

Industry 4.0 Projects in the Energy/Power Sector Implementation and business models

CIBO Conference

May 14th 2024

Ben Janvier – Enero Solutions



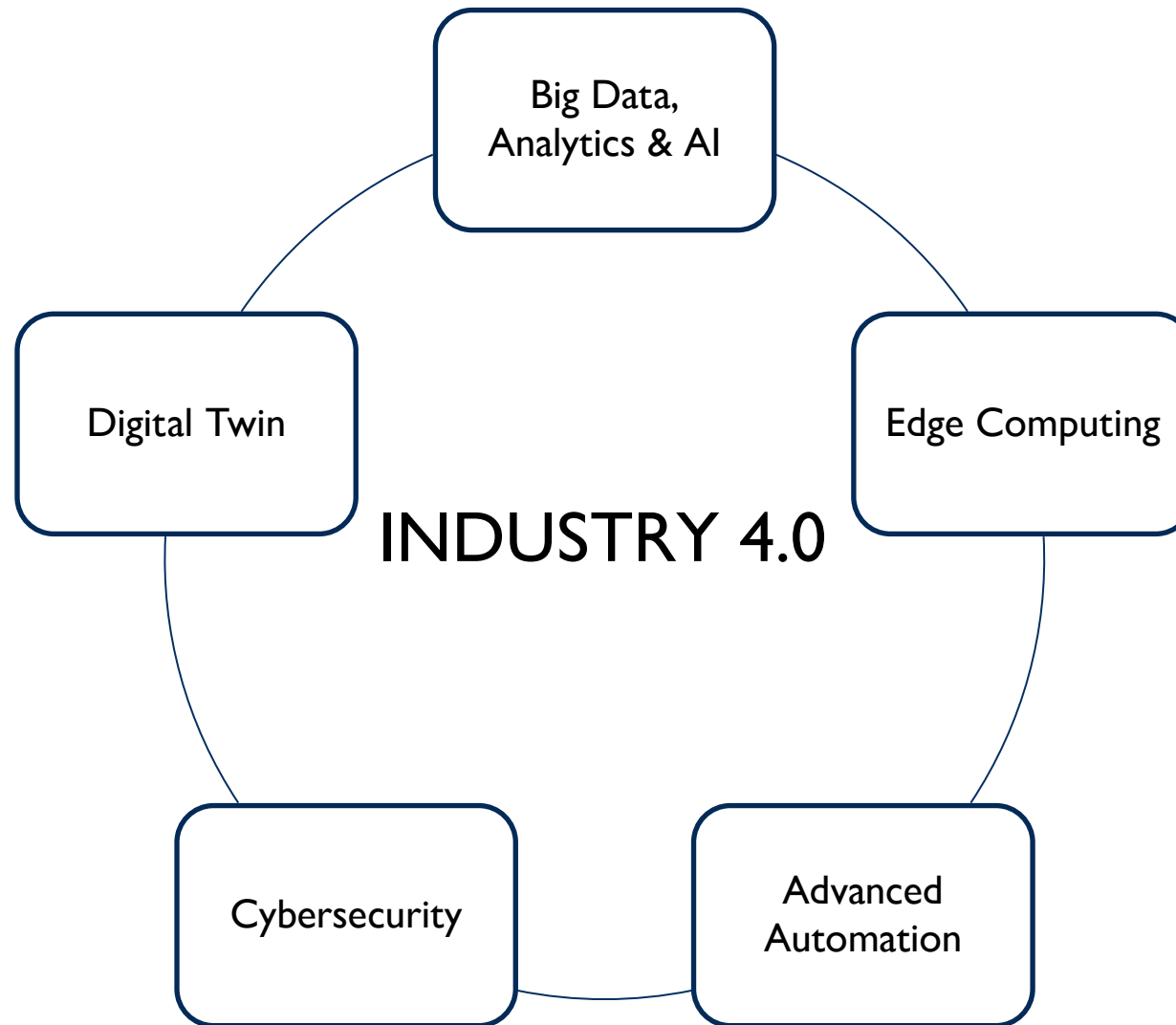
About this presentation...

1. Present Enero Solutions
2. Review Industrial 4.0
3. Industrial 4.0 Project: project execution, financing and where does each technology fits (with its **buzzword**)
4. Get to reception

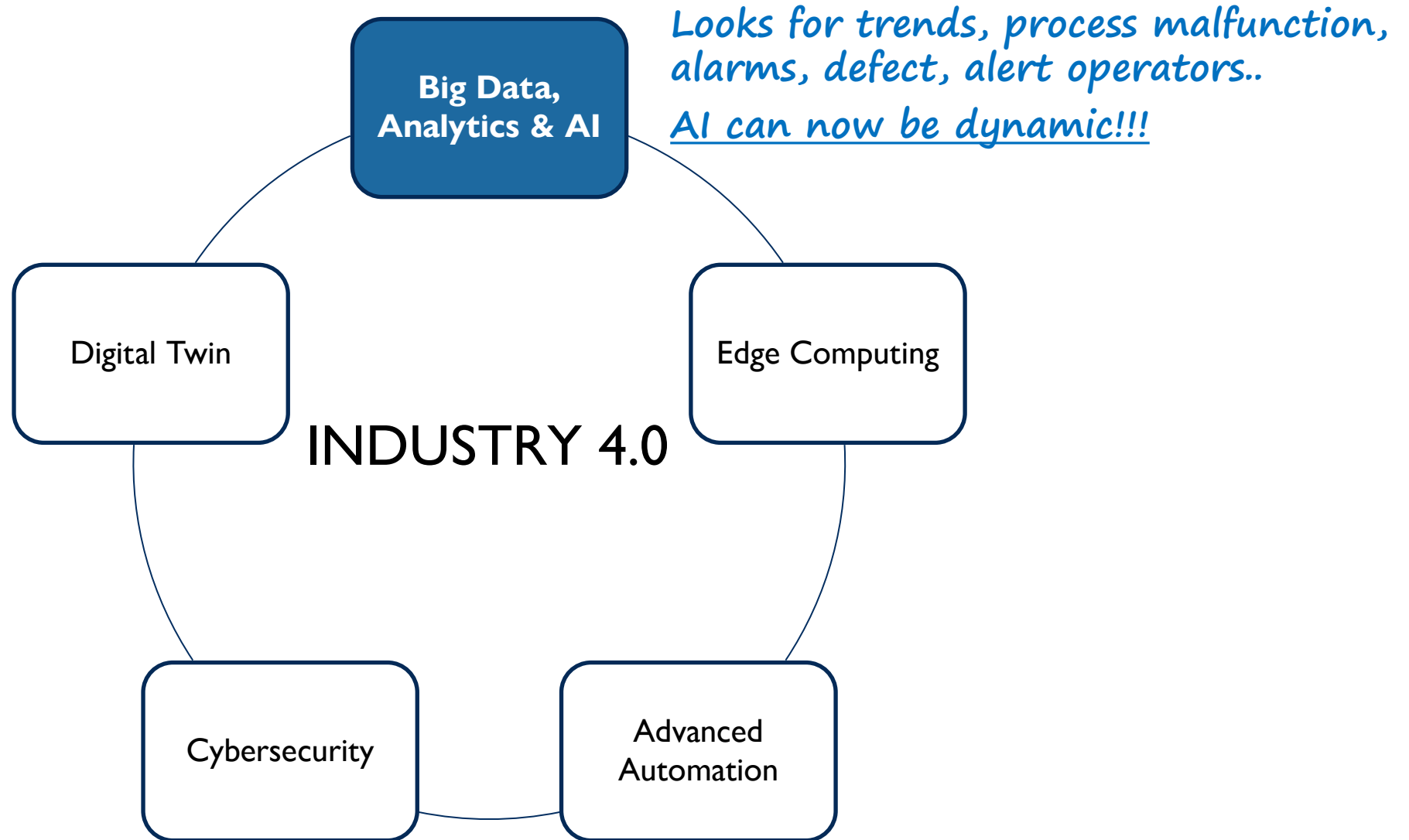
About Enero Solutions

- Founded in 2004
- Engineering services and process control products
 - Process control, tuning and optimization services
 - Advanced controls: Steam Plant Controls, Boiler Controls, Power Contract Optimization, etc.
- Hardware-Software Solutions:
 - Process simulator for operator training and software testing
 - Loop tuning software
 - Instrumentation and Process Performance Dashboard
 - Data-diode and Cybersecure remote performance monitoring

