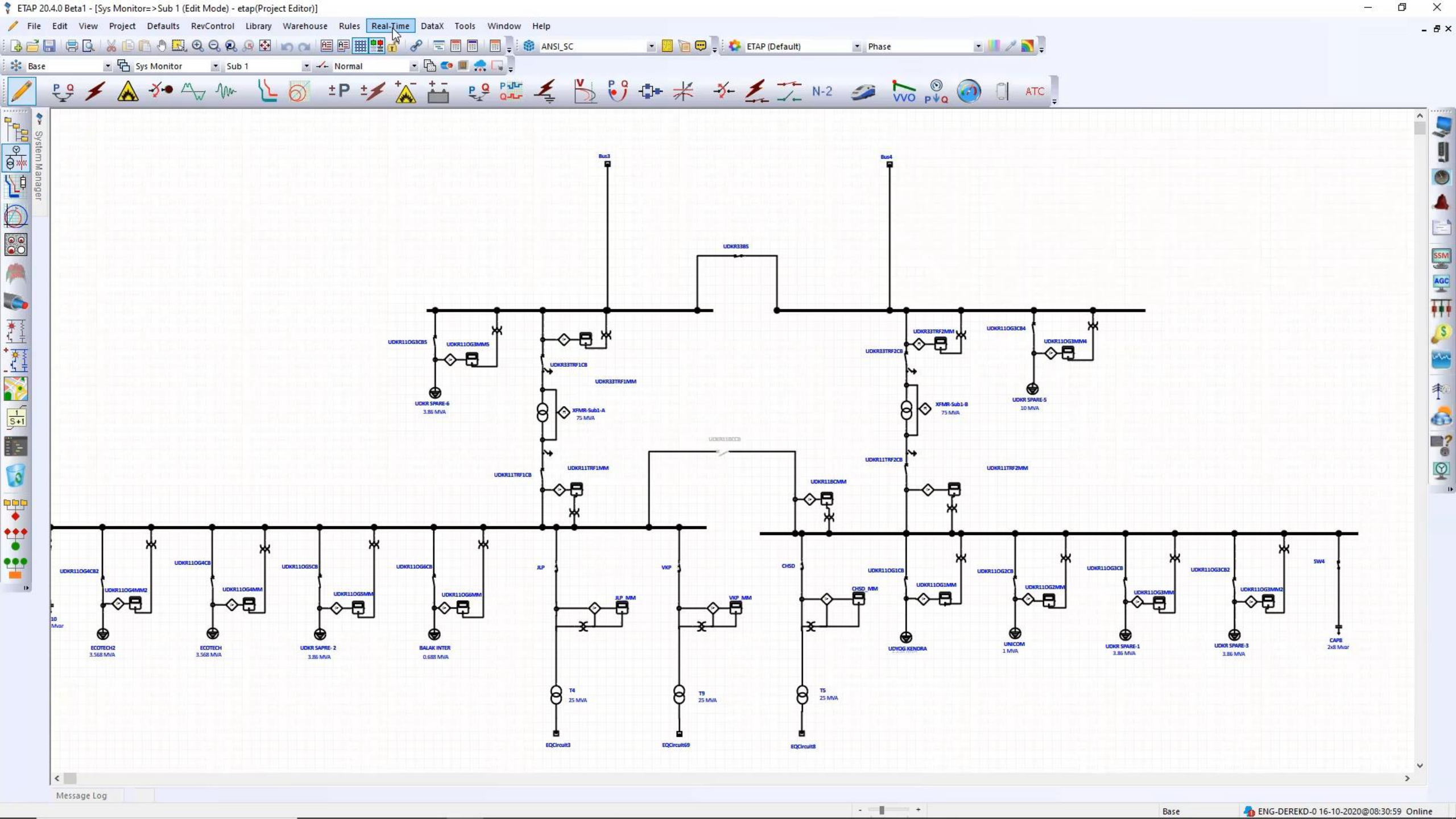
Operation & Control

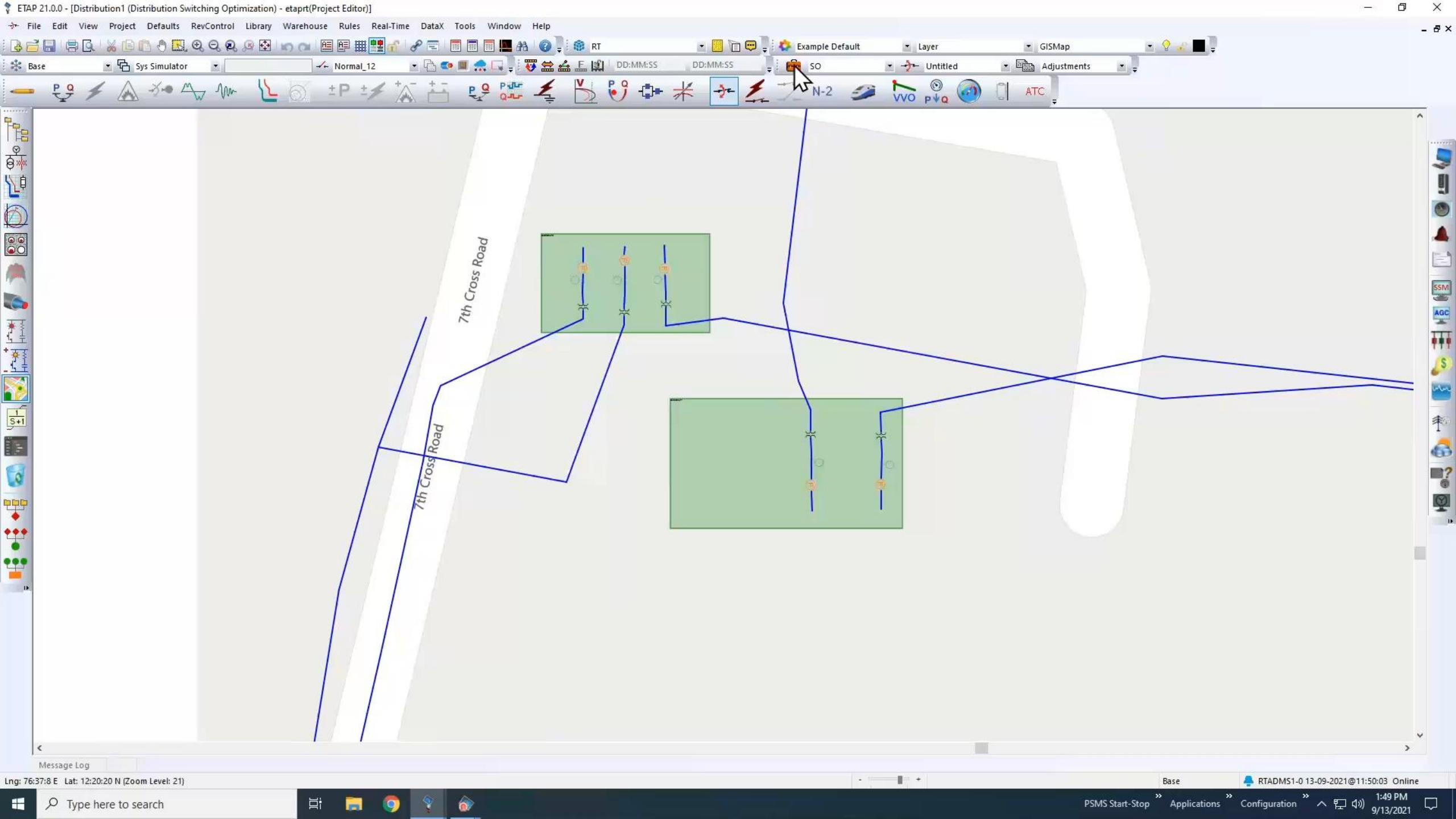
Predictive Analysis

Operator Training to Outperform

- Deep learning in a safe, simulated, non-intrusive environment.
- Improve operator competency through hands-on training.
- Qualify and certify new and experienced operators using standardized operating scenarios and test cases.
- Use of ETAP SIL (Software-in-the-Loop) to emulate user interface and create a high-fidelity training simulator.







ETAP SOM

localhost/SOMC4/

Switching Order Manager

Refresh

New Request

Export

Crew Reviews

Network Change

Classification: All

Switching Orders

Log Out

Welcome Frank.Zhang
August 12, 2021
14:41 hrs

From 8/11/2021 2:39 PM

To 8/19/2021 2:39 PM

Pause Auto Update

Save Filter

Custom Filters

Drag a column header and drop it here to group by that column

S/W O ID	Req Dept	Type of Request	Schedule Start	Duration	Status	Classification	Division	Voltage Level	SO Type	Attachment
0038-081221		Power Transformer Maintenance	8/15/2021 2:26:00 PM	3 hr 0 min	Closed	Administration:: Sub1	Alpha Sub-Division		Planned-Normal	
0037-081221		Power Transformer Maintenance	8/15/2021 2:01:00 PM	2 hr 0 min	Closed	Administration:: Sub1	Alpha Sub-Division		Planned-Normal	
0036-081221	R&D	Outage	8/15/2021 1:16:00 PM	2 hr 0 min	Closed	Administration:: CHSD Feeder	Alpha Sub-Division		Planned-Normal	
