



The Digital Transformation Journey at Bluescope, Australian Steel Products, Manufacturing

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THE DIGITAL TRANSFORMATION JOURNEY AT BLUESCOPE STEEL MANUFACTURING

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Bluescope Steel

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Digital Transformation – BlueScope's Journey

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Digital Foundations – The Pillars for Success

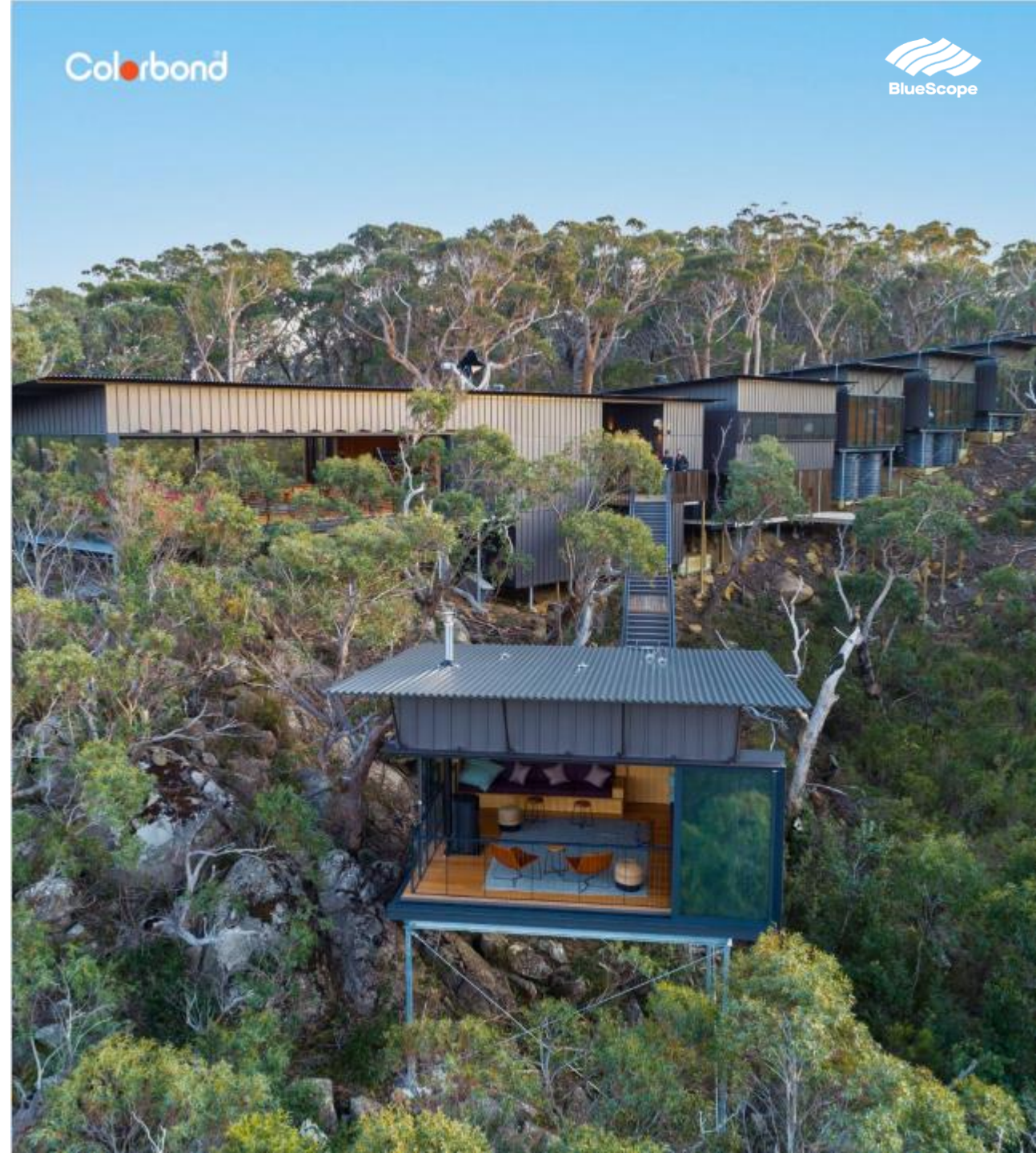
4

Example of Digital Transformation in ASP Manufacturing

- The Information Layer – Lorawan IoT Sensors
- Digital Twin - GHG Intensity Scenario Evaluation
- Asset Intelligence – Transforming our approach to Asset Maintenance
- Machine Learning – Operator Guidance in Steelmaking