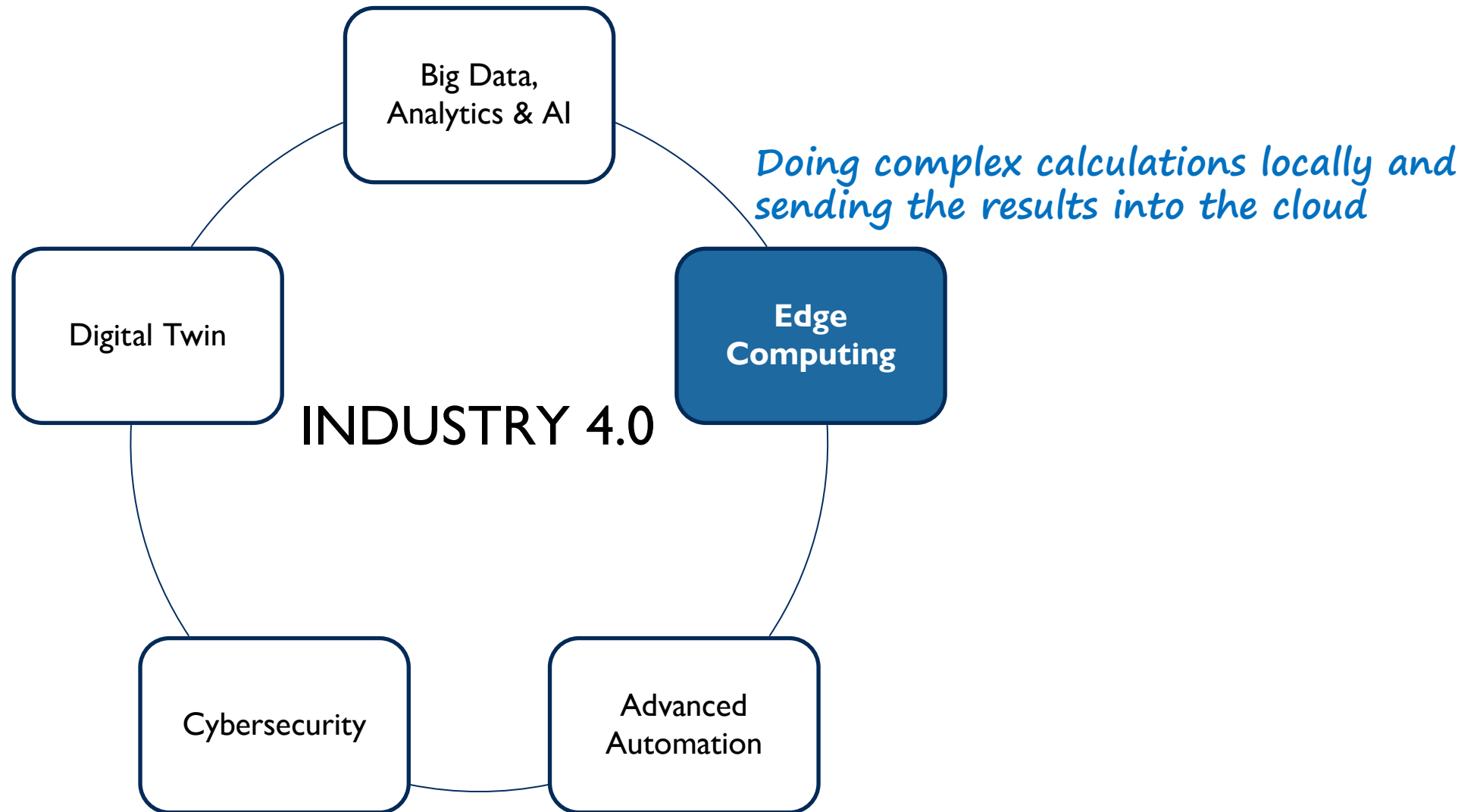
Pillars of Industry 4.0



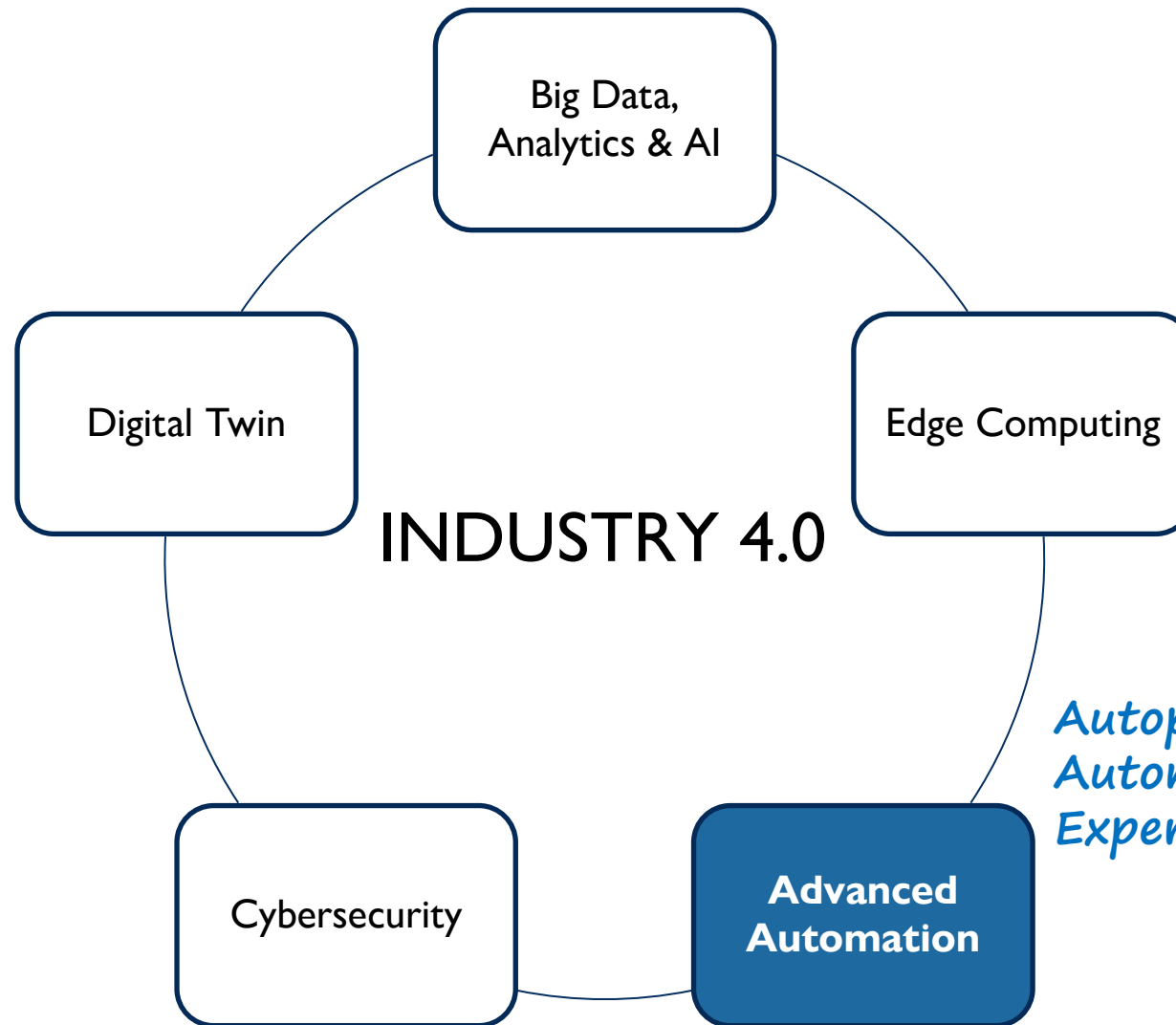
Pillars of Industry 4.0



Pillars of Industry 4.0

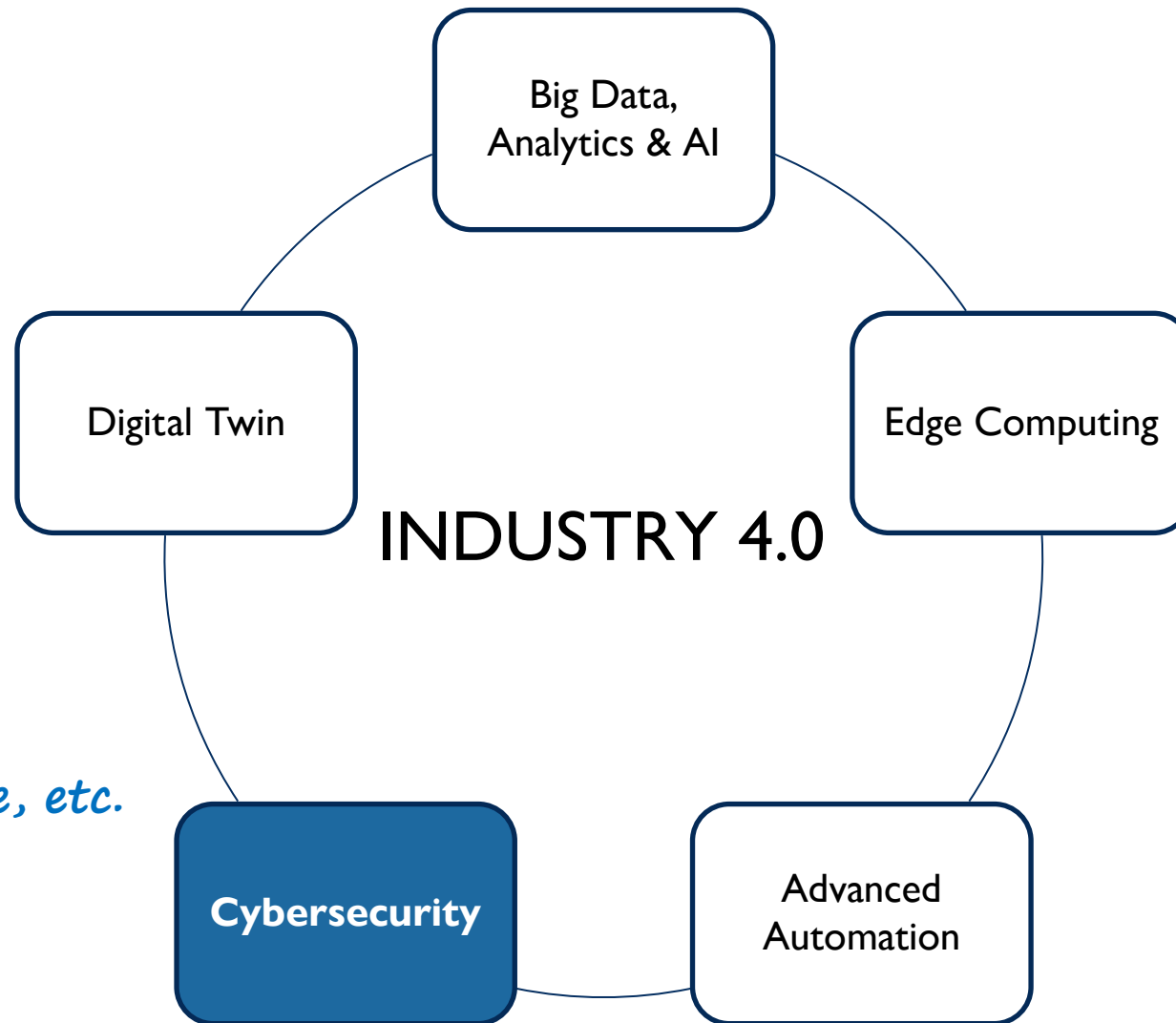