0035-081221		Outage	8/15/2021 1:09:00 PM	2 hr 0 min	New	Unclassified			Planned-Normal	
0034-081221	R&D	Outage	8/12/2021 11:38:00 AM	4 hr 0 min	New	Unclassified			Planned-Normal	
0033-081221-1	R&D	Maintenance	8/13/2021 9:48:00 AM	3 hr 0 min	In Progress - Isolation Proceed	Unclassified			Planned-Normal	

Activity Logs

Timestamp	S/W O ID	Revision	Action	By	Request Type
08/12/2021 14:35	0038-081221	9	Switch Plan Execution Closed	jetstream	Power Transformer Maintenance
08/12/2021 14:35	0038-081221	8	Switch Plan Execution In Progress - Restoration Proceed	jetstream	Power Transformer Maintenance
08/12/2021 14:35	0038-081221	7	Switch Plan Execution In Progress - Restoration Proceed	jetstream	Power Transformer Maintenance

Export to Excel

Attribute	Value
S/W O ID	0038-081221
Revision	9
Type	Planned
Req Dept	Automation
Type of Request	Power Transformer Maintenance
Requested on behalf	etaprt
Department	
Schedule Start	2021-08-15T14:26:00-07:00
Duration	3 hrs 0min
Actual Duration	3 m
Status	Closed
Requested By	Frank.Zhang

Crew Coverage

Start SOEnd SO

Related Switching Orders

Related Switching Orders

Rel...Type of R...Status

AddRemoveSave

web.microsoftstream.com is sharing your screen. Stop sharingHide

localhost/SOMC4/

Windows Taskbar

Cypress2 LinksCypress4 Links

2:41 PM 8/12/2021

