



***Overview of Consulting
and Solution Capabilities***

May 2026

TPM Solutions at a Glance – Consulting & Technology for the Energy Industry

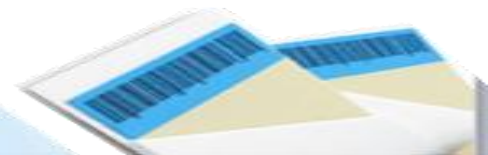
- Founded in 2005 (as R2E)
- USA-based with Singapore entity - Global presence
- Highly experienced Technology & Business Consultants
- Hundreds of plants and facilities visited & reviewed
- Cutting Edge Solutions
- Specializing in AI-driven digital operational excellence

- Advanced Planning and Scheduling including Backcasting
- Optimization including Energy and GHG Emissions Management
- ESG, Environmental, HSE, PSM and Control of Work
- AI-Driven Operator Advisory and Digital Asset
- Connected Worker & Connected Asset
- Digital Transformation / IIOT / Industry 4.0



TPM Consultants Heritage

Company Type	Heritage Companies
Operating Companies	Valero, ConocoPhillips, ExxonMobil, Shell, Chevron/Caltex, BP, Citgo, Total, Pemex, Tesoro, PDVSA, Westlake/Titan, Aramco, Dow, SLNG, Petronas
Technical Consultants	KBC, Solomon, Jacobs, Pace
Management Consultants	ADL, Wright Killen
System Integrators	Accenture, IBM
Software Applications & IT	Aspen Technology, Invensys, Simulation Sciences, Honeywell Process Solutions, ABB Lummus
Process Technology	UOP, Technip/KTI, Lummus, Profimatics, Johnson Matthey/Intercat, Sulzer Chemtech
Engineering Procurement & Construction	WorleyParsons, Technip, KBR, Bechtel



TPM Consulting Examples

People

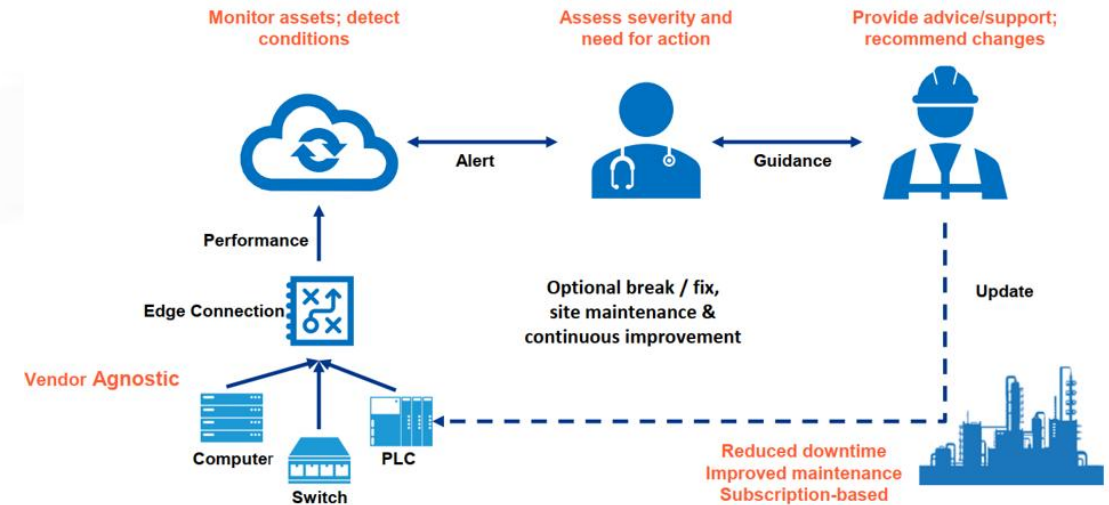
- Organizational Effectiveness
- Workforce Capability
- Adapting to a Digital World
- Productivity Enhancement
- Field Worker effectiveness
- Leadership
- Training and Development
- Specialists for Capital projects

Processes

- “As-Is” business process review
- Gap Analysis
- “To Be” based on best practices
- Workflow digitalization
- BPaaS (Business Process as a Service) for continuous improvement
- Business Process Blueprint for capital projects

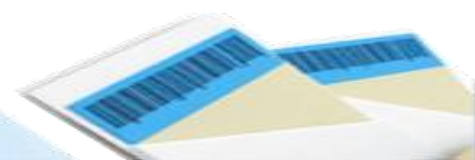
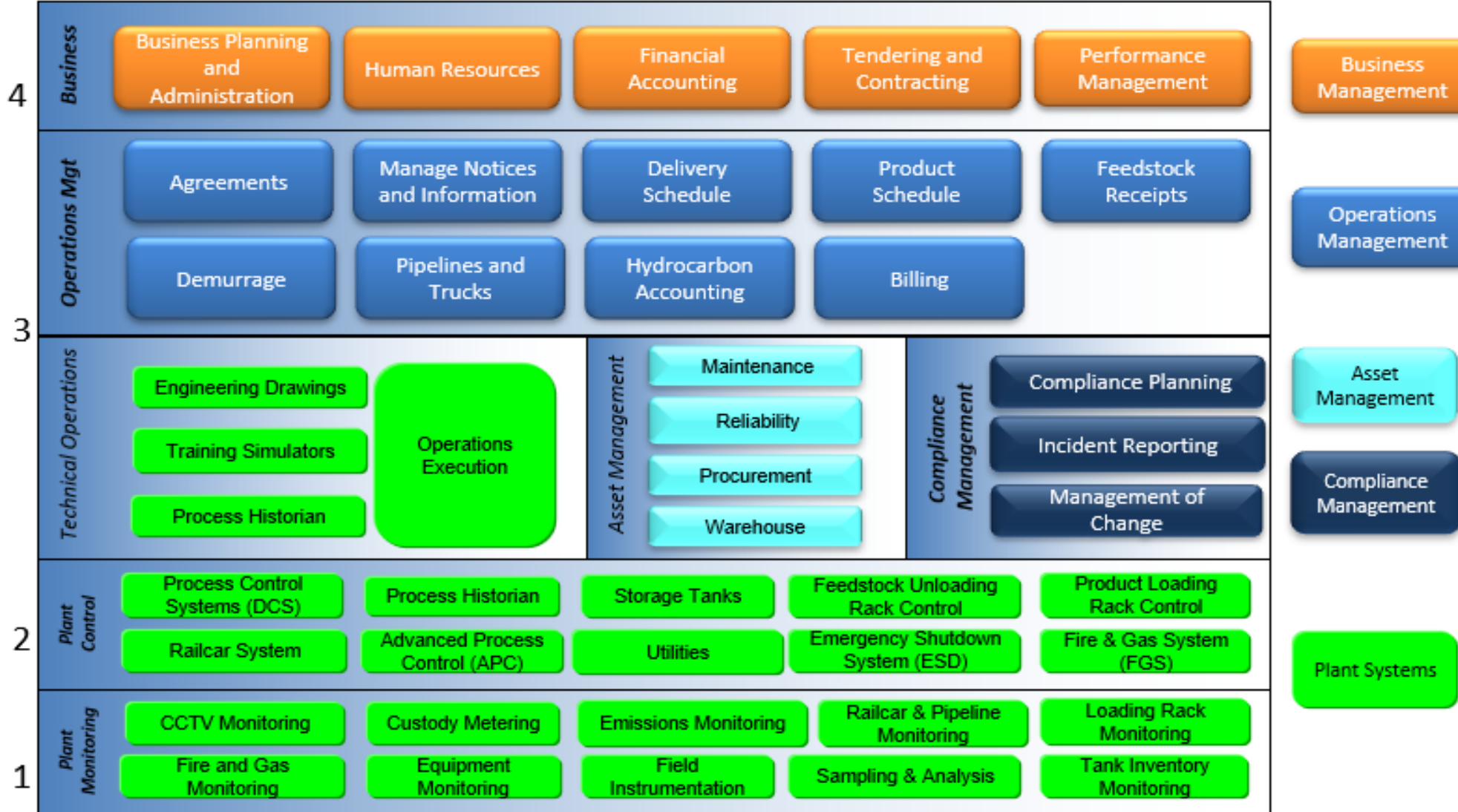
Technology

- Plantwide Optimisation
- Energy and GHG Management
- Connected Worker
- Connected Asset
- Digital Operational Excellence
- AI applications



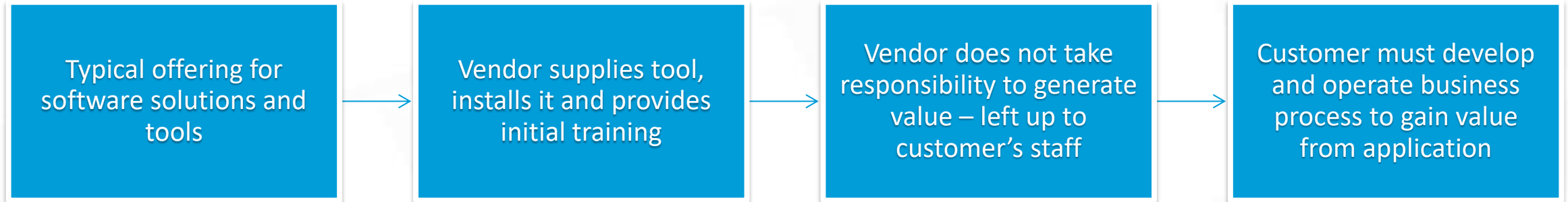
TPM Business Process as a Service (BPaaS) Experience

Level



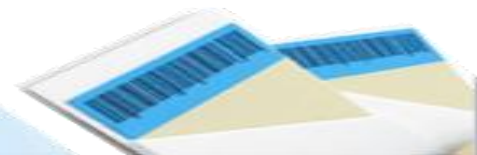
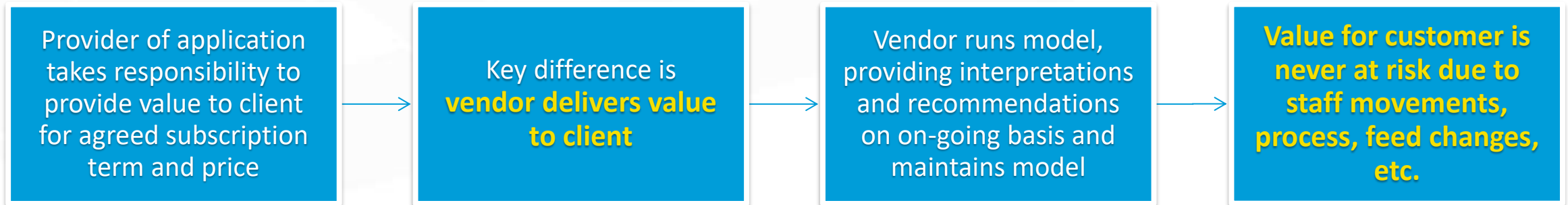
Value Sustainment – Difference between SaaS and BPaaS

Software as a Service (SaaS)



