Baringa

Bridging the Gap

The role of data in Digital-Physical Integration for a Smarter Energy Industry

November 2024

Certified B Corporation

Baringa is a certified B Corp™ with high standards of social and environmental performance, transparency and accountability.

Baringa | a specialist consulting firm

Putting people first. Creating impact that lasts.

Baringa

Our purpose is to create a distinct and innovative consulting experience by **genuinely partnering** with our clients and bringing exceptional **Sustainability subject matter expertise**.

Our **2,000+**

professionals globally can support you with your climate journey.

- ✓ Consistently **ranked as one of the leading Energy & Sustainability consulting businesses**
- ✓ Professionals across the **UK, Europe, Singapore, North America, Asia and Australia**
- ✓ Led by 130+ market-facing partners, who are **subject matter experts in our industries and capabilities**
- ✓ Operationally-minded, **specialist consultancy with proven IP** to understand problems and **deliver bespoke, innovative solutions**

Our brand vision defines what is distinctive about Baringa

"Putting people first

Delivering impact that lasts."

Baringa

Our energy and resources practice

A globally leading advisory business helping organisations navigate the energy transition

>800 energy experts

300+ clients

60 countries where we model the energy system

$150bn of capital advised on into low carbon

What we do

Analyse and design markets and policy

Determine strategy and investment decisions

Identify new commercial opportunities and manage risk

Structure and run more effective businesses

All underpinned by a world leading energy market modelling capability

Our impact

- Most Highly Regarded for Power Market Forecasts in independent research undertaken by *Kroll* (formerly Duff & Phelps) in 2020
- Awarded World's Best Management Consultants by *Forbes 2023* in the US.
- Climate Risk Advisory Firm of the Year *Energy Risk Asia 2023*
- Voted Leading Energy & Utilities Advisor by the *Financial Times* in their annual survey of Management Consultants for 5 years running
- The largest management consultancy in the world to achieve B Corporation status