Colorbond

BlueScope



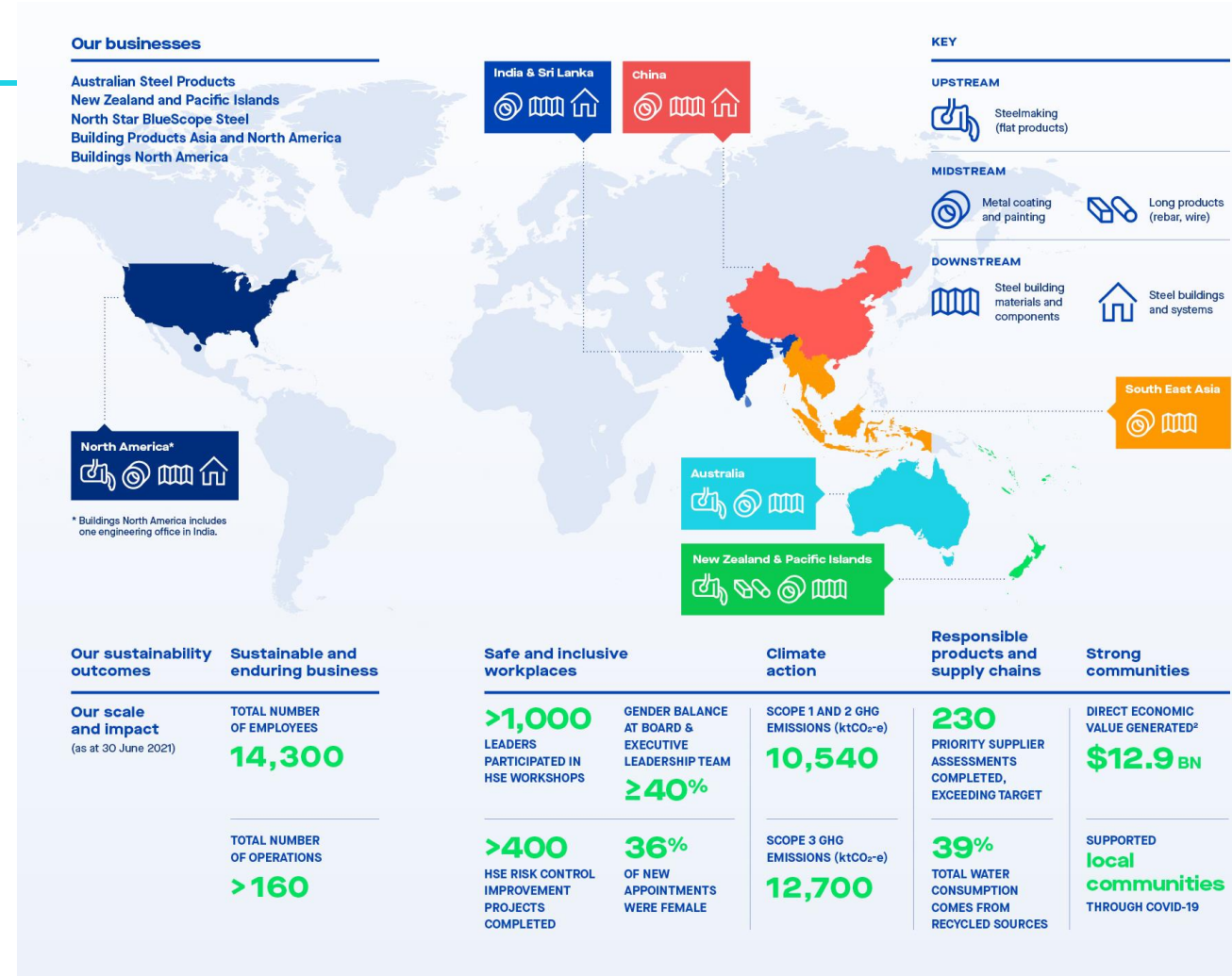
BLUESCOPE STEEL



BlueScope is a provider of innovative steel materials, products, systems and technologies, headquartered in Australia with operations spread across North America, Australia, New Zealand, Pacific Islands and throughout Asia.

We are one of the world's leading manufacturers of painted and coated steel products, and with our strong expertise in steel we provide vital components for houses, buildings, structures, automotive and more.

www.bluescope.com



Australian Steel Products

- Australian Steel Products employs around 6,000 employees at more than 50 facilities and over 50 distribution centres in Australia.
- We specialise in flat steel products, including slab, hot rolled coil, cold rolled coil, plate and value-added metallic coated and painted steel solutions. Our key focus is on higher value, branded products for the building and construction industry.
- Our steelworks at Port Kembla - in New South Wales Illawarra region - is the largest steel production facility in Australia. With an annual production capacity of approximately 3.0 million tonnes of crude steel it manufactures slab, hot rolled coil and plate products.

Colorbond®

COLORBOND® steel is one of the most advanced pre-painted steel products in the world [more](#)

Deckform®

New DECKFORM® steel is the latest development in composite concrete slabs and formwork. It carries a full BlueScope Steel warranty and is available in two galvanised coating thicknesses [more](#)

ENDURO FRAME®

The ENDUROFRAME® building system is a efficient light gauge steel framing system used to design, detail and manufacture steel trusses and wall frames for residential and light commercial markets [more](#)

Galvaspan®

Cold formed, galvanised purlins made from GALVASPAN® steel have minimum yield strengths around 60 per cent greater than hot rolled steel purlins [more](#)

LYSAGHT

BlueScope Lysaght is a business of BlueScope Steel, Australia's largest steel maker and the company whose reputation, growth and success have become part of the nation's industrial history [more](#)

Truecore®

Few things in life are as important as protecting the value of your family home and the environment. A house frame made from TRUECORE® steel is strong and durable, straight and true, lightweight and termite proof [more](#)