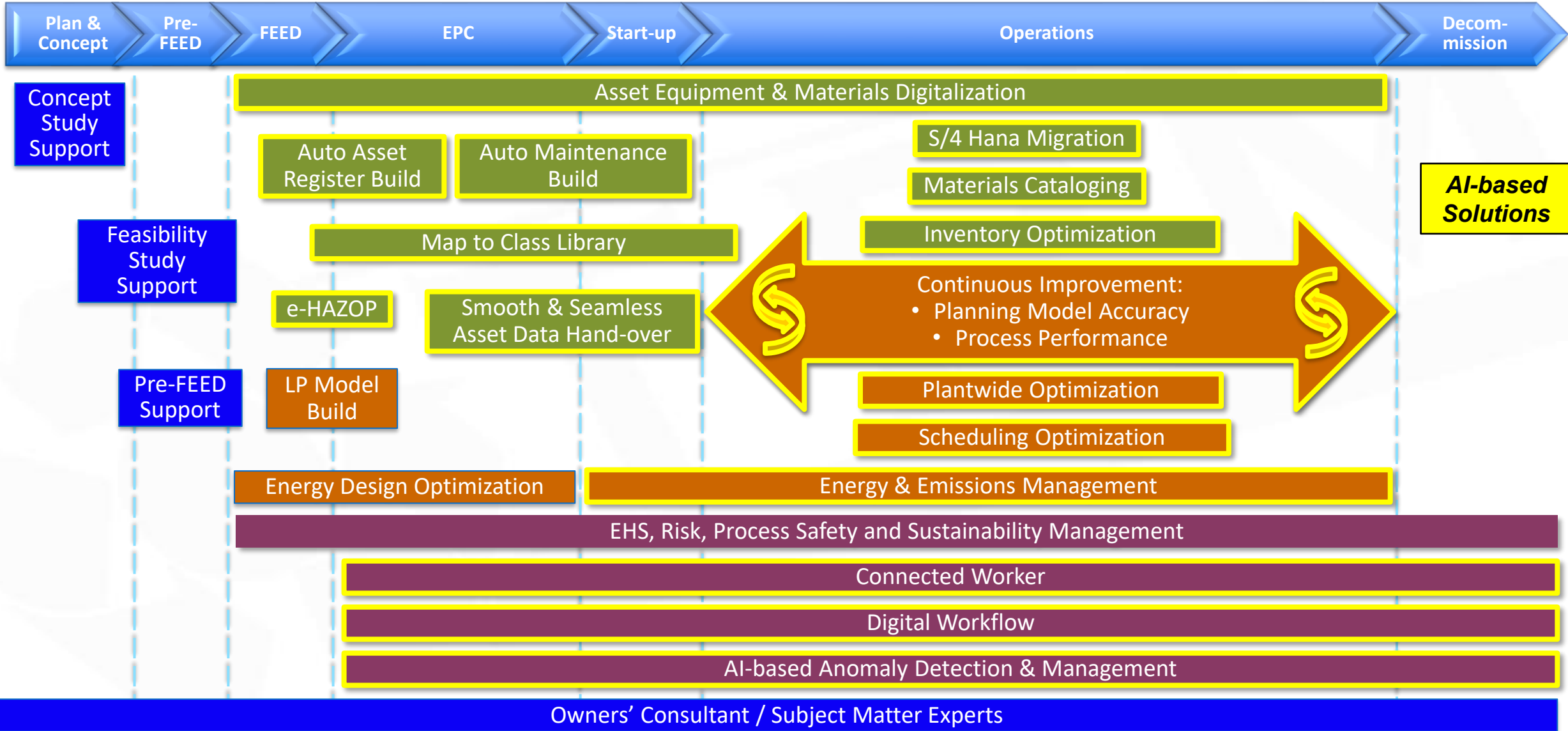
Business Process as a Service (BPaaS)

(TPM Business Model)

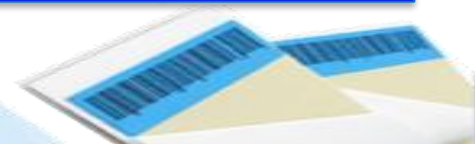


TPM Solutions Covers the Asset Lifecycle

Consulting Optimization
Assets Operations

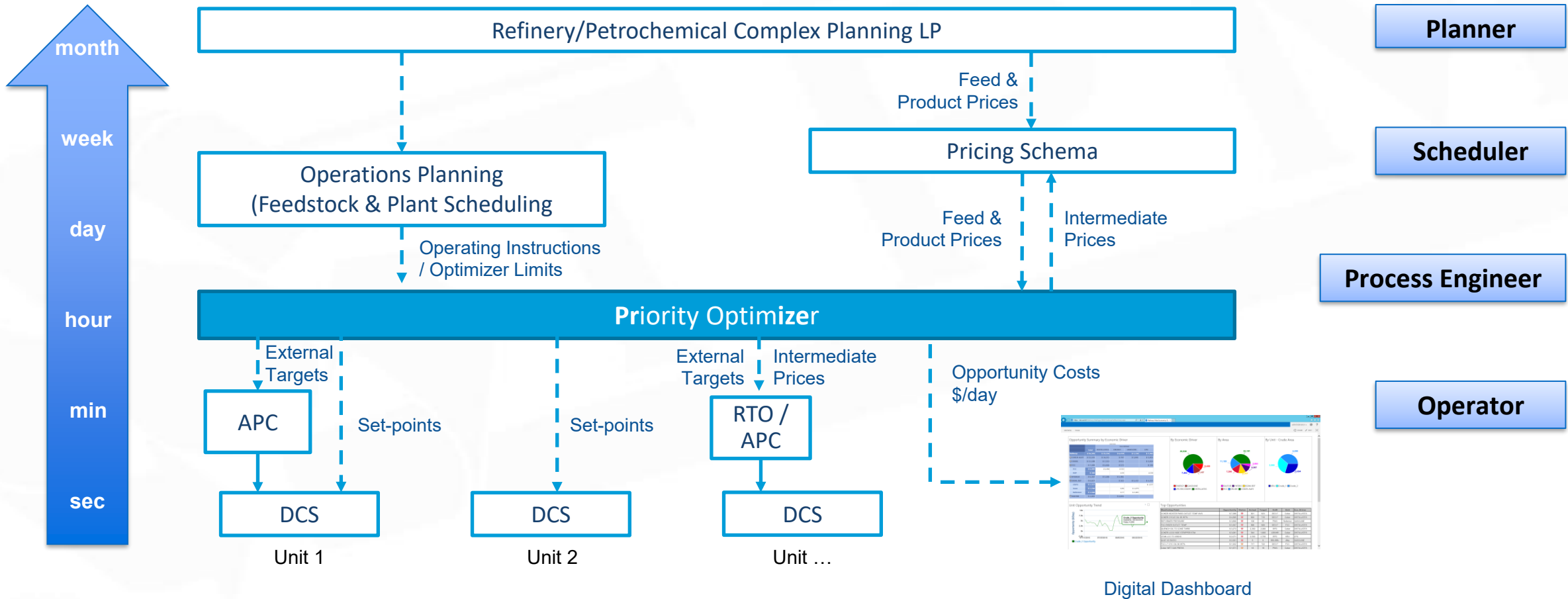


AI-based Solutions

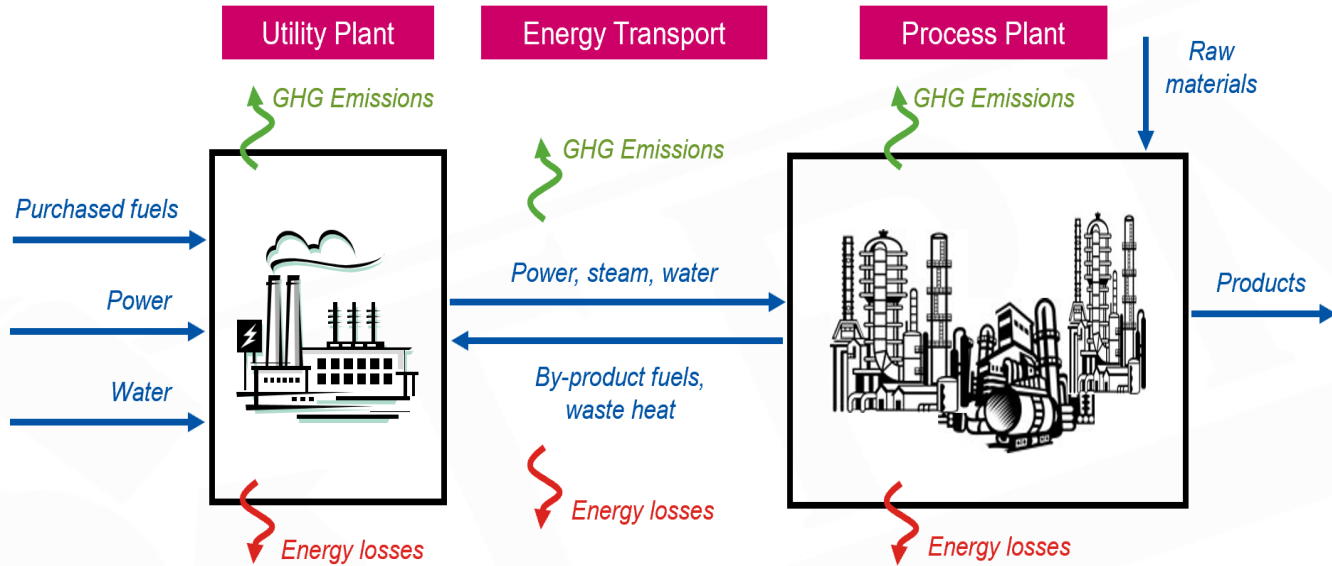


Plant-wide & Multi-unit Optimization

- **Priority Optimizer (PRIZE) Profit Enhancer**



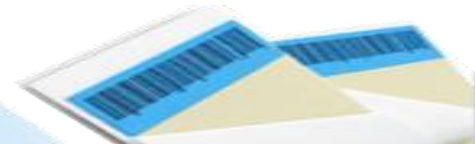
Energy & Emissions Reduction/Management



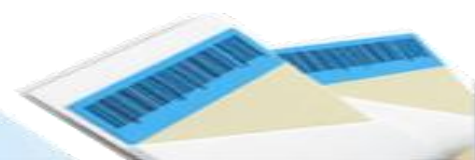
Equipment types

- | | | |
|---|--|---|
| <ul style="list-style-type: none"> • Boilers • Steam Turbines • Gas Turbines • Generators | <ul style="list-style-type: none"> • Steam headers • Let-down turbines • Let-down stations / Desuperheaters • Fuel gas network • Transmission lines | <ul style="list-style-type: none"> • Fired Heaters • Heat exchangers • Pumps, compressors, fans, blowers, motors • ... <u>all process units</u> |
|---|--|---|

Holistic Approach Proven Methodology		
	Supply Side (Utilities)	Demand Side (Processes)
 Design	SUPPLY AT LOWEST COST <ul style="list-style-type: none"> • Utilities system modeling • Optimize utilities system design • Total Site Pinch Analysis • Cogeneration Feasibility • Hydrogen system design 	REDUCE DEMAND <ul style="list-style-type: none"> • Energy/yield/purity trade-off • Process/Column Pinch Analysis • New Technologies • Process re-sequencing & optimization • Establish energy targets
 Operations	<ul style="list-style-type: none"> • Fuel, Steam & Power optimization • Performance Management • Utilities Contract Management • Hydrogen & Fuel gas management • Reduce flaring & venting 	<ul style="list-style-type: none"> • Operator Decision Support System • Advanced Control Systems • On-line Advisory Optimization Systems • Performance management • Fired heater furnace tuning • Heat Exchanger Monitoring