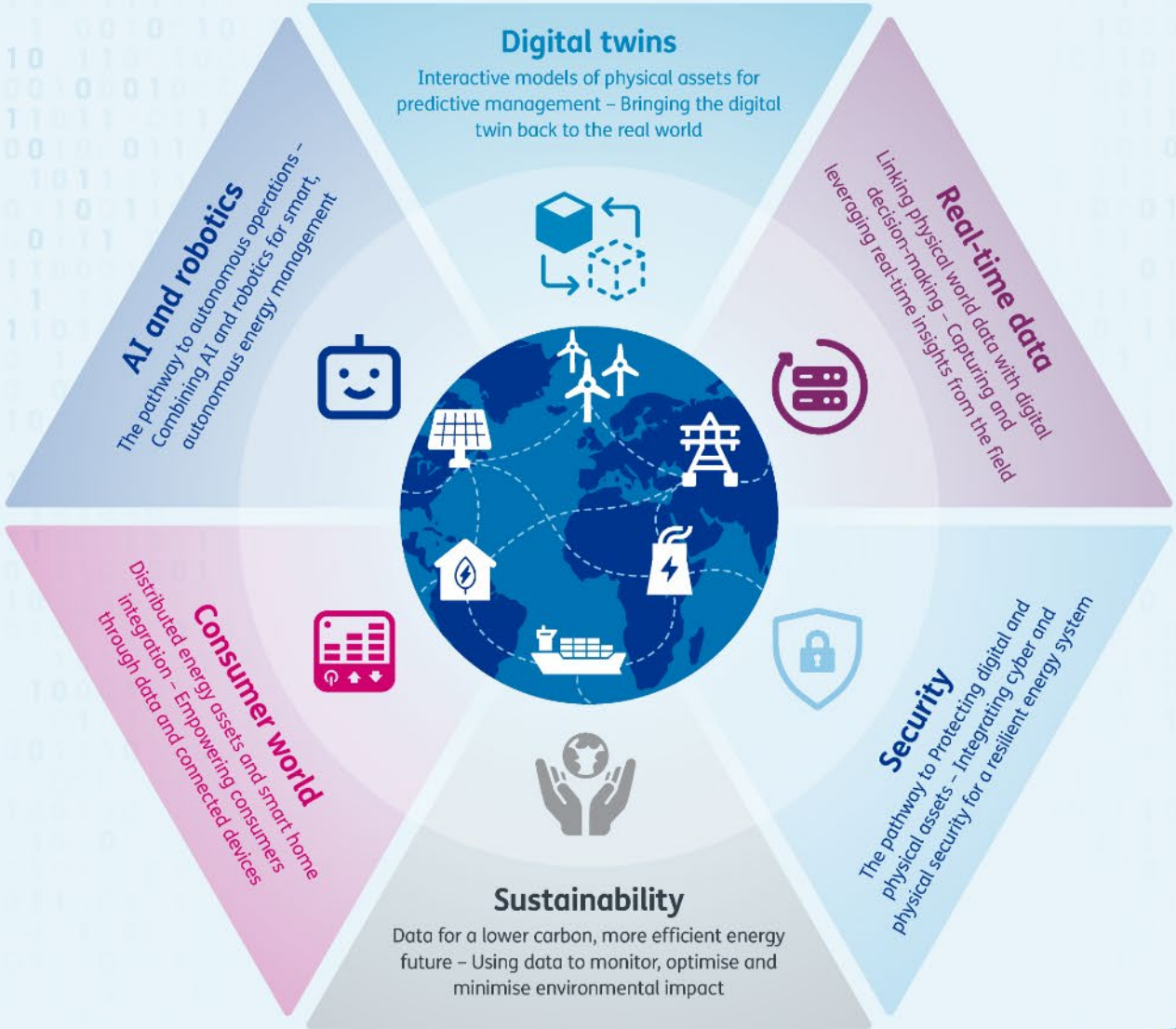
What our clients say

"We looked to Baringa as the only partner with the thinking and track record of experience to start to unpack the complex benefits of Hydrogen."

The Hydrogen Council, 2023