Xlerplate®

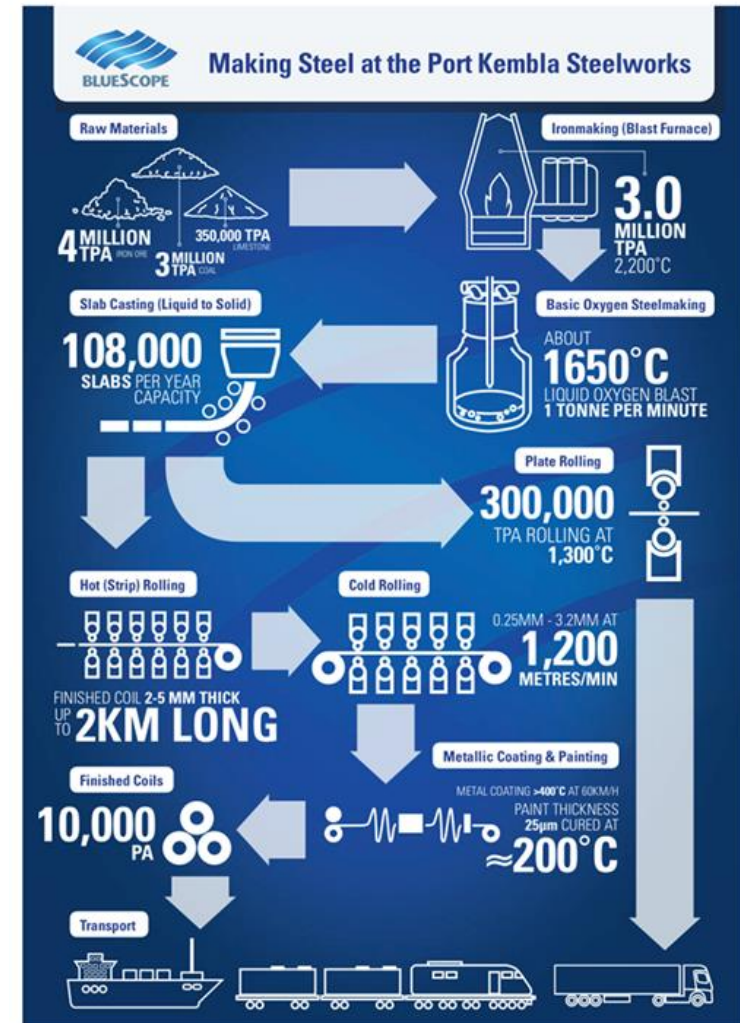
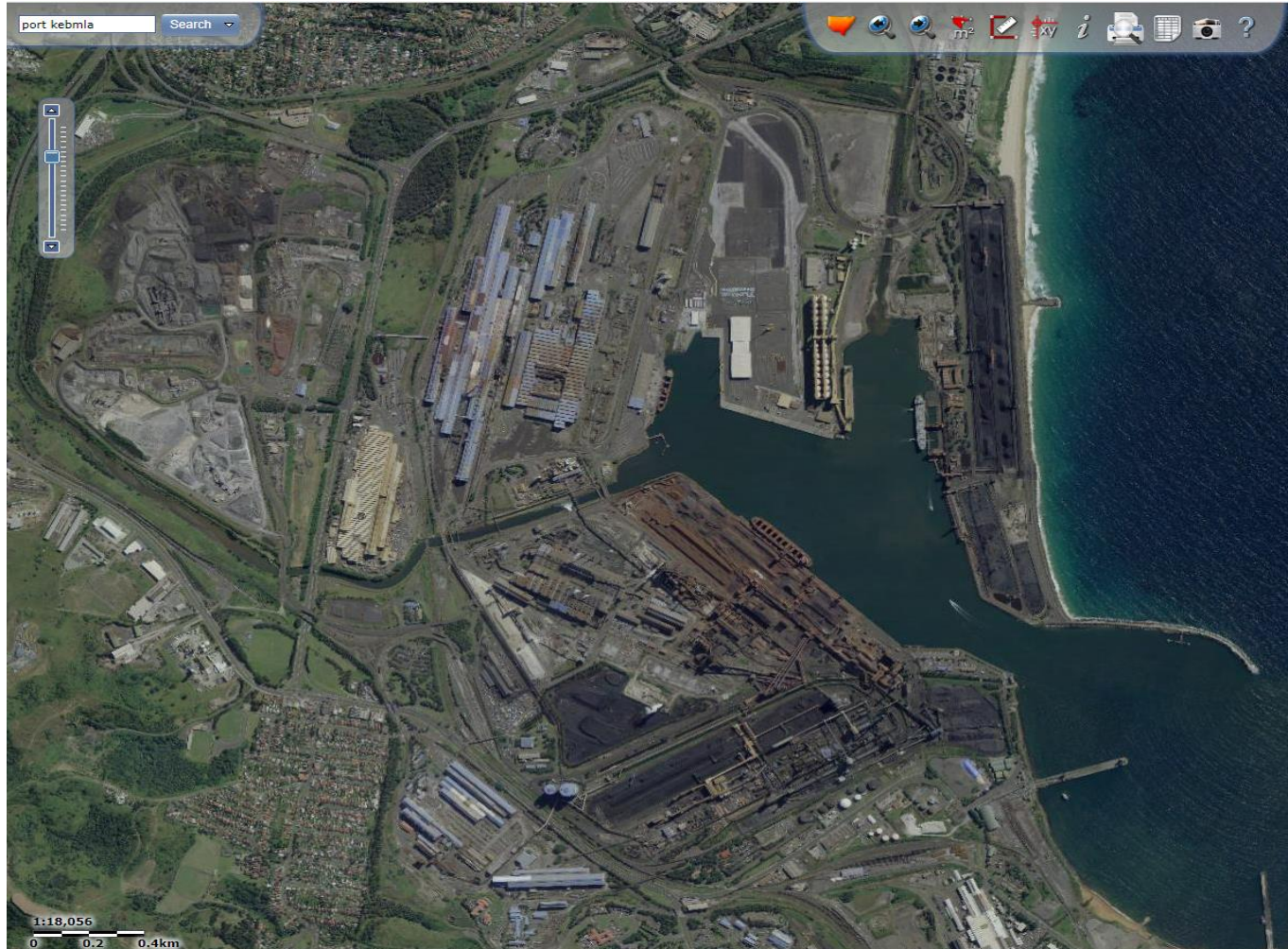
XLERPLATE® is the brand name for high quality hot rolled plate steel from BlueScope Steel [more](#)