Pillars of Industry 4.0



Autopilot: Advanced Controls, Automatic startup/shutdown, Expert System, Robotics,...

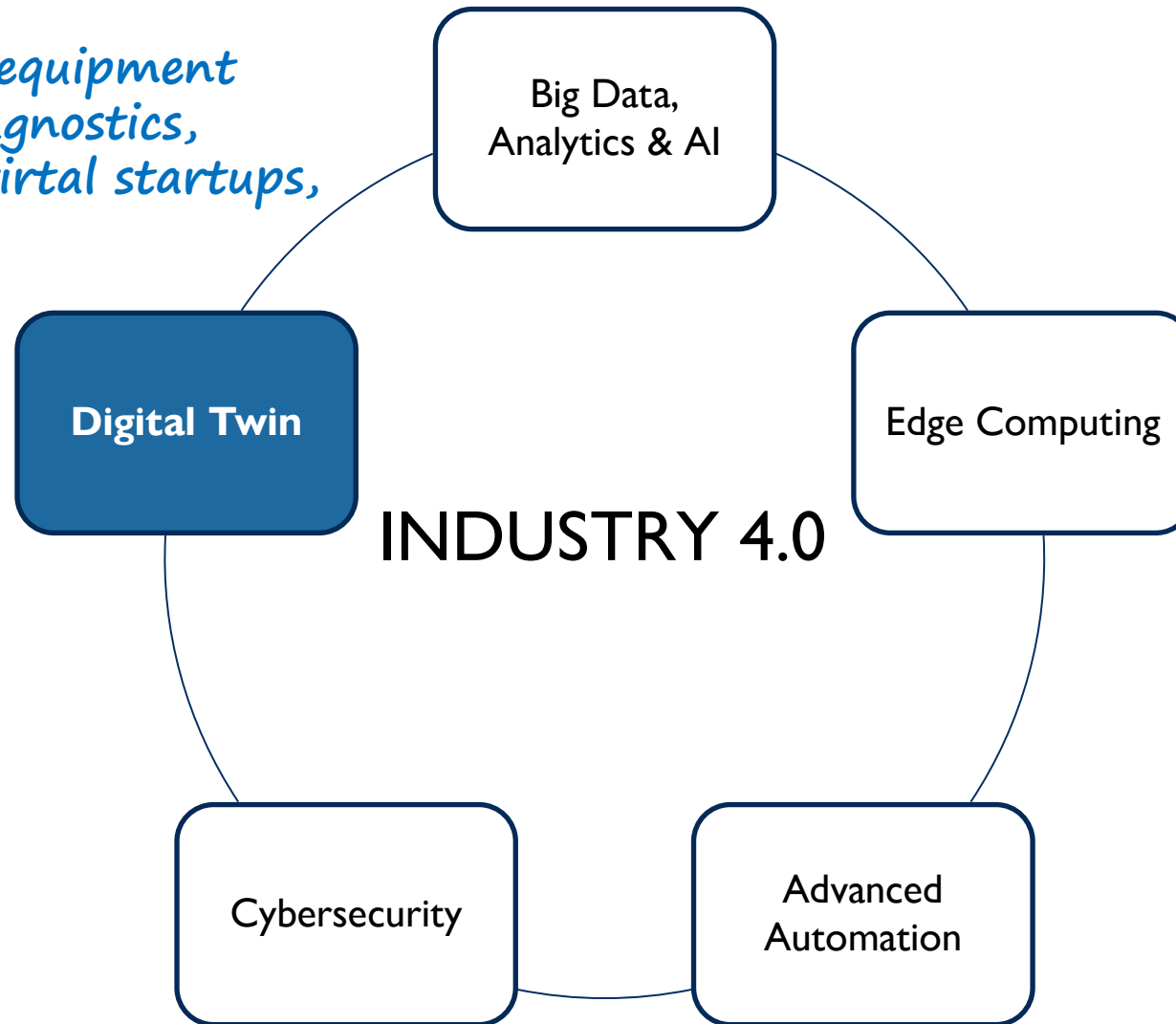
Pillars of Industry 4.0



Firewalls, Datadiode, etc.