Bridging the gap

The role of data in digital-physical integration for a smarter energy industry



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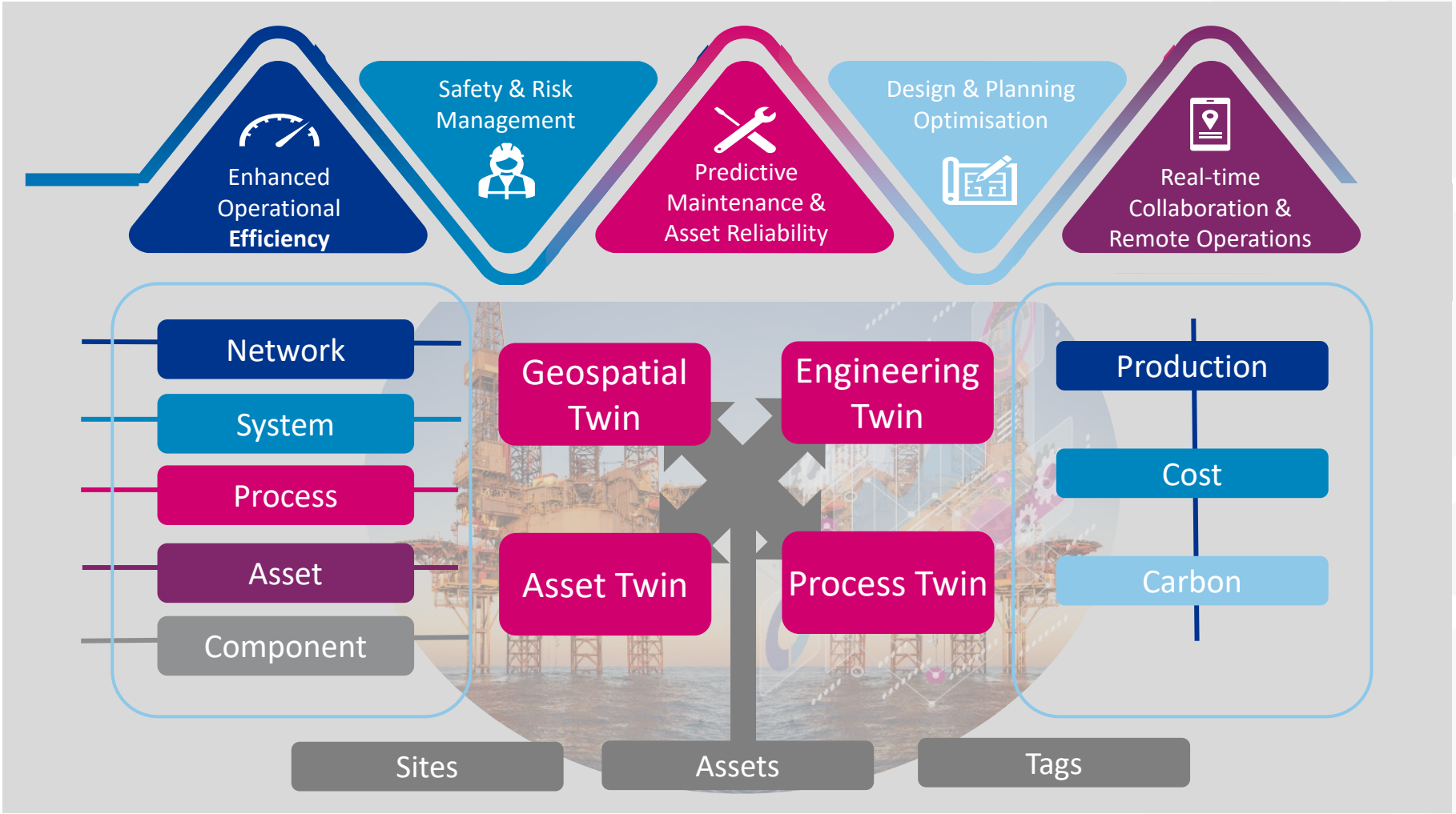
Digital twin(s)