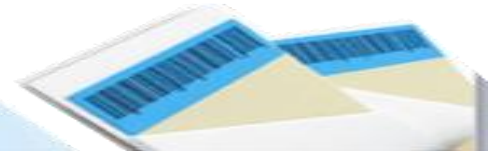
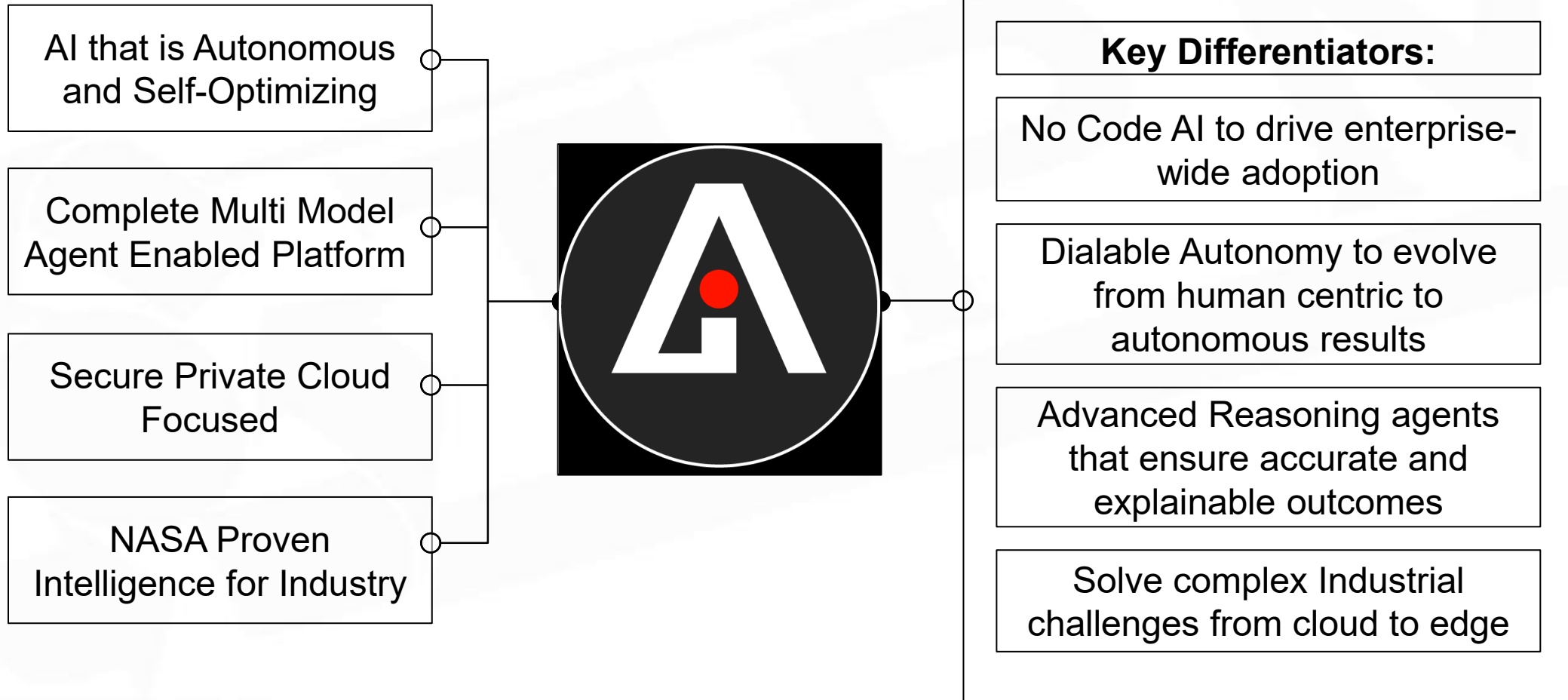
Advanced Solutions & AI Partnerships with TPM



Beyond Limits – A Leader in Industrial AI







Hybrid Agentic AI that Delivers Autonomous Intelligence at Scale

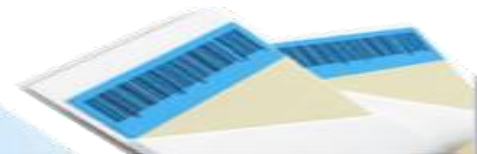
BEYOND AI



Product Offerings

Solution offerings

Application	 Operations Advisor	 Beyond Search	 DocLink Hub	 Beyond Vision	 Global Optimizer	 Beyond Eye
Description	AI-driven real-time decisioning system to optimize operations, enhance asset reliability and execute autonomous actions	A complete platform to accelerate the development, deployment and ongoing management of Private LLM Initiatives	Intelligent document hub powered by vision and generative AI to automate document processes and workflows	Secure border control systems including airport passenger verification and land border crossing	Multi agent prescriptive actions solution for global supply chain and production planning optimization	Combines computer-vision technologies with spatial-temporal concepts to enable security, safety and inspection systems
Industry Sectors	Energy, Chemicals Manufacturing, Mining	Industry Agnostic	Industry Agnostic	Industry Agnostic	O&G, energy, chemicals	Smart Cities, Safety, Energy



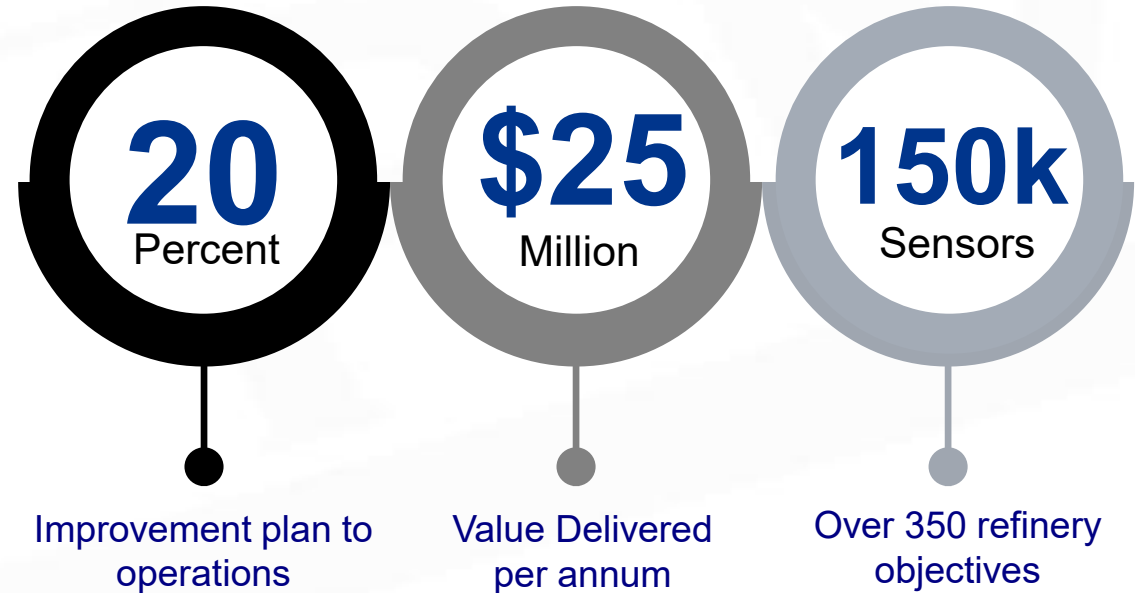
Operations Advisor – bp Case Study

Enables Operators to Optimize production yield, increase asset utilization and improve reliability sustainably

BEYOND AI

BP Whiting Refinery posed the challenge to Beyond Limits to build solution to leverage hybrid AI to guide the operators to hit the production objectives and targets with confidence which eventually took the form of product Operations Advisor.

Industry: Oil & Gas **Geography:** U.S.A



Results & Benefits

- Rapid solution adoption time of 2 month by operators
- Increased plant utilization, gasoline yield, H2 reduction
- Reduced energy usage and emissions
- Over 1,500 Users spanning operators, engineers and planners

aramco

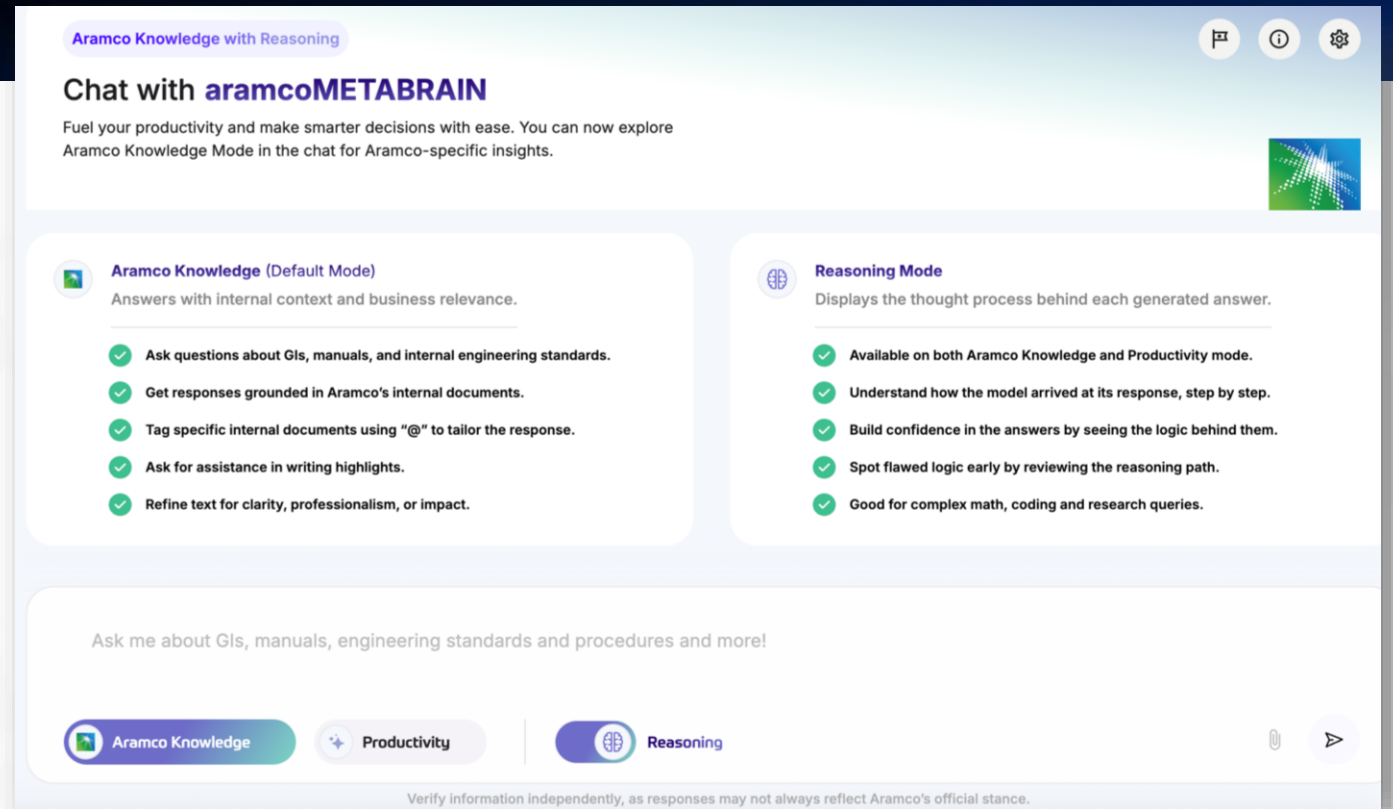


aramcoMETABRAIN

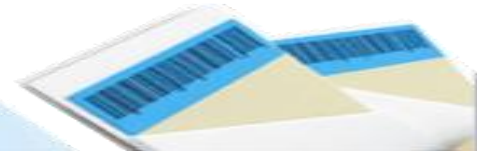
Powered by Beyond Search GenAI Platform

Aramco implemented Beyond Search enterprise wide to create **aramcoMETABRAIN**, a powerful enterprise knowledge platform that transformed how their organization accesses and utilizes critical information across departments

- ✓ **Secure Knowledge Access:**
Enabled secure, private access to enterprise knowledge without exposing sensitive data to external cloud providers
- ✓ **Reduced Search Time:**
Decreased information retrieval time by 78%, allowing employees to find critical information in seconds rather than hours



- ✓ **Knowledge Retention:**
Preserved institutional knowledge and expertise, making it accessible through natural language queries
- ✓ **Customized Experience:**
White-labeled solution with custom branding and guardrails aligned with organizational policies



About Enablon



Enablon, is the **world's leading enterprise EHS, Risk, Process Safety, and Sustainability platform.**

Our mission is to help organizations **protect people, manage risk, and achieve sustainable performance** – all from a single, integrated platform.