Pillars of Industry 4.0

Process simulation, equipment simulation, fault diagnostics, operator training, virtual startups, process design



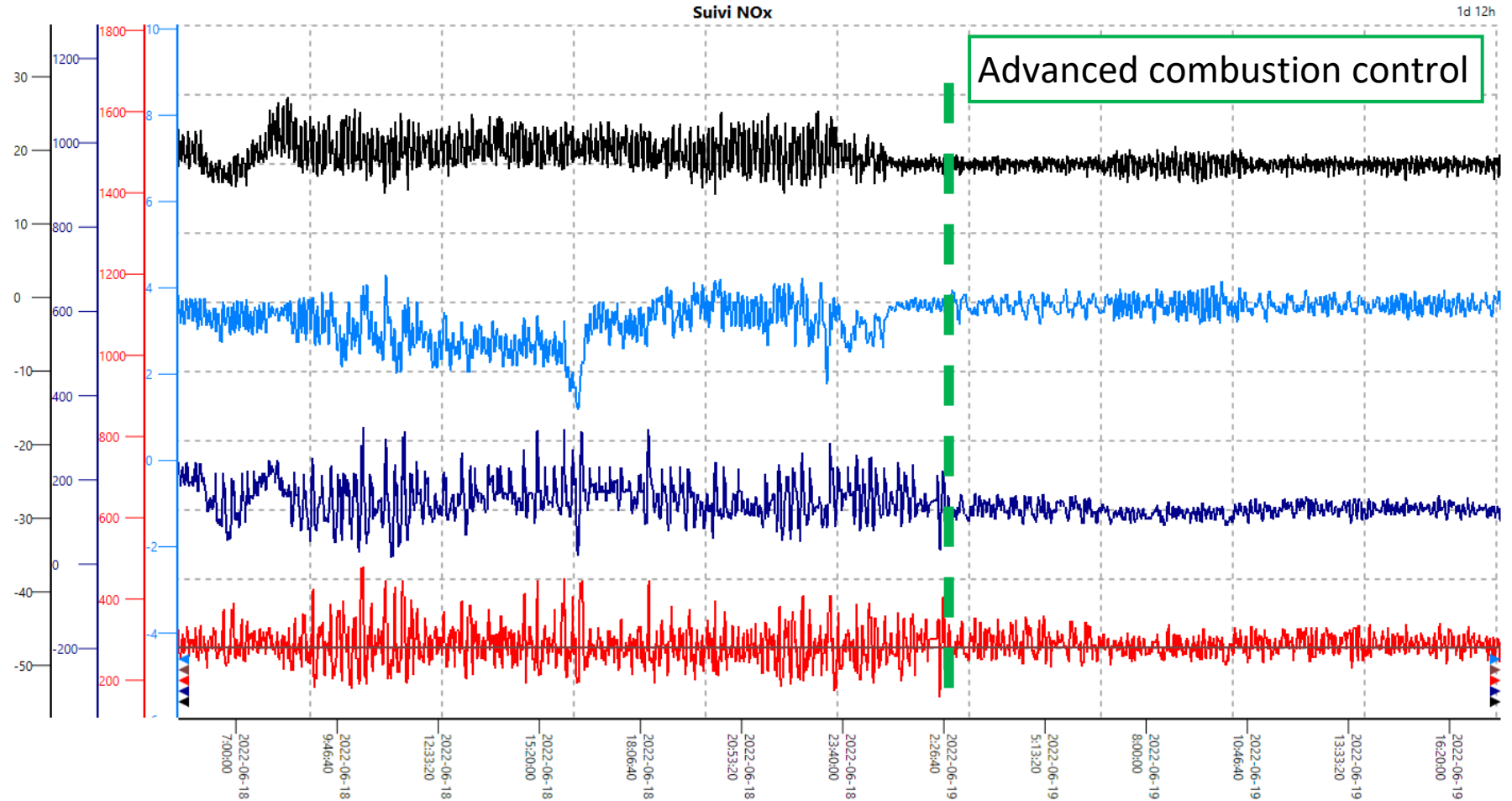
Boiler Optimization – Advanced Automation

Boiler load (kg/s)

Oxygen (%O₂)

Ammonia flow (l/h)

NO_x (mg/Nm³)



Advanced combustion control

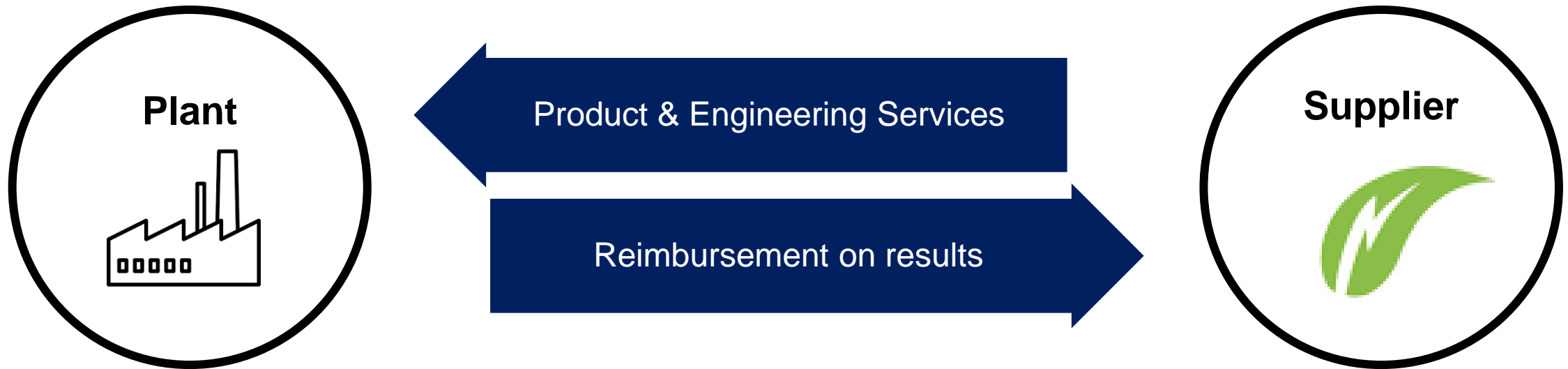
Your CEO wants 4.0, Shareholders want 4.0,
...so why are we not seeing more 4.0 Projects?



vs.