In a multi-twin world, designing for interoperability and aligned master data are key



Network Digital twin for onshore Oil & Gas in the Middle East

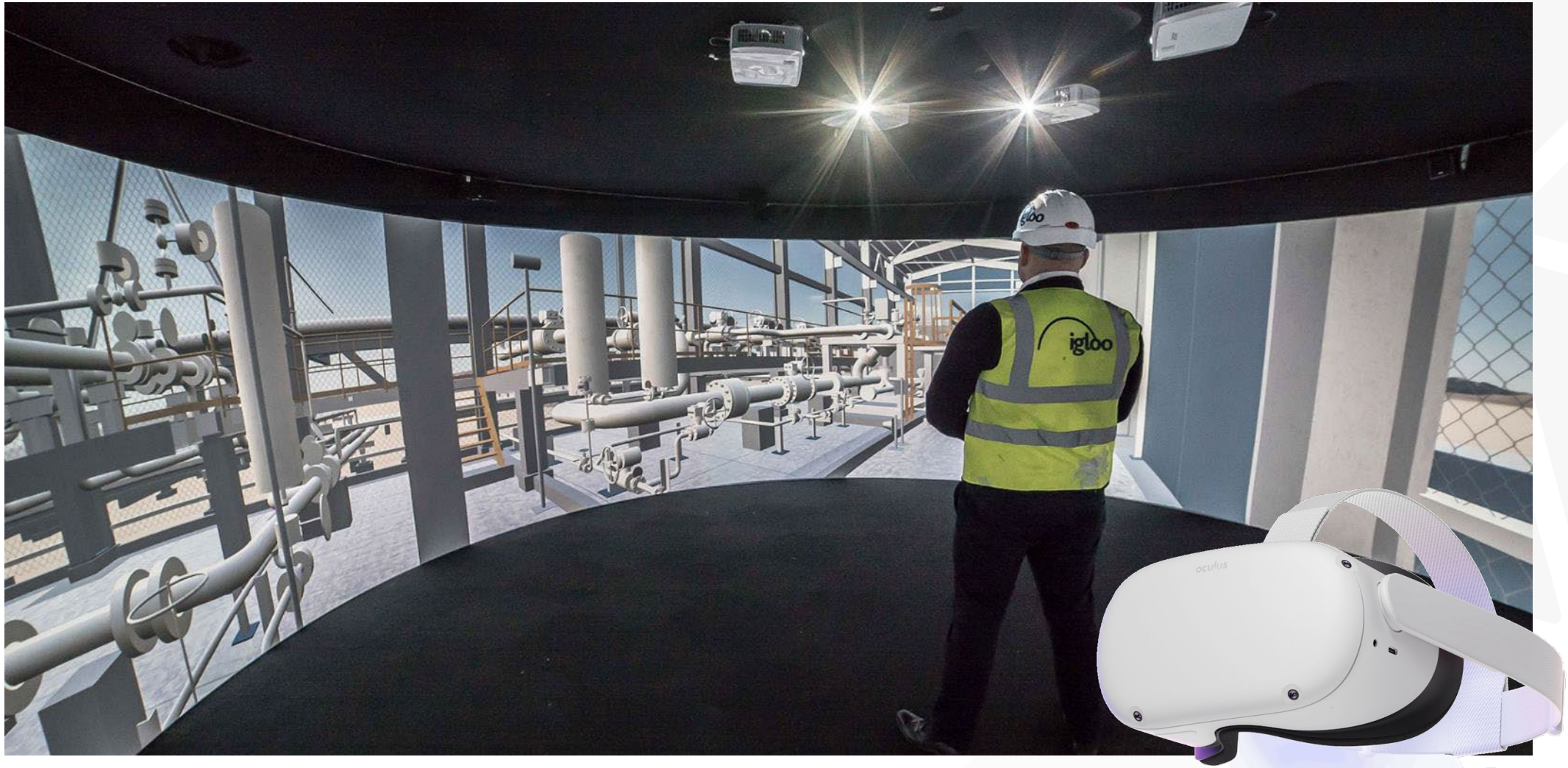
Engineering Digital Twin for a Power Generator in the UK