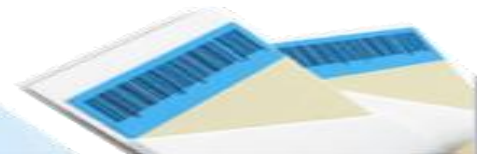
Award-winning software for optimizing environmental performance, improving worker safety, streamlining reporting, and achieving regulatory compliance



Recognized as a global market leader by third party analysts including Verdantix and Gartner



25 years of expertise of delivering innovative software that adapts to evolving regulations



Integrated solutions that drive results



ESG Excellence

Achieve net zero, improve company social responsibility, and drive shareholder value



Environmental Management

Minimize environmental impacts to secure license to operate and increase operational efficiency



Health & Safety Management

Provide a safe and healthy workplace for employees and contractors



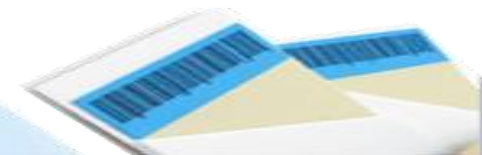
Process Safety Management

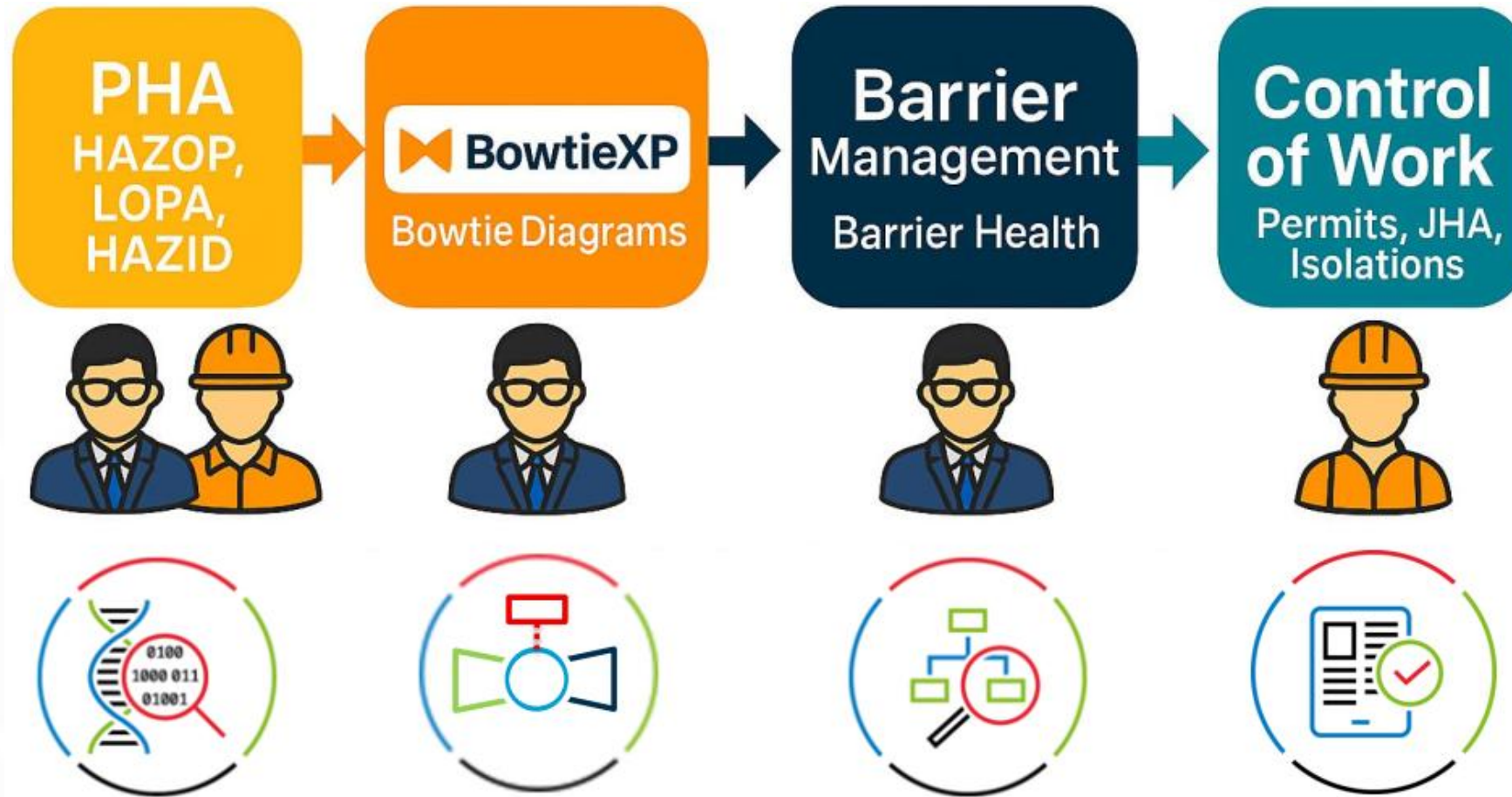
Streamline process safety management programs to meet operational integrity objectives



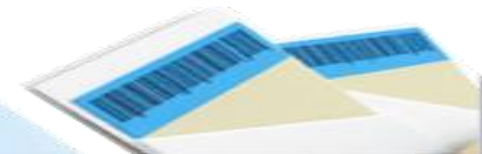
Control of Work

Maximize Asset Performance and Workforce Efficiency while ensuring safety and compliance





PSM Interface Solutions for Operating Assets



AI-based Asset Digitalization

What business challenges are we addressing ?



20% of time is spent looking for data*



* McKinsey et al

That's one in every FIVE employees

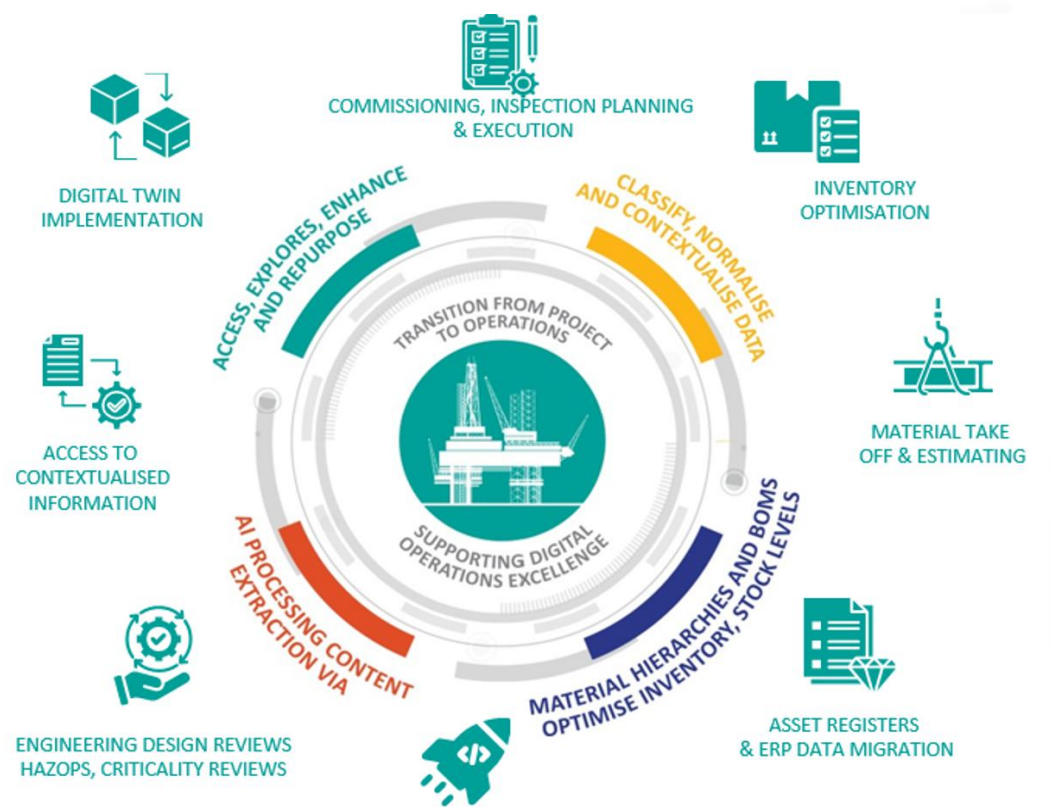
We solve this problem by



Enabling Digital Twins by transforming 2D legacy data



By leveraging AI technology – Services with no people



DATA AS A SERVICE



KNOWLEDGE HUB

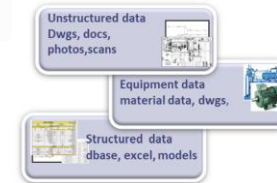


ENGINEERING HUB



INVENTORY HUB

Unconnected Inconsistent Mis-information



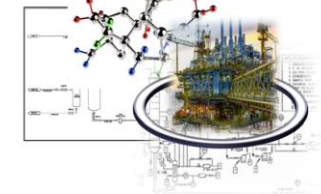
Data Anarchy

Data as a Service



DIGATEX - DI-analytics [Artificial Intelligence Platform]