Guaranteeing results for Energy Projects



Financing Model to de-risk Industry 4.0 Energy Projects

- Standard capital project financing with **performance guarantees**

Financing Model to de-risk Industry 4.0 Energy Projects

- Standard capital project financing with performance guarantees
- **ESCO** contracts (Energy Service Company):
 - ESCO provide energy solutions, guaranteeing energy savings and operational performance.
 - ESCO finances or assists in financing the project, recovering costs through the achieved energy savings. Pays a penalty if financial savings are not achieved
 - ESCOs often offer a turnkey contract and will subcontract a portion of the project execution (auditing, purchasing, commissioning, monitoring, maintenance, etc.)

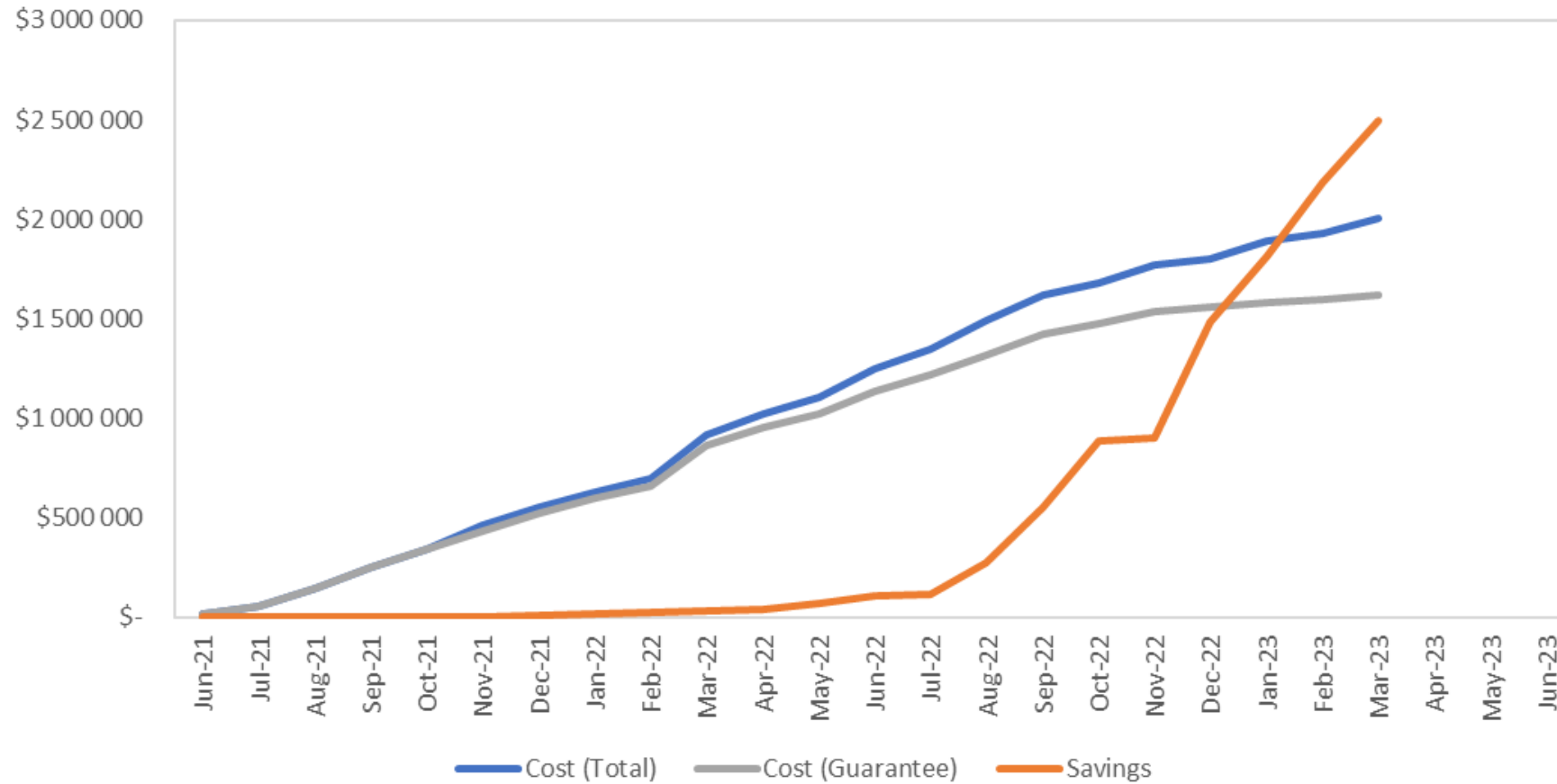
Financing Model to de-risk Industry 4.0 Energy Projects

- Standard capital project financing with performance guarantees
- ESCO contracts (Energy Service Company):
 - ESCO provide energy solutions, guaranteeing energy savings and operational performance.
 - ESCO finances or assists in financing the project, recovering costs through the achieved energy savings. Pays a penalty if financial savings are not achieved
 - ESCOs often offer a turnkey contract and will subcontract a portion of the project execution (auditing, purchasing, commissioning, monitoring, maintenance, etc.)
- **SaaS** contracts (Software as a Service/Solution aaS / Product aaS,...)
 - Similar to ESCO but monthly payment. (in the long term, the monthly payment is small)
 - SaaS providers owns solution but can purchased through a buyback fee.
 - SaaS are not always tied to energy performance guarantees .