System and Asset Digital Twins for a Network Utility in Scotland

Asset Digital Twins for an H2 Electrolyser in Europe

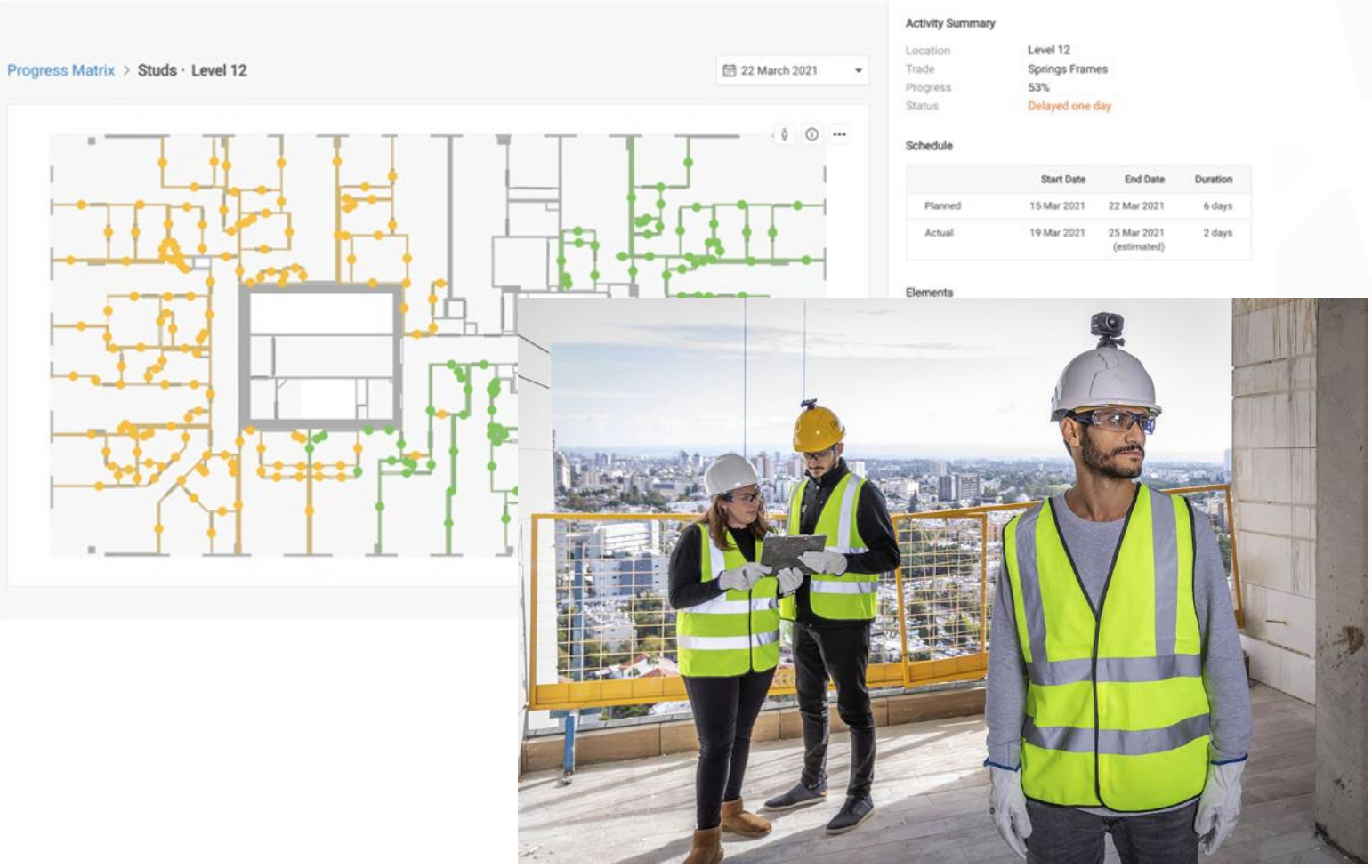
Digital twin

Bringing the digital twin back to the real world



Real-time data

Linking physical world data with digital decision-making – Capturing and leveraging real-time insights from the field