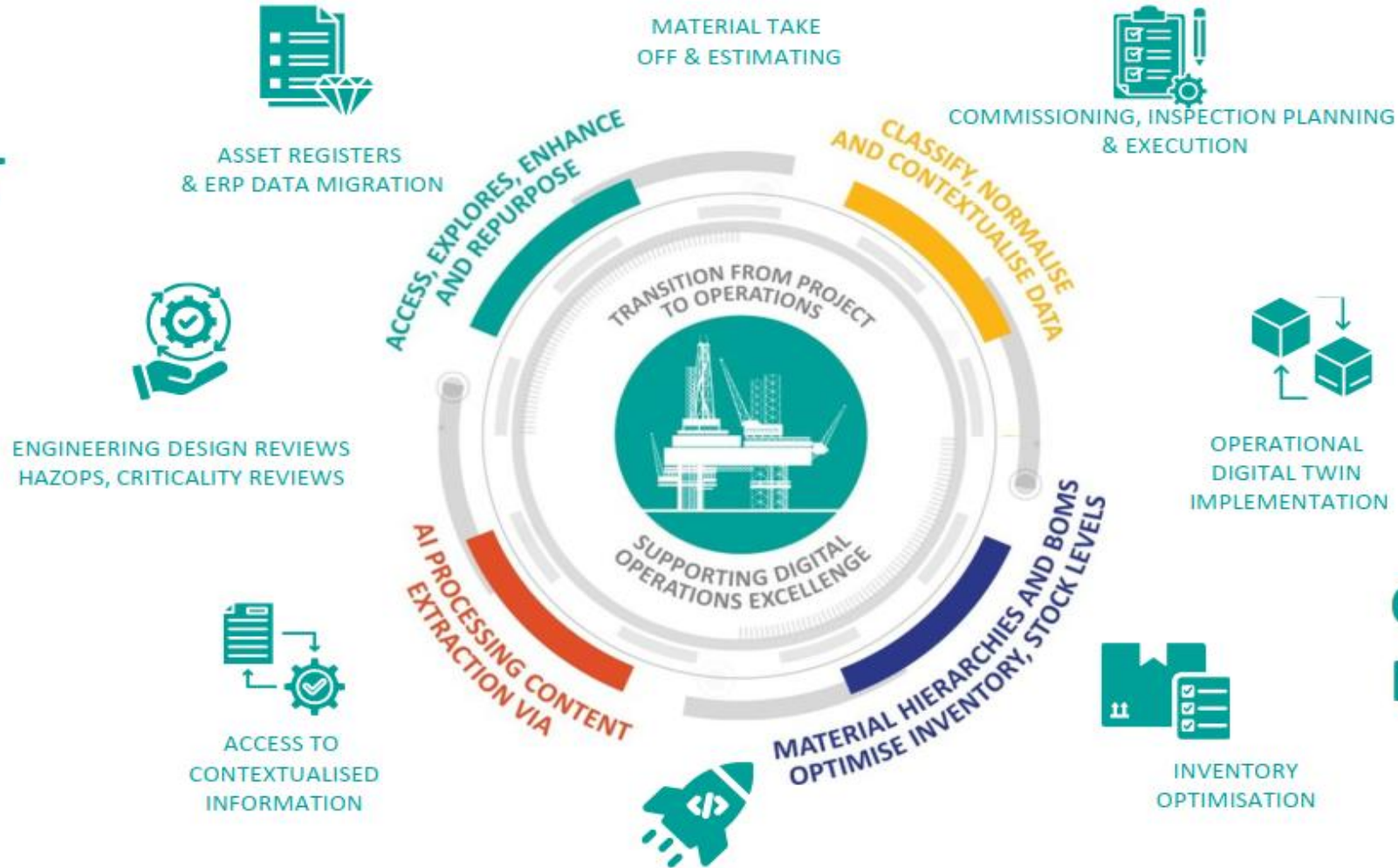
Connected Consistent Information

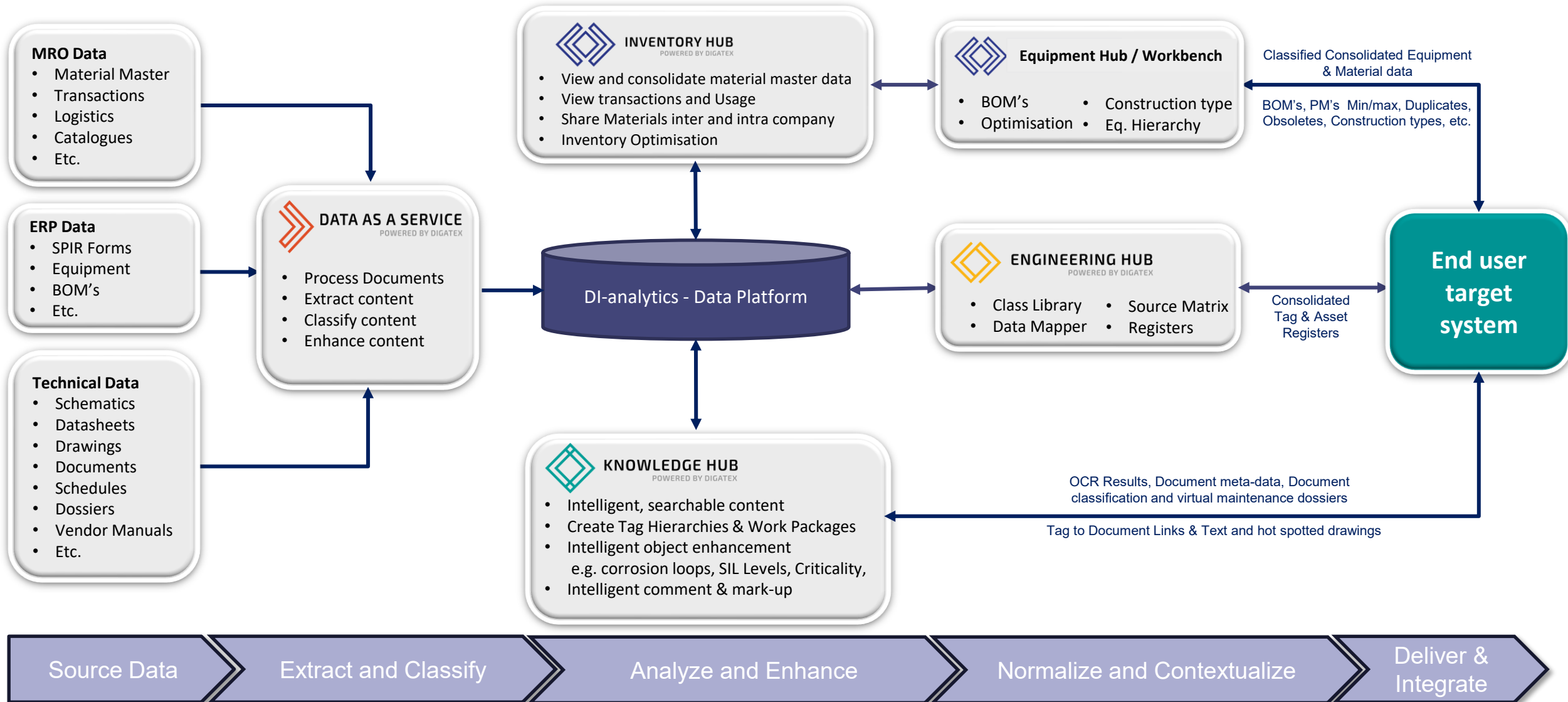


Digitally Intelligent Documents Fast Data access to Stakeholders System to System Collaboration

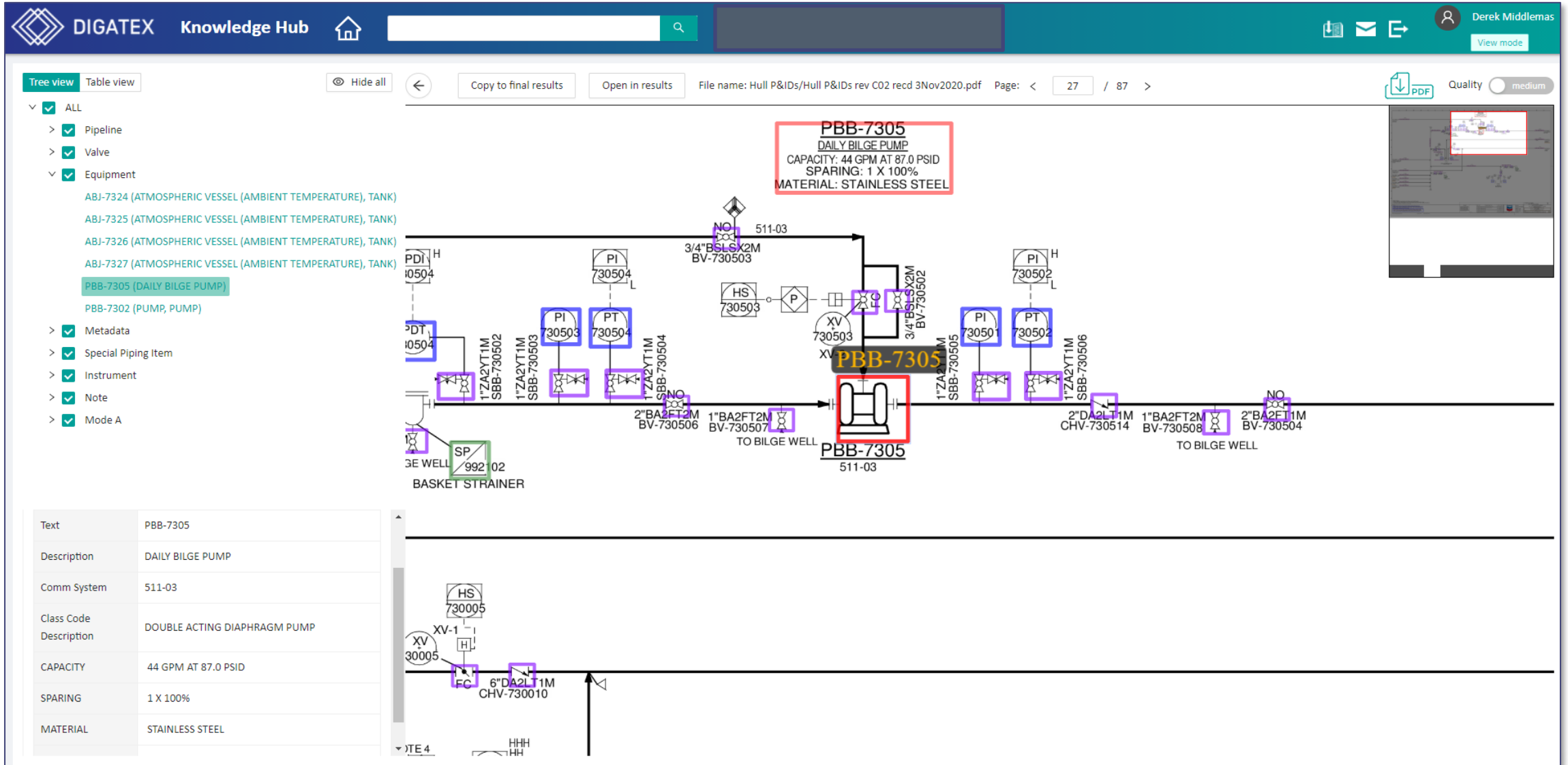


PROJECT





Case Study – P&ID Data Extraction



The screenshot displays the DIGATEX Knowledge Hub interface. At the top, the user is logged in as Derek Middlemas. The main area shows a P&ID diagram for a bilge pump system. A callout box for pump PBB-7305 provides the following details:

- PBB-7305**
- DAILY BILGE PUMP
- CAPACITY: 44 GPM AT 87.0 PSID
- SPARING: 1 X 100%
- MATERIAL: STAINLESS STEEL

The P&ID diagram includes various components such as tanks (ABJ-7324 to ABJ-7327), pumps (PBB-7302, PBB-7305), valves (XV-730503, XV-730505), and instruments (PI-730503, PT-730504, PI-730502). It also shows piping with specifications like 3/4" BS1X2M BV-730503 and 6" DA2L1M CHV-730010. A basket strainer (SP-99202) is also depicted.

On the left, a tree view shows the following structure:

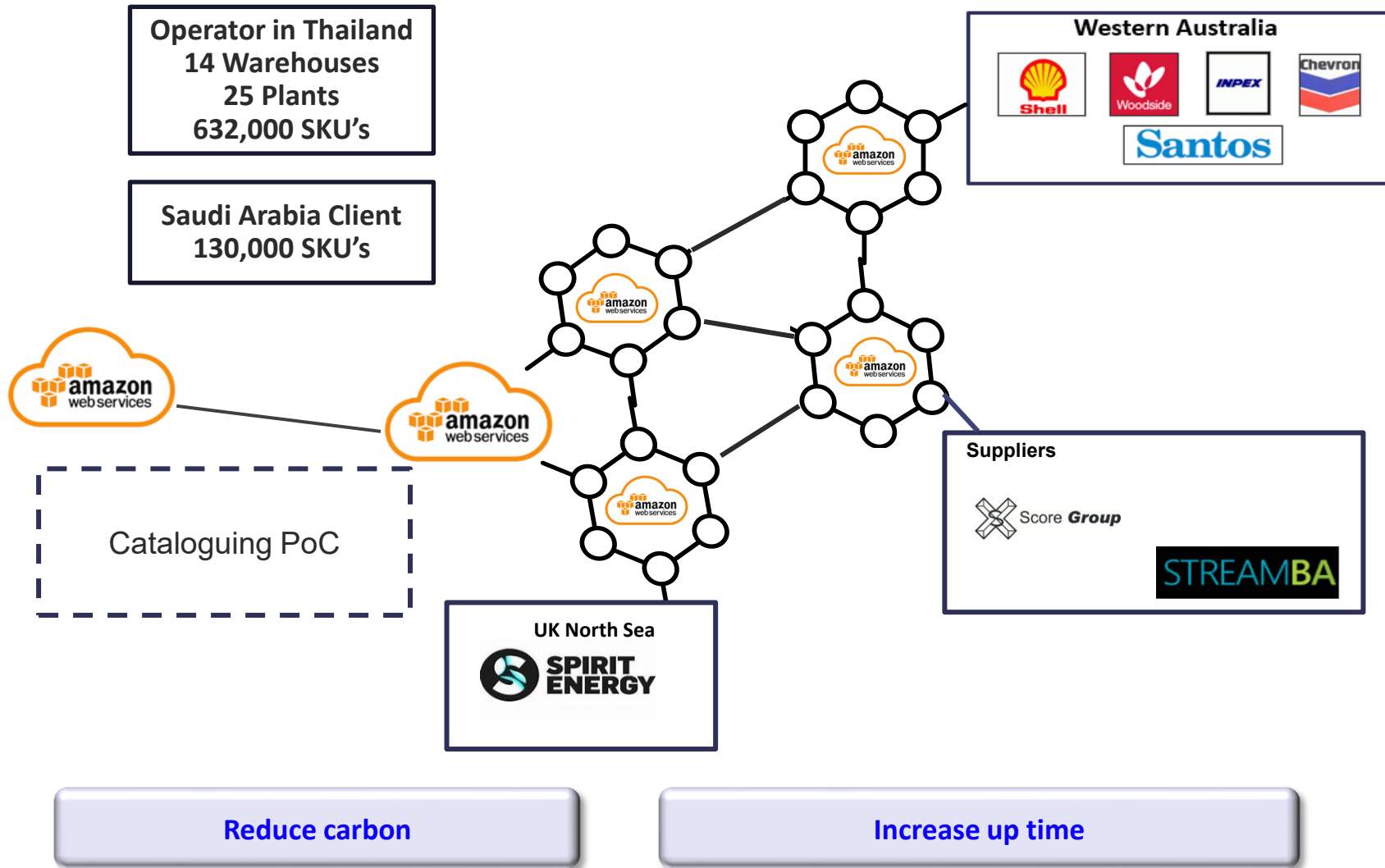
- ALL
 - Pipeline
 - Valve
 - Equipment
 - ABJ-7324 (ATMOSPHERIC VESSEL (AMBIENT TEMPERATURE), TANK)
 - ABJ-7325 (ATMOSPHERIC VESSEL (AMBIENT TEMPERATURE), TANK)
 - ABJ-7326 (ATMOSPHERIC VESSEL (AMBIENT TEMPERATURE), TANK)
 - ABJ-7327 (ATMOSPHERIC VESSEL (AMBIENT TEMPERATURE), TANK)
 - PBB-7305 (DAILY BILGE PUMP)**
 - PBB-7302 (PUMP, PUMP)
 - Metadata
 - Special Piping Item
 - Instrument
 - Note
 - Mode A

At the bottom left, a metadata table provides detailed information for the selected pump:

Text	PBB-7305
Description	DAILY BILGE PUMP
Comm System	511-03
Class Code	DOUBLE ACTING DIAPHRAGM PUMP
Description	
CAPACITY	44 GPM AT 87.0 PSID
SPARING	1 X 100%
MATERIAL	STAINLESS STEEL

Case Study – Inventory Optimisation

Implemented as Inventory Sharing eco-system



Current Stats:

Total items	613,000
Total attributes	12 million
Registered users	300

UK Operator saves planned shutdown by sourcing a critical spare part from another Operator in Darwin, Australia

➤ **Savings - Priceless**

Australian oil and gas operator ***saved 19 weeks delivery lead time and eliminated business risk*** for a planned gas turbine turnaround, ***saving millions of dollars per day on an unplanned shutdown***

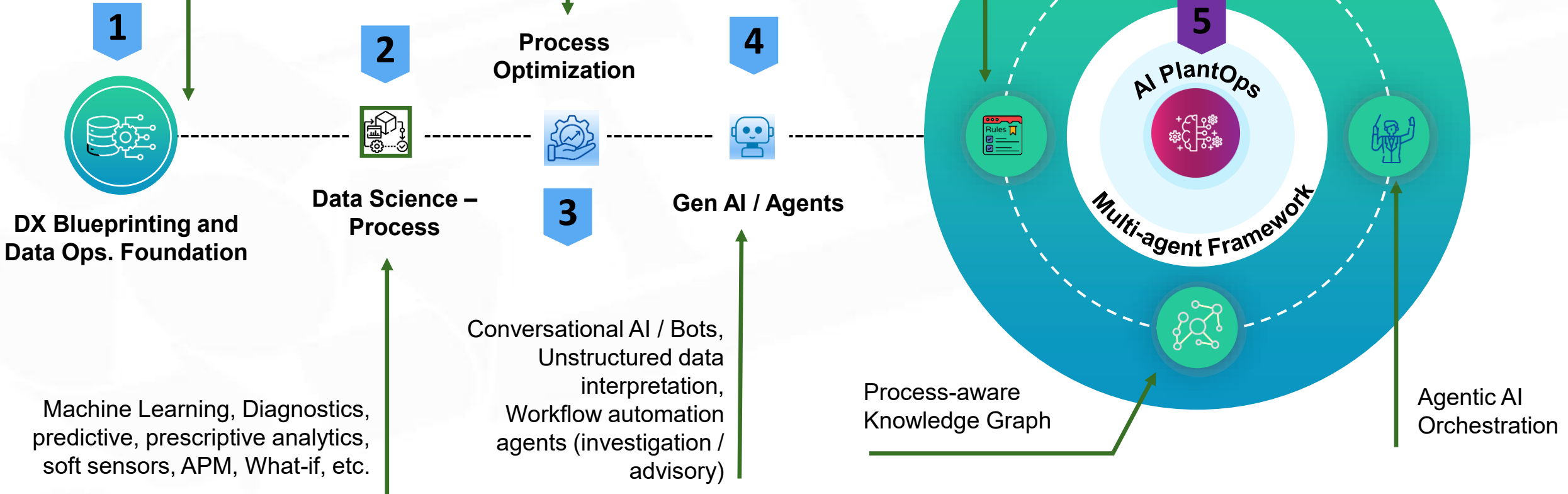
Tridiagonal.AI – Empowering Industrial AI Evolution

DX Roadmap, IT-OT,
Data fabric / DataOps,
Metadata modeling,
Knowledge graphs

Hybrid Modelling, APC, AI-
based process control,
Dynamic / steady state
process simulations

Symbolic AI + Causal AI

Context-aware AI



Tridiagonal.AI – Core Functionalities

6 AI PlantOps

- Recommendations & prescriptions
 - Network Intelligence, Value Chain
 - Knowledge management,
 - Standardization of processes

4 Inference (Predictive)

- ML or AI based non-linear / multi-variate estimators
- Quality predictions, production prediction, emissions prediction

5 Workflow Management

- Persona based – Reasoning Agents
- Advisory for enabling decision making
- PlantGPT – For Industrial Data

3 Physics

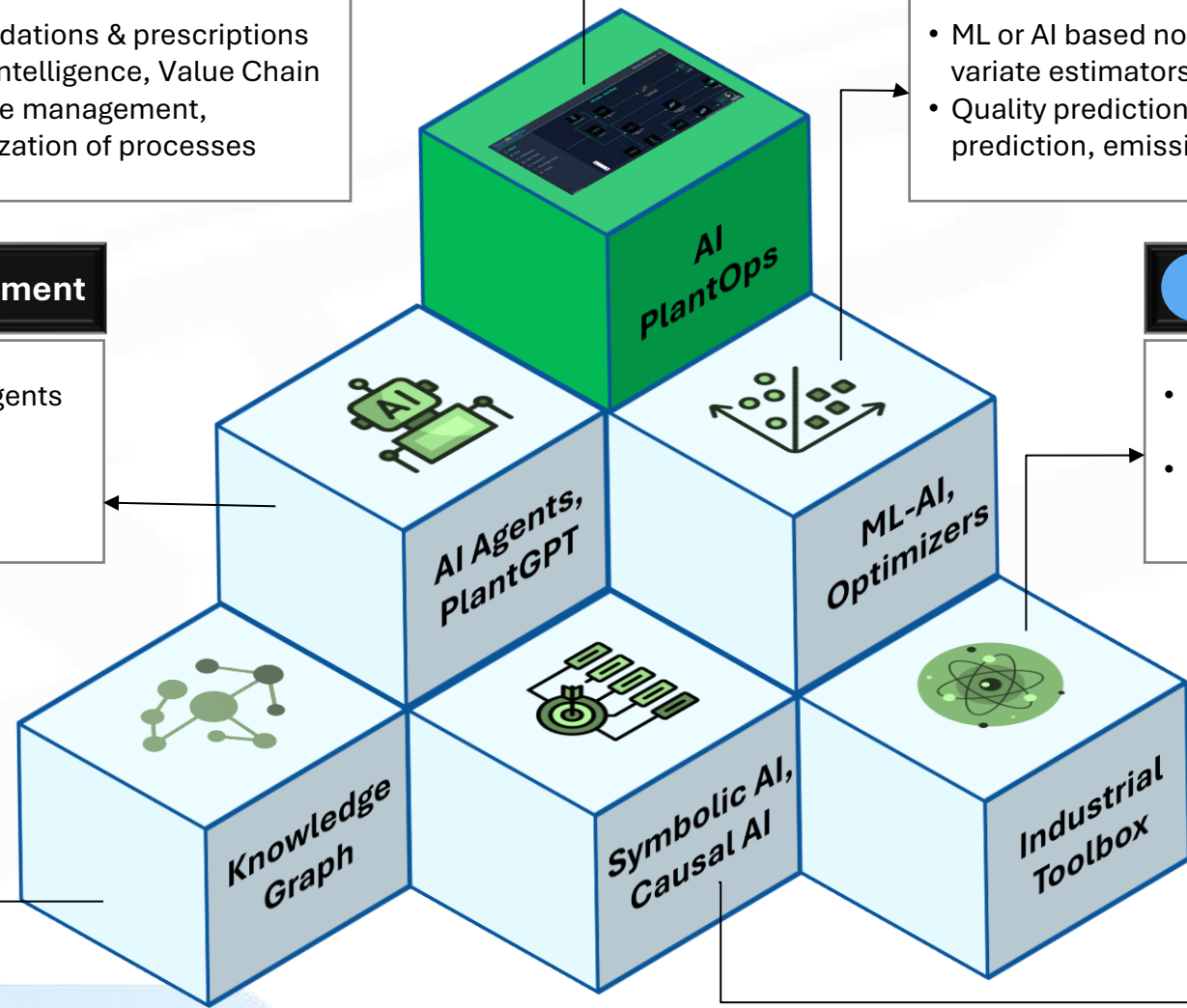
- Industrial Toolbox to capture physics – heat & mass balance
- Capture first-principles to validate recommendations

1 Process Interconnections

- P&ID based contextualization
 - Interconnected assets, processes
- Value chain based - Identifies the direction of material & fuel flow

2 Domain Experience

- Symbolic AI to Model – production planner’s experience
 - Enable knowledge mgmt.
- Develop plant-level Fault tree analysis



Tridiagonal.AI – AI PlantOps

Modes of Use:
Shadow / Advisory / Autonomous

Agentic AI –
Simulates, validates, and executes actions using physics-economic coupling

Context-aware AI –
Connects plant insights with cost, demand, logistics, and price drivers

Machine Learning –
Learns and predicts yield, energy, and fouling behaviors across feedstocks and operating conditions

Symbolic AI –
Encodes process rules, heuristics, and operational logic (e.g., COT, TMT limits, furnace coking dynamics, yield relationships)