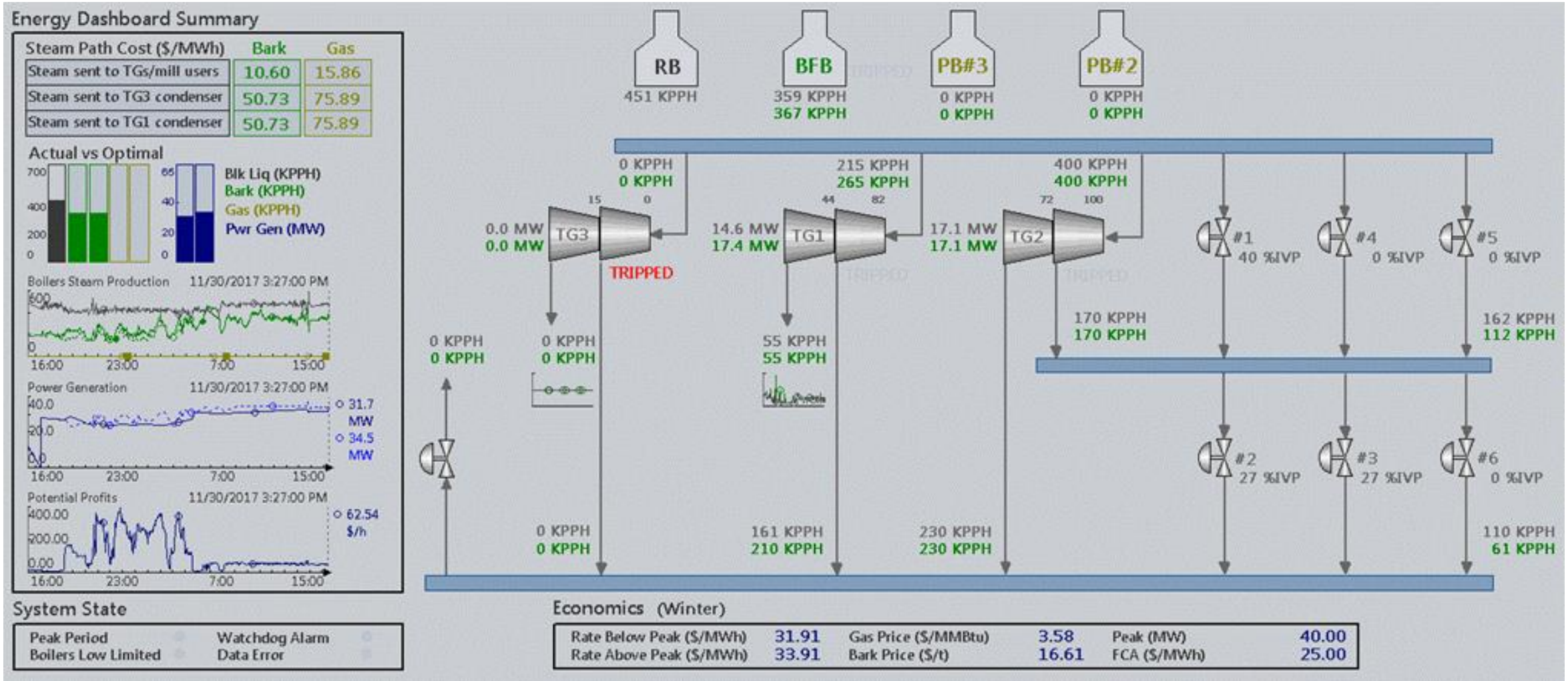
Repay-on-Performance financial overview

Advanced Steam Automation Project

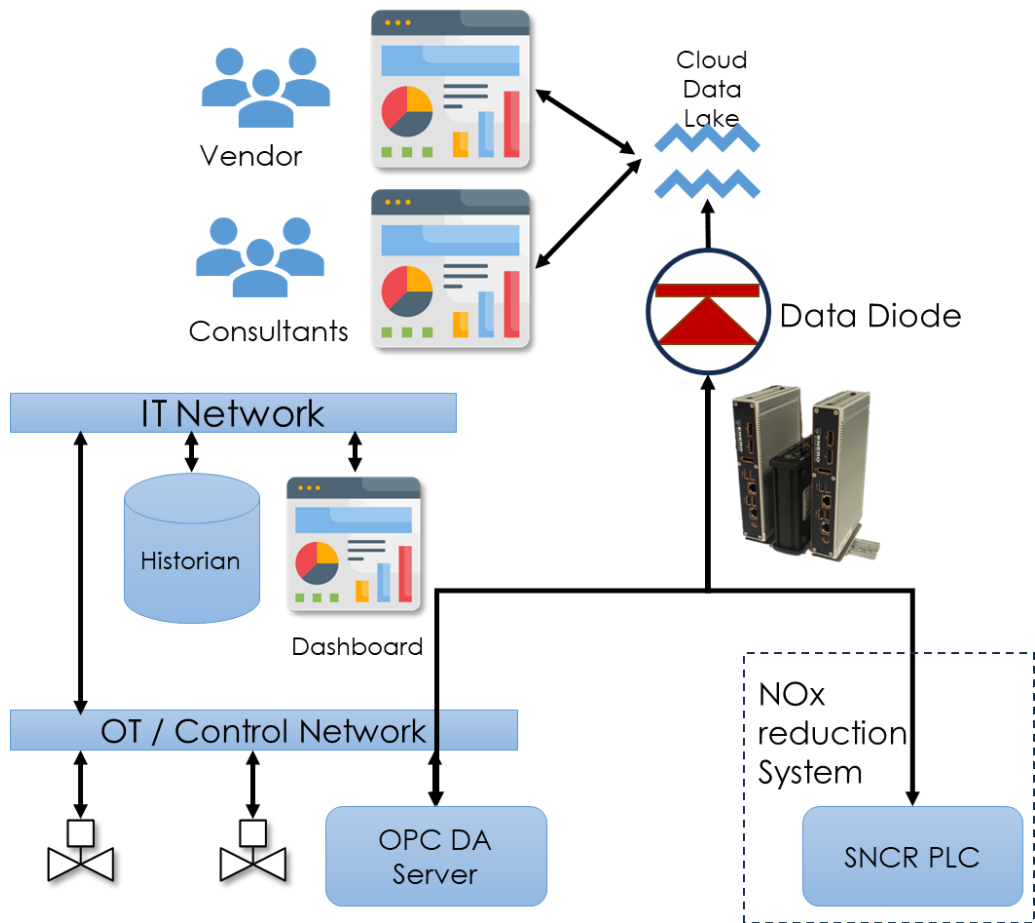
Cumulative Project Costs and Savings



Digital Twin for process and energy monitoring



Cybersecurity for Remote Performance Monitoring



Advantages of DataDiode:

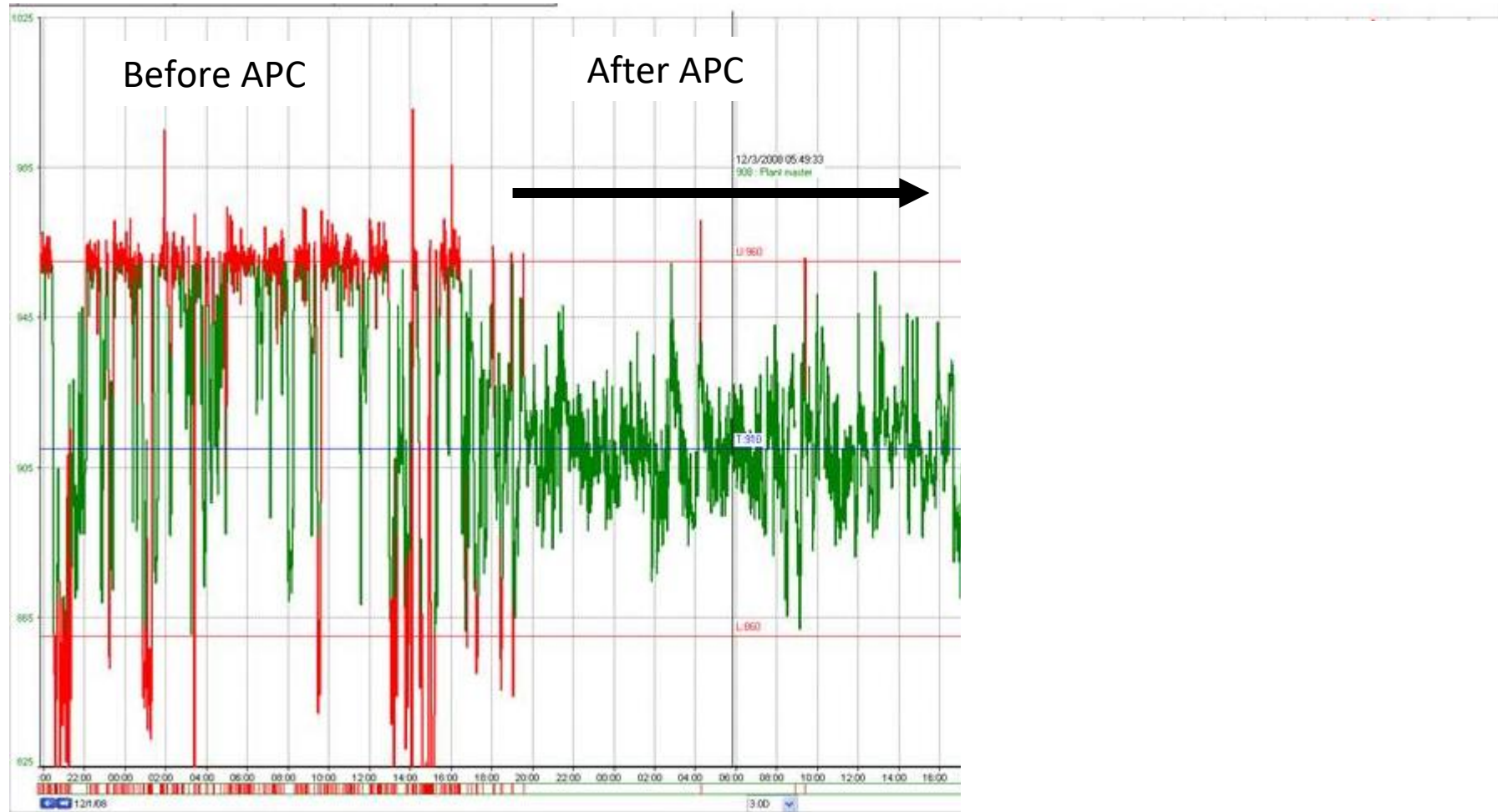
- Physically impossible for Vendor/Consultants/Corporate to get in the OT/IT System.
- Vendor/Consultant does not have access to complete plant data through historian and is only provided with the data needed to conduct work.