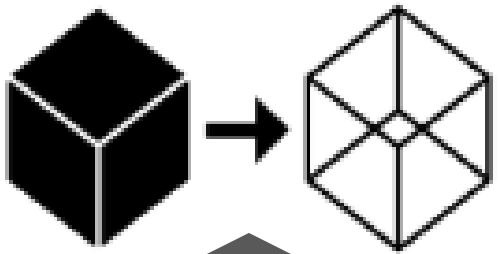


Real-time field feeds

- Instrumentation
- Clip on sensors / LoRaWAN
- Static Video feeds
- Worker worn camera
- Drones
- Robotics

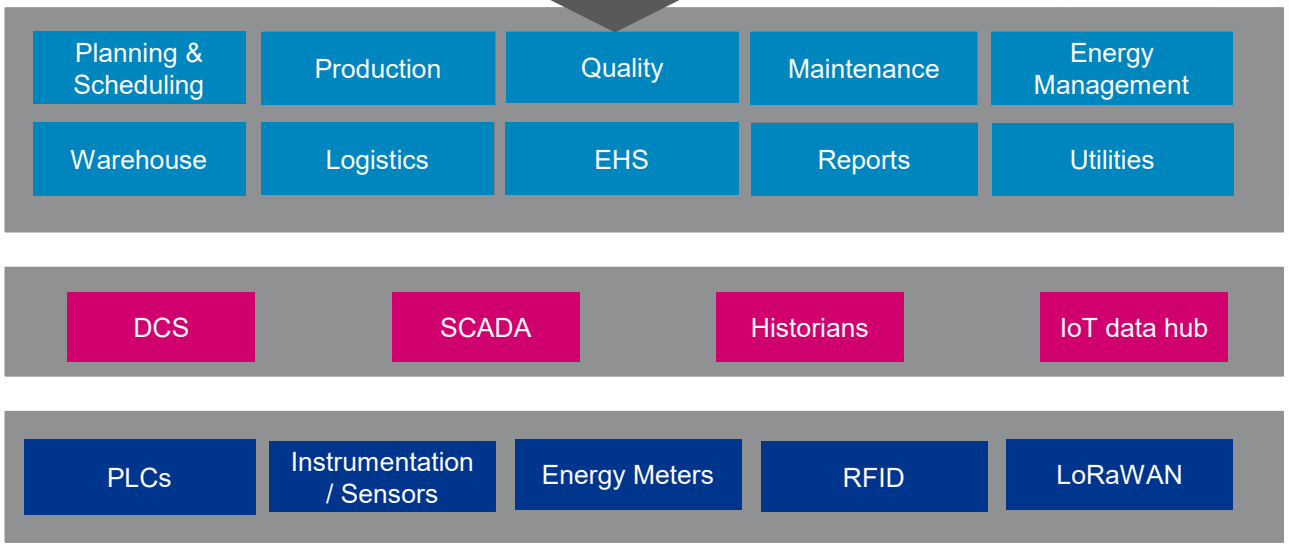
Digital twin

While energy companies are planning for digital Twin value, data foundations often hold them back



Digital Twin

Digital Twin Foundations

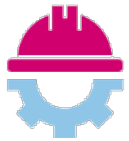


Typical Digital Twin data issues

- Gaps in data from past projects
- Legacy data sources – e.g. Paper / dumb pdfs
- Historical acquisitions / integrations
- Lack of data governance culture and processes
- Interoperability challenges

AI and robotics

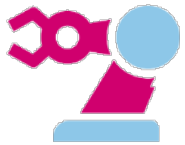
The pathway to autonomous operations – Combining AI and robotics for smart, autonomous energy management



Operated

Robotics controlled remotely by operators

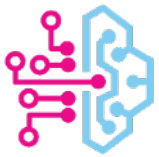
- ✓ Perform inspections in difficult to reach areas (drones, crawlers, swimming)



Semi-Autonomous

Execute tasks on a fixed path & require human intervention

- ✓ Fixed repeatable tasks e.g. crawlers on risers, stock picking
- ✓ Human intervention for more complex routes and analysis



Fully Autonomous

Autonomously move around assets & real time anomaly detection

- ✓ Robotics understand environment

Decision Making

Ability to identify, assess and fix issues without human support.