Value Chain Knowledge Graph –
Creates a unified digital backbone linking feedstock, furnaces, downstream units, logistics, and markets into one digital ecosystem

Solutions

Automated Alarm management, RCA, Workorder planning
Maintenance Planning

Optimized product yields, increased operational efficiency, and cost savings
Conversion unit coordination

Hydrogen purity & routing optimization
H2 recovery unit efficiency
Hydrogen Network Optimization

Steam & condensate network balancing, Flare minimization
Energy & Utilities

Capacity & Resource Planning, scheduling Opti,
Planning & Coordination

Modes of Use

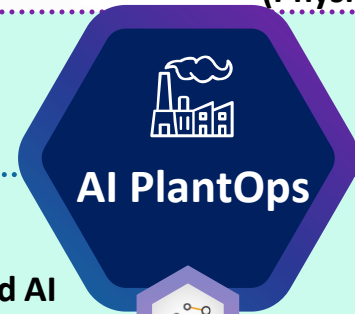
Plant GPT

Agentic AI (Physics-augmented)

Orchestration

Machine Learning

Context-aware AI (Hybrid Intelligence)



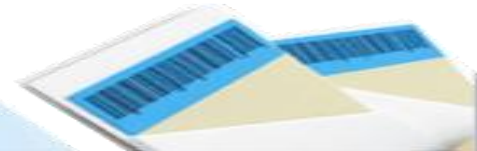
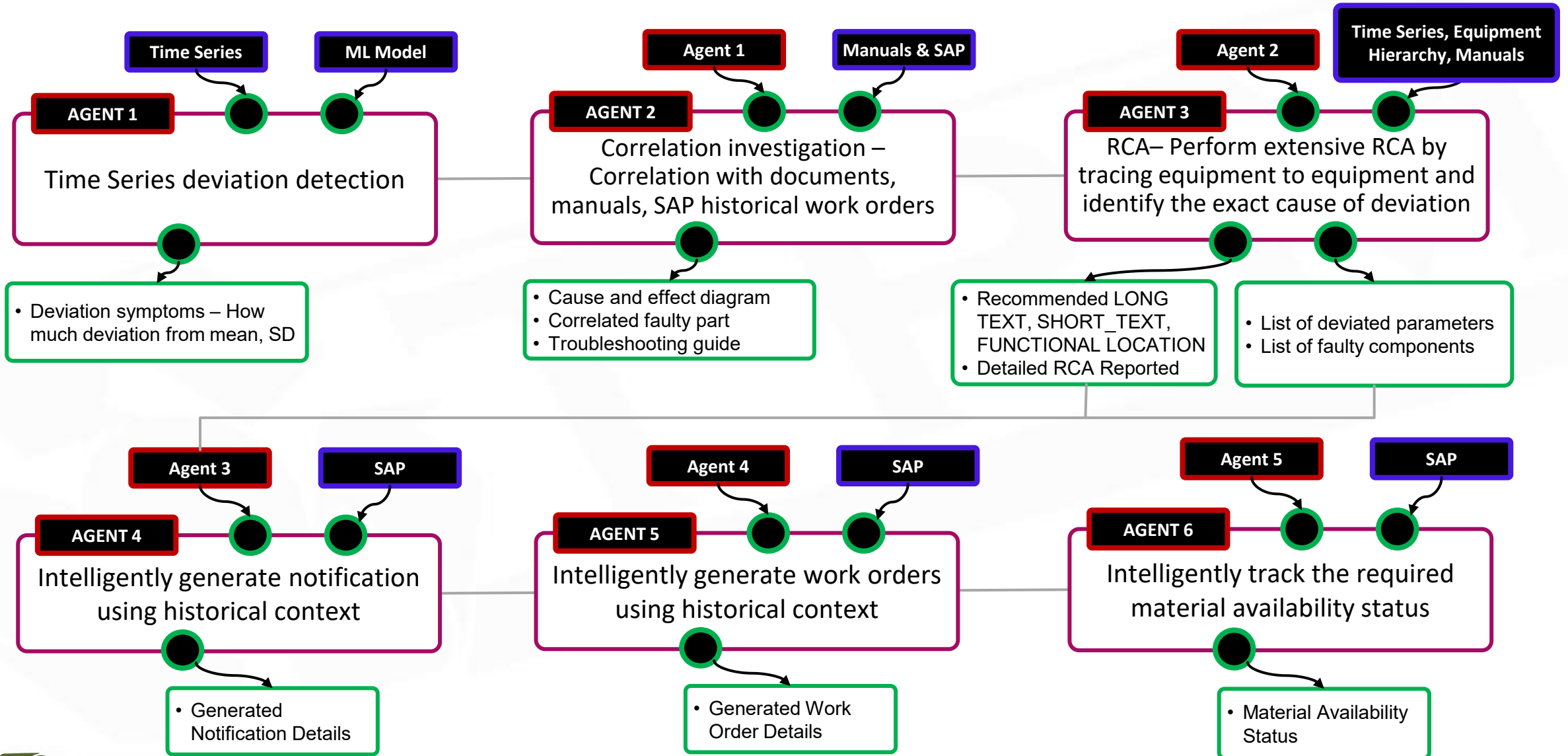
Knowledge-based AI (Symbolic)

Core

Knowledge Graph



Automated Multi-Agent Maintenance Workflow



TPM Connected Worker Solutions

- RealWear Navigator Head-Mounted Tablets
 - Ruggedized, Hands-free, Voice-controlled, Intrinsically-safe
 - New lighter-weight Arc 3
- RuggedEdge Mobile 5G Gateway & IoT Hub
 - Intrinsically-safe EdgeWatch
 - Field Connectivity with Edge AI
- Intoware WorkfloPlus
 - AI-enhanced Workflow & Business Process Digitalization
- XR Tech's XR Sense
 - Machine Vision AI with Automatic Anomaly Detection & Situational Awareness
- WolterKluwer's Enablon
 - Integrating process safety management to the Connected Worker



Connected Worker

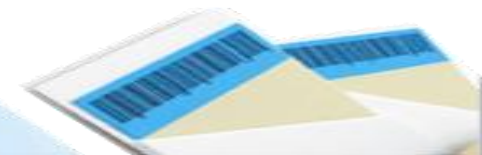
Key Benefits of Hands-Free Solutions:

- *Eliminate downtime by up to 75%*
 - First-time fixes on heavy equipment can be reduced by up to 75% through collaboration
- *Reduce travel footprint*
 - Let a single remote expert assist multiple machines and facilities at once, without costly travel
- *Improve safety and productivity*
 - Access to information in context without distraction workers maintain situational awareness



- Modular & rugged with full-shift use
- Seamless hands-free use with robust voice controls
- Intrinsically-safe and Thermal Camera (FLIR) options
- Services and Support

<p>What you can do out of the box</p> <p>No extra software or connectivity required</p>	Image & Video Capture	<ul style="list-style-type: none"> • Share knowledge • Capture processes • Perform inspections • Document issues • Reduce paper • Faster training 	<p>What you can do with 3rd party software</p> <p>Select from one of our many software partners</p>	<p>Remote Mentor (XR Sense, Brochesia, etc.) Requires connectivity</p>	Provide expert knowledge remotely
	Video Playback			<p>Industrial IoT Data Visualization (XR Sense) Requires connectivity</p>	Performance, diagnostics, predictive data & historic trends
	Document Navigation			<p>Digital Workflow (XR Sense, Intoware, Brochesia, TeamViewer)</p>	Increased productivity & error reduction



RealWear Navigator 520



Communicate and Connect

Four Microphones with Active Noise Cancellation

100% Hands-Free Use

Fully Voice-Controlled up to 100 dBA



See the Invisible

Access to FLIR Thermal Studio Suite



Revolutionary Modular Design

48MP Camera Sensor with Enhanced Zoom



"Flashlight On"

Ease of Use and Secure

Fingerprint Reader to Unlock Device



The Next Generation of Rugged Wearables



** RealWear Navigator Z1 is the intrinsically-safe model*



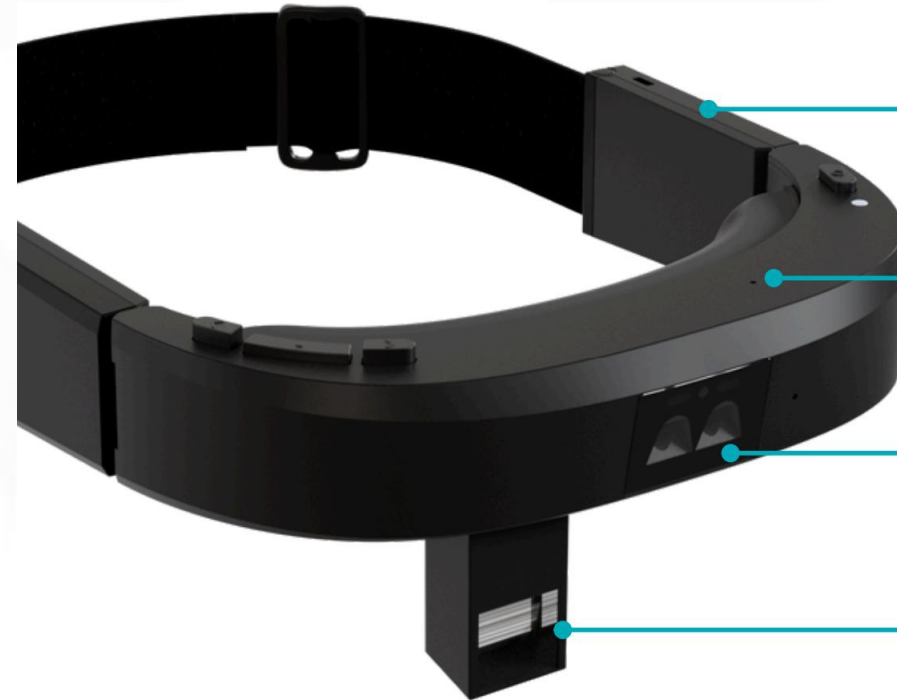
RealWear Arc 3 (released Oct 2025)



Why the Arc 3?

Not every job requires heavy ruggedization, such as in lighter-duty use in logistics, warehousing, retail, healthcare, and field service

- **Precision display:** Featuring a double retina display, designed for sharp visuals
- **Sleek, as it should:** Weighing 175 grams, and can be worn with any PPE equipment
- **High-performance camera system:** Two lenses, capturing any environment

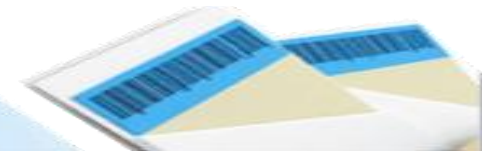


Weighing just 175 grams, the RealWear Arc 3 is lightweight, easy to wear and adjust.

Featuring four built-in microphones and advanced noise reduction technology.

Dual camera system to capture a broader field of view and allowing to zoom for details.

See-through display, allowing sharp details and a full-color HD micro-OLED display.



Connected Worker – Mobile 5G Gateway & IoT Hub



RUGGEDEDGE



Purpose-built, industrial grade, intrinsically safe (ATEX Zone 1 & Zone 2) edge computing hub with 5G, enterprise grade Wi-Fi 6/6E, BLE, NFC and Starlink connectivity ready out-of-the-box



Fixed Mounted 5G

5G & Wi-Fi /Bluetooth anywhere in the field with intrinsically safe power. Audio & video surveillance viewed globally (EdgeView™)



Global Push-To-Talk (PTT)

Fully functional PTT digital communications anywhere in the world



RUGGEDEDGE



wood.