Benefits of SaaS and RoP Financial Structure

1. Integrated Control Performance Maintenance Program
2. Integrated Operator Training Program
3. Reduce risk, cost and increase value of capital project investments

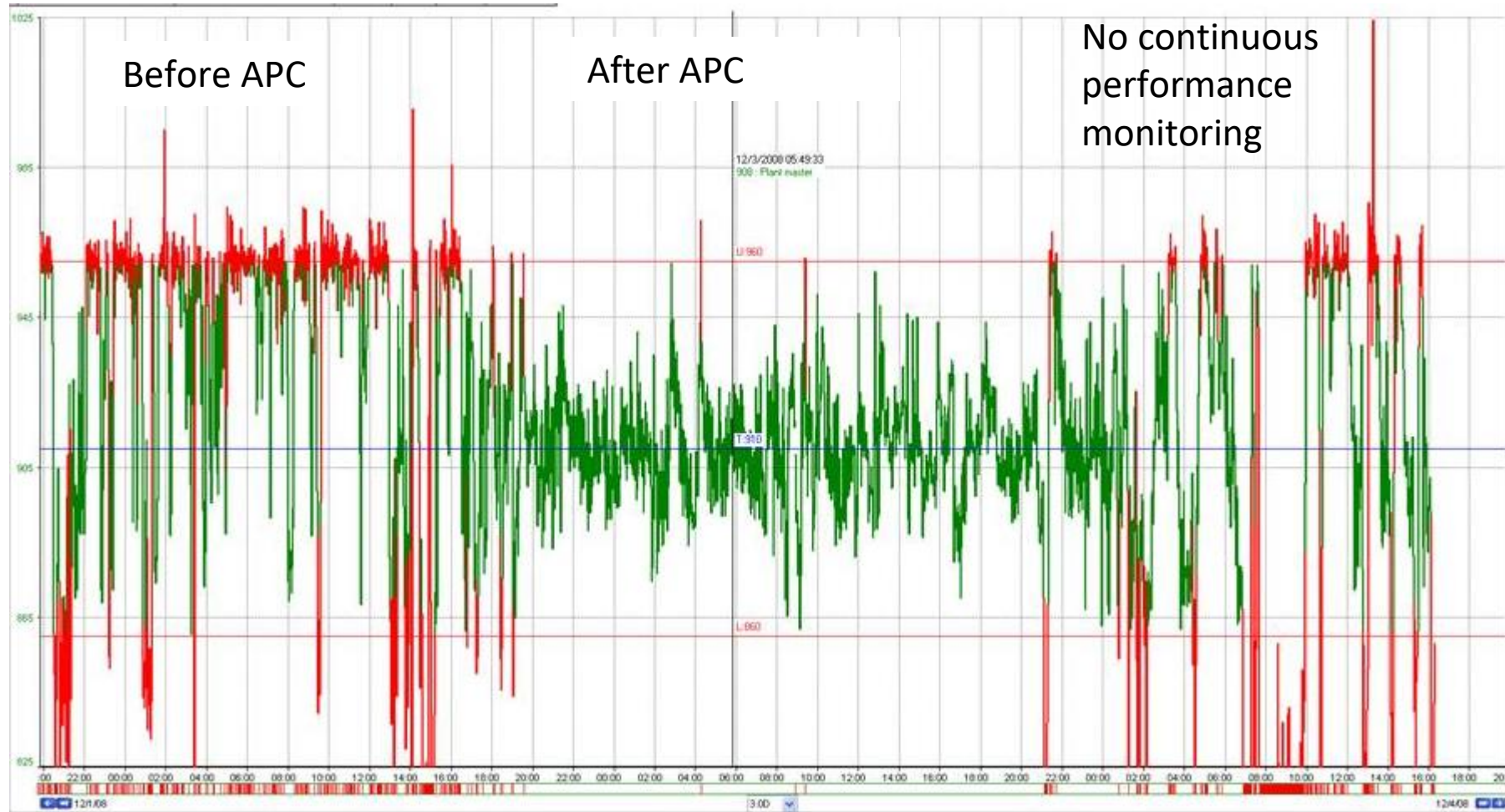
APC Project

Team is successful and paper writes a paper.



APC Project Outcome

With Black-Box Solutions or no continuous performance program



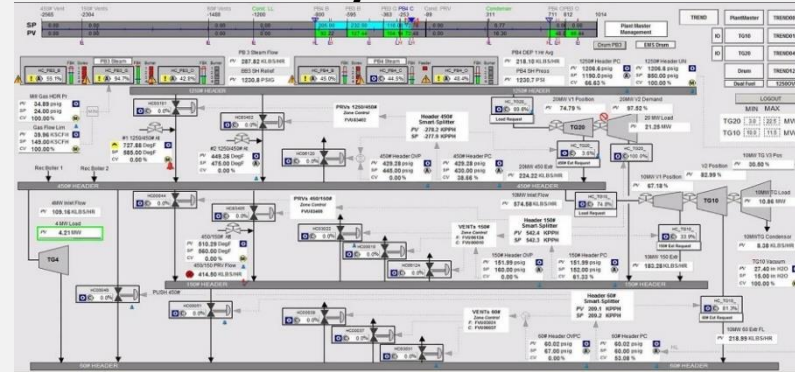
1- Benefits of non-traditional capital projects

Integrated Control Performance Maintenance Program

- Performance of most Advanced Automation Projects tends to deteriorate if not regularly monitored and maintained.
- In traditional advanced automation capital implementations, the funding for ongoing performance optimization and operator training often gets cut after one to two years.
- SaaS model provides a significant benefit by integrating essential maintenance tasks into its financial structure, ensuring consistent performance upkeep.

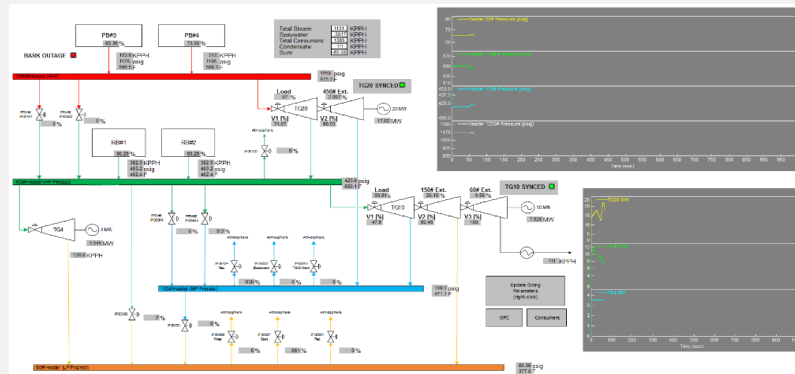
Digital Twin for APC testing and Operator Training

Control System Emulator



OPC Connection

Virtual Plant



Process variables:

- Air flows
- Steam pressures
- Turbine load
- Steam temperatures
- ...