- ✓ **Self-healing** (e.g. paint over rust, fix leaks)
- ✓ Auto deploy robotics to perform detailed inspections when problem identified

Enablers:

Experienced robotic operators	• Ability to understand and map environment.	• Ability to understand and map environment. • Pay load: Lidar & cameras, sensors, edge compute	Robotic AI platform to enable: • Swarm robotics • Non homogenous intelligence • Complex manipulation

Requirements to deploy: *Connectivity for communications, access to power (tethered or battery), strong network security, flexible IOT network topology, edge compute capability, regulatory framework*

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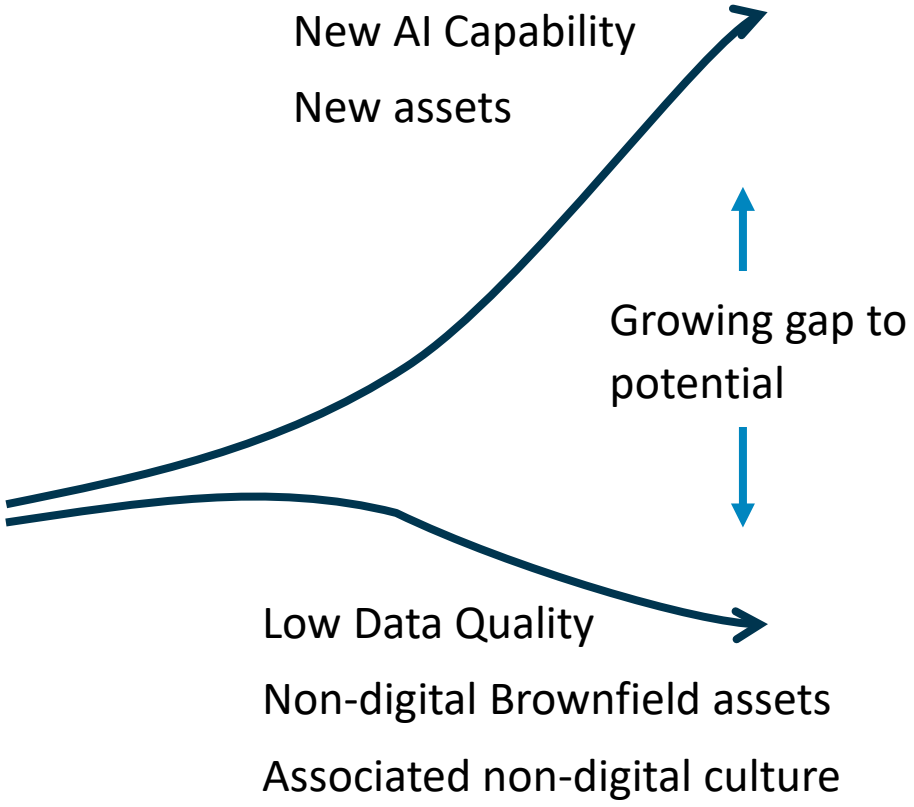
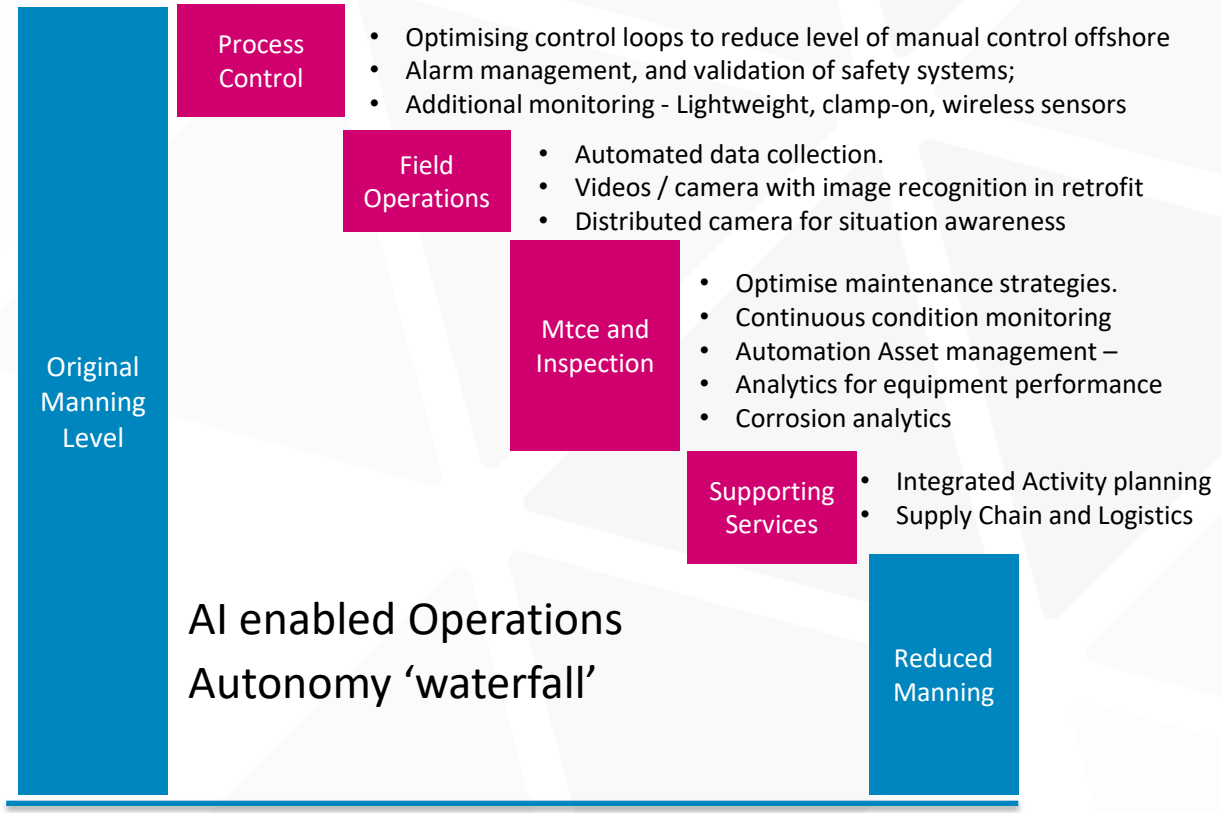
AI and robotics