NOV

أدنوك
ADNOC



aramco



Honeywell ExxonMobil



RuggedEdge Intrinsically Safe EdgeWatch

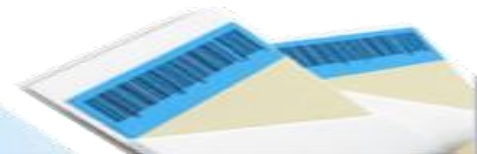


RUGGEDEDGE

World's only AI-enabled health monitoring smart watch designed for combustible environments



- Class 1 Div 1 / Zone 1 Certified
- IP68 dust/waterproof
- Ruggedized MIL-STD-810H
- Android Operating System
- WIFI Enabled
- Bluetooth, GPS, NFC
- **SOS** button
- **Man-down** feature
- GPS Location
- Vibration Alarms
- Health Monitoring
 - Activity Levels / Exertion
 - Heart Rate / Pulse Tracking
 - Blood Oxygen Level



AI on the Edge



RUGGEDEDGE

- **RuggedEdge AI Push-to-talk**

- Uses natural speech to communicate with AI and answers are returned audibly and on screen
- Supports 80 languages and auto-detects the language spoken
- Large language model (LLM) is trained with domain specific information, OEM and customer data, providing detailed and accurate answers to technical questions
- Platform can tap into real-time data like maintenance, safety and operational records
- Highly secure platform where the speech engine, LLM, domain & customer data stay local to the device



Workflow & Business Process Digitalization



Streamline & standardise paper processes into digitalised tasks accessed by mobile, tablet or wearable device

w⁺ **WorkfloPlus**
Making the complex simple

Instantly distribute job reports and generate previously unavailable data into human based procedures



Work Instructions



- 200% Productivity Boost*
- Accurate Machine Set Up
- Distribute SOPs Instantly

Compliance



- 100% Accurate ISO Audit Trail
- Improve Health & Safety
- Guarantee Industry Regulations

Inspections



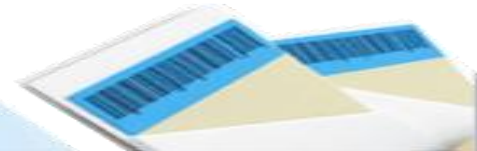
- 300% Extra Inspections*
- Optimise Maintenance
- Increase Product Quality

** Petrofac Proof of Concept Use Case*

Training



- Retain Expertise of Workers
- Onboard Workers Quickly
- Remote Expert Assistance



WorkfloPlus AI Features

Smart Workflow Creation

Create a prompt and AI-generates digital instructions based on your needs

New Draft Workflow

Workflow Name *
HAZOP workflow

Description

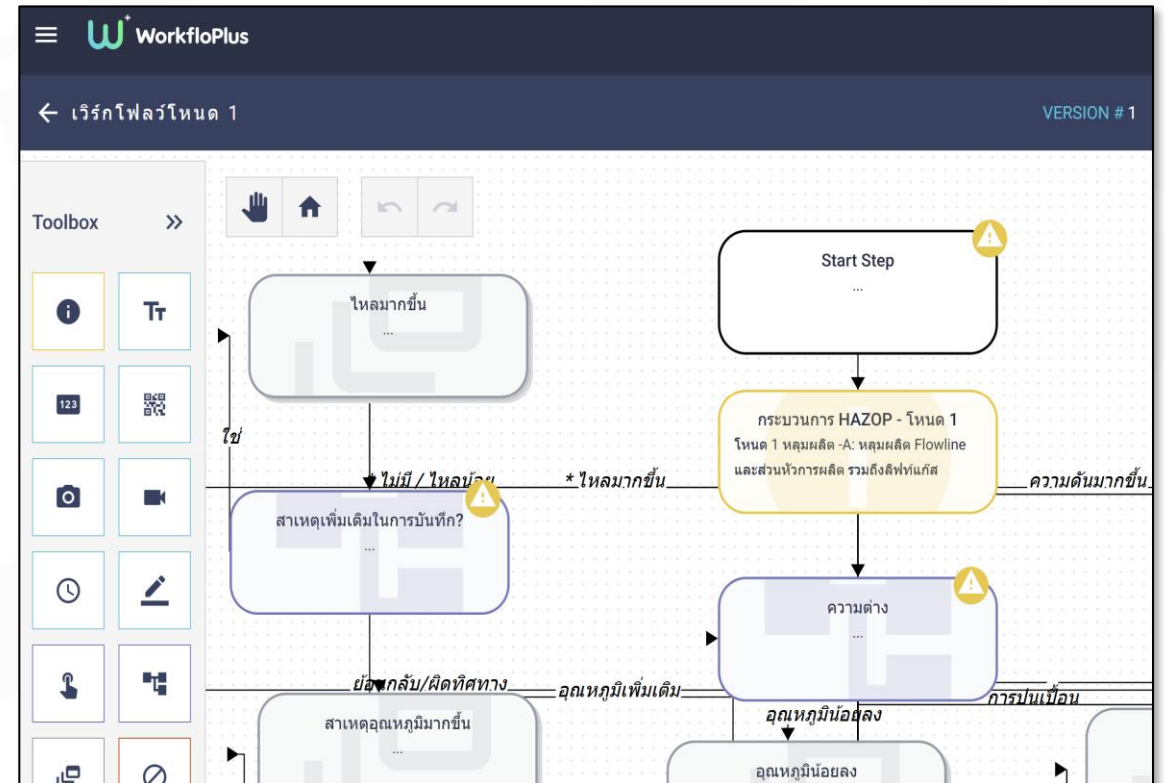
Generate a workflow for executing a HAZOP study, importing the relevant data from Asset Database, selecting a HAZOP node from a drop down list, then a parameter, then a deviation, then causes, then consequences, then safeguards, then risk matrix value, then recommendations, and then responsible party. Workflow should iterate over all deviations, then parameters and then nodes.

Please note that you are responsible for reviewing and verifying the Workflow generated by the AI Workflow Generator. The AI Workflow Generator may not generate a Workflow that is compliant with applicable laws and regulations and you must therefore fully verify the process to ensure it meets your business needs and any legal and/or regulatory requirements.

Create
 Generate
Cancel

Instant AI Translation

AI translates workflows instantly into multiple languages for global rollout, with workflow consistency across languages

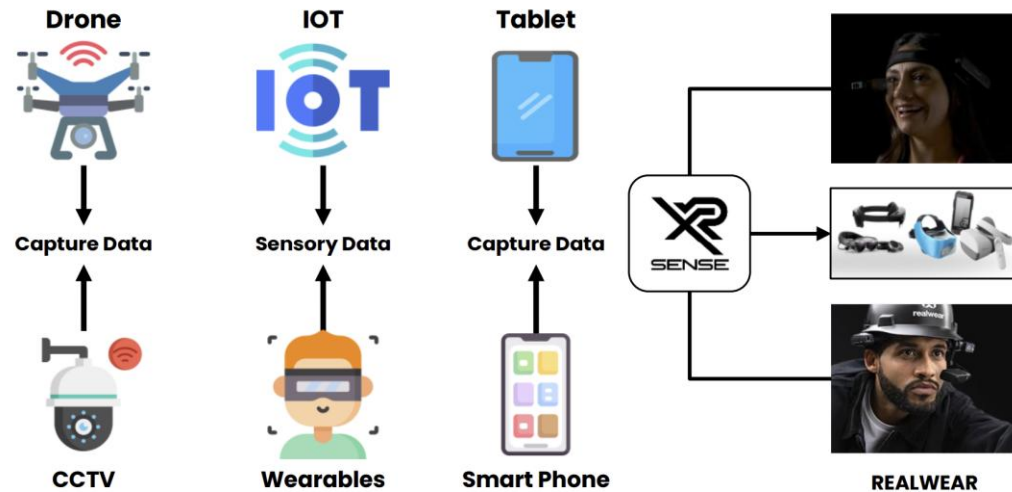


One Process. One Standard. Everywhere.
Satu Proses. Satu Piawaian. Di Mana-mana.
 หนึ่งกระบวนการ มาตรฐานเดียว ทุกที่
 एक प्रक्रिया। एक मानक। हर जगहा।

AI-enhanced Vision – XR Sense

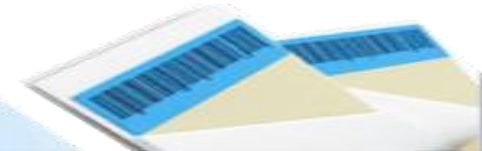


- XR Sense uses Machine Vision to automate tasks and seamlessly incorporate MV findings into a single operational view
- Powerful web-based platform combines camera-enabled end-user devices, with highly accurate geographic information systems and a smart decision-making engine
- High-performance, scalable, secure solution








This section highlights five key benefits of the XR Sense system, each illustrated with a circular image of a worker wearing an XR device:

- WORKFLOW**: The step-by-step workflow for quality assurance. Glass to glass remote support to optimize productivity.
- Remote Support**: Ability to see operators' location, connect with experts and support via call, annotation, and key data as required.
- Computer Vision**: Automatically detect anomalies from various capture devices and centralise results to increase business intelligence.
- Automation**: Immediate actions and alerts to reduce waste, increase productivity and ensure worker safety.
- Situational Awareness**: Know where your workers are and the tasks they are performing; to improve performance and create a safer environment.

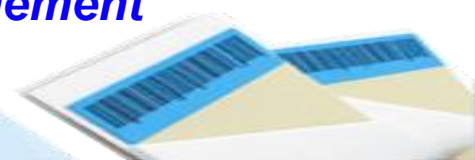


Connected Process Safety Management



 ESG Excellence	 Environmental Management	 Health & Safety Management	 Process Safety Management	 Control of Work
Asset level emissions Water discharge	Air Quality Water Management Waste Management	Occupational Health Industrial Hygiene Ergonomics Analysis	Barrier Management Dynamic BowTie	Shift Management
Stakeholders Mgmt <i>Materiality Assessment</i> Project Portfolio Mgmt ROI Analysis Scenario Analysis	Environmental Analysis <i>Spills and Air emissions event tracking¹</i>	JSA/JHA Training/Competency BBS Observations <i>Full Investigation Mgmt</i>	BowTieXP <i>Process Safety Event¹</i> <i>Emergency planning & response</i>	SIMOPs ORA LO/LC & TD Checklists <i>On-time Prevention¹</i>
Risk Management	Compliance Management	Inspection Management	BowTieXP Enterprise	iDiagrams (P&IDs)
GHG Emissions Utility Data Management <i>API to 3rd party systems</i>	Calendar	<i>Injury/Illness tracking</i> Safety Meetings	Process Hazard Analysis Mechanical integrity Inspection	Permit to Work Isolations Mgmt./LOTO TRA/JHA
Objectives Management Metrics	Document Control Audit Management	Root Cause Analysis Incident Management	Management of Change	Site Monitoring & Graphics
ESG Disclosure Reporting (Powered by CCH Tagetik) ESG Open Insights	Compliance+	H&S Open Insights Risk & Control Register		MOC & PSSR (ORM) GIS Visualization Tag Assistant

TPM Connected Worker solutions can integrate into Enablon for real-time process safety management



TPM Solutions Summary

- Highly experienced Consultants/Subject Matter Experts driving value through Business Process as a Service (BPaaS)
- Energy & Process industry focus including Energy Transition / Clean Fuels
- Value Add to Capital Projects
- Cutting Edge Solutions for Plant Performance
- Digital Operational Excellence full capability including proven AI applications
- Connected Field Worker/Technician empowerment for Energy, Manufacturing and Service industries
- Our advanced digitalization and Artificial Intelligence solutions provide leading-edge technology to our clients, supported by our deep domain expertise, capturing benefits, improving efficiencies, and enhancing safety in a sustainable manner

***Design, Operate, Manage and Improve your Business
(from any location on any device)***



www.tpm-solutions.com
info@tpm-solutions.com