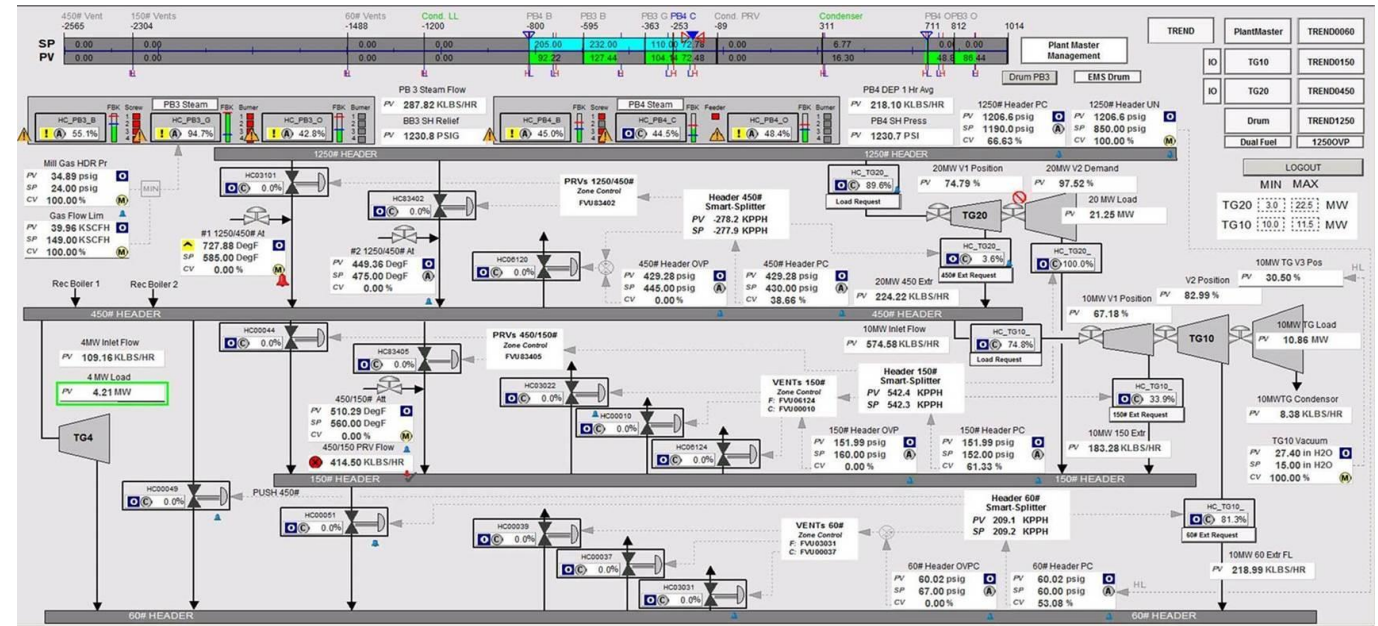
Controlled variables:

- Damper position
- Valve opening
- Turbine demand
- Spraywater valve

PC or WebServer

Digital Twin for operator training

- “Flight simulator” for new operators - safety, reliability, production, retention.
- Operational tool for continuous improvement, performance tracking and alarm management.



2- Benefits of non-traditional capital projects

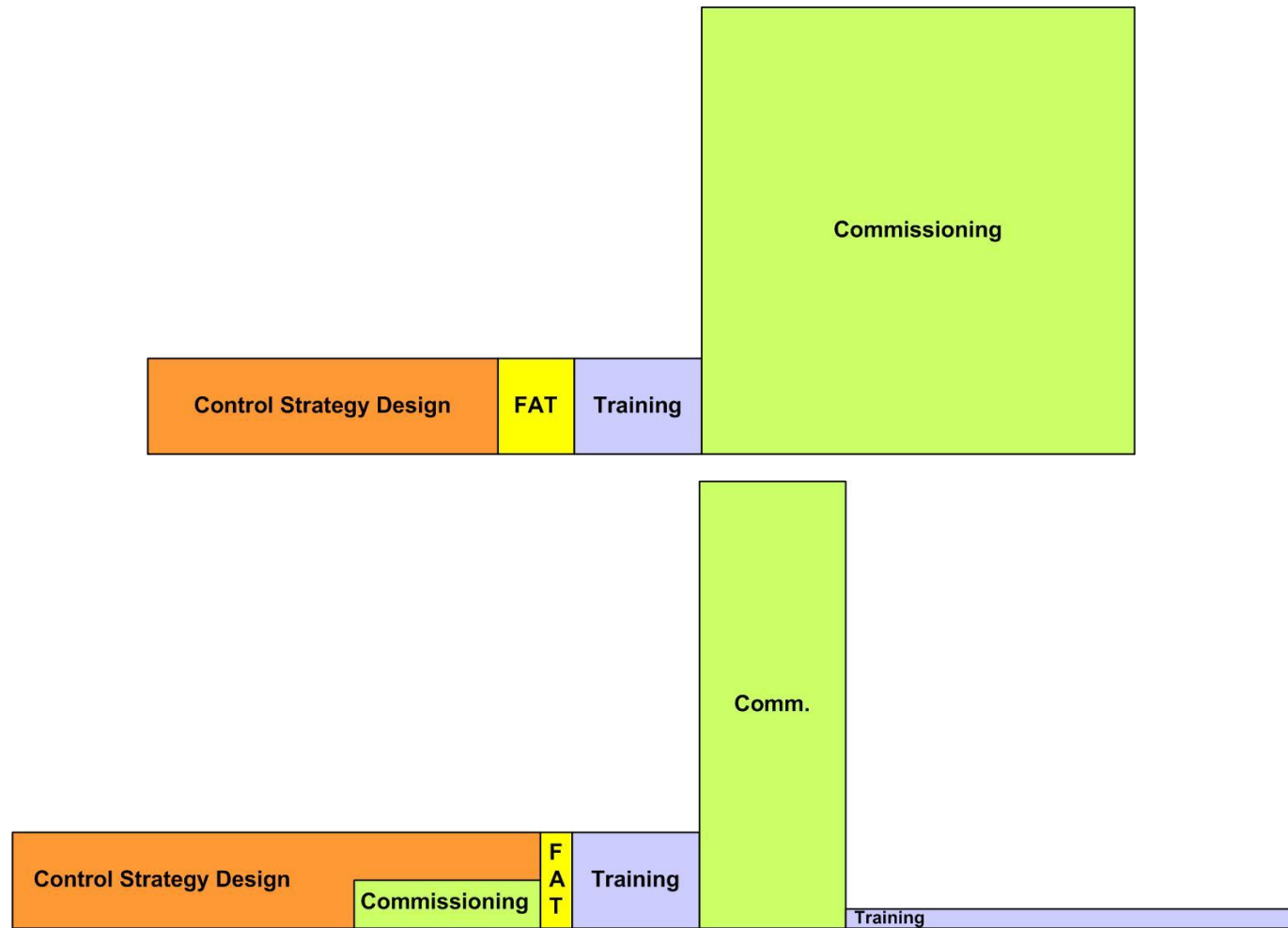
Integrated Operator Training Program

- In a SaaS structure continuous operator training requirement into the SaaS monthly cost.

20-35% of operators will retire in the next 5-10 years.

Brownfield, greenfield project startup

With and without a virtual startup (**Digital Twin**)



3- Benefits of non-traditional capital projects

Reduce risk, cost and increase value of capital project investments:

- Industrial projects are typically based on selecting lowest cost provider based on T&M rates/cost
- Difficult to specify 'good performance from advanced automation'

- Results:
 - Value-added work such as operator simulation, auto-pilot control is seldom proposed.
 - Operator training and software testing is inadequate prior to startup.
 - Capital project overrun
 - Higher operational cost
- Solution:
 - Advanced automation and 4.0 is separated from tradition control system engineering work.
 - Performance guarantees are ties to the Advanced Automation work.

Conclusion: 4.0 makes sense when vendor takes risks

Questions?

Ben Janvier

President

M: +1 (514) 207-5678

bjanvier@enerosolutions.com