The pathway to autonomous operations – Combining AI and robotics for smart, autonomous energy operations management

The speed of progress in new AI capability combined with slow progress addressing brownfield asset is creating a growing gap



In each operations domain, data, insight and analytics helps us close the gap



Sustainability

Data for a lower carbon, more efficient energy future – Using data to monitor, optimise and minimise environmental impact

Consumer world

Distributed energy assets and smart home integration – Empowering consumers through data and connected devices

Smart meter (including Comms Hub, In-Home Display) to communicate half-hourly readings to system and consumer

Energy efficiency, such as loft/cavity wall insulation, to maximise flexibility potential of premises and avoid energy loss

Home Energy Management System to optimise consumption, production and storage of energy assets

Roof-top solar panel or other forms of micro-generation, to produce energy for consumption, storage or export

Smart white goods/appliances that optimise consumption to reduce cost, carbon or grid impact

Battery storage system to store energy for use at a later point or export to the grid

Electric vehicle, supported by smart/bi-directional **charging** that optimises charging patterns and exports back to home or grid

Low Carbon heating, cooling or air conditioning (HVAC), such as electric heating, air/ground source heat pump or heat network

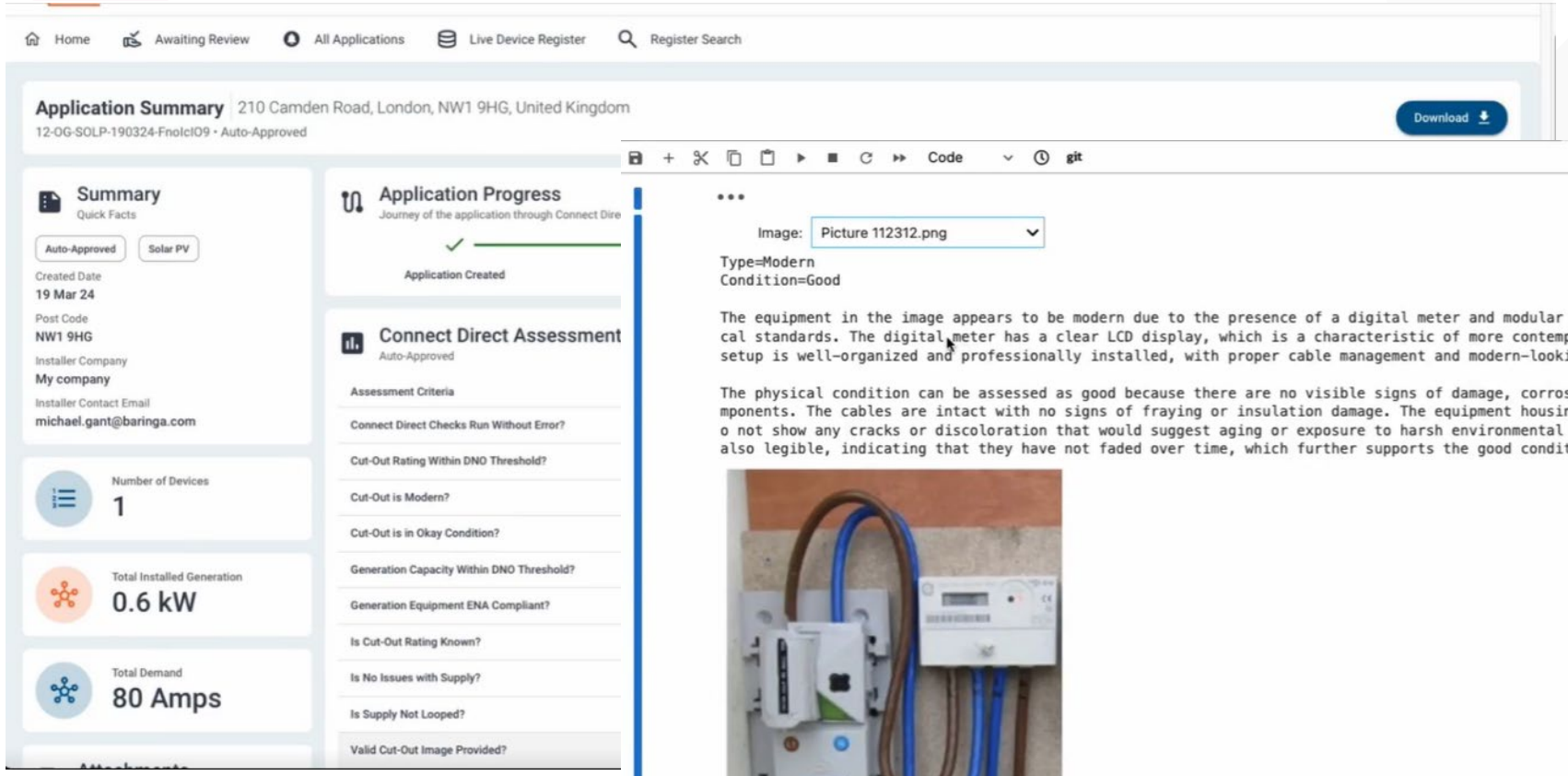
All devices **connected to local/remote network,** and able to communicate with each other

Smart consumer tariffs that incentivise demand optimisation and reward export

Real-time data monitoring, communicated back to consumer and other third parties

Consumer world

AI Powers getting renewable asset data right



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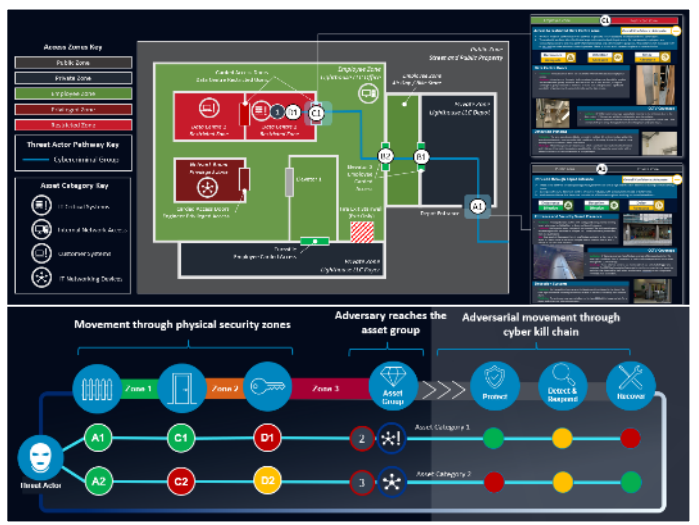
Security

The pathway to Protecting digital and physical assets – Integrating cyber and physical security for a resilient energy system

Russia is fighting a hybrid war in Europe…

A war that leverages data and ‘cyber physical’ tactics…



our clients need to protect against ‘dual domain’ attack.

Bridging the gap

The role of data in digital-physical integration for a smarter energy industry

- Data is key to bridging the gap between physical and digital worlds
- Digital Twins enabling a path to optimizing asset performance and autonomous operations
- Gaps today in data foundations across the sector including lack of data governance culture and processes
- Emerging gap to full AI potential with brownfield data and capability gaps
- New focus on Open (Smart) Data in the Energy System – Trust is key
- Cyber & Physical security need to come together to address threats