Zincalume®

ZINCALUME® steel delivers outstanding durability [more](#)

PORT KEMBLA STEELWORKS

Port Kembla Steelworks is a large integrated steel production site



Our Vision

Investment in data and technology will drive the next wave of operational excellence and customer experience improvements across the business. BlueScope is investing in targeted use cases in priority areas, in growing our people and technology capabilities, and transferring solutions and knowledge across our global business

Our Approach

Each of our businesses face different strategic challenges and opportunities relative to their local industry. We work to respond to these needs, utilising the enterprise capability across BlueScope to help accelerate and scale solutions globally and between businesses.

We have a disciplined approach to transformation investments, including building the critical people, data and technology capabilities required to support our growth ambitions. A dedicated corporate Digital Transformation team works with our businesses and regions to provide strategic leadership in these areas whilst also ensuring the fast transfer of knowledge and solutions across the Group.

DIGITAL TRANSFORMATION

Delivering the next wave of customer, growth and productivity improvements through technology

Strengthen foundations to accelerate value

Capabilities

Right skills and behaviours

Data and platforms

Investing in enabling platforms

Partnerships

Strong technology and strategic partnerships

Transfer learnings

- Extend proven use cases to other areas
- Transfer knowledge and learnings across the enterprise

Use cases delivering value in strategic focus areas



Manufacturing Excellence



Connected Supply Chain



Sales and Marketing



Support Functions

Manufacturing Excellence

Step change in quality, cost and throughput

Examples include:

- Asset intelligence (predictive maintenance)
- Process optimisation
- Energy optimisation

Connected Supply Chain

Improve service levels and optimise inventory and costs

Examples include:

- Demand planning
- Inventory optimisation
- Order tracking
- Network optimisation

Sales and Marketing

Drive growth and profitability with the right commercials

Examples include:

- Pricing enablement
- Customer platforms
- Process automation

Support Functions

Improve employee experiences through efficient and effective processes

Examples include:

- Robotic process automation
- Data visualisation & performance reporting

DIGITAL FOUNDATIONS THE PILLARS FOR SUCCESS

The Importance of a Road Map

Manufacturing Departments are developing departmental digital road maps that are **aligned** to the ASP Manufacturing and Corporate Road maps

- Alignment of the digital plans at the department level is important because it provides use with :-
 - Ability to progress at **speed** and **scale**
 - A way to identify the next **opportunities**
 - The ability to **learn** and extend each other to **accelerate** transformation
- Help departments **identify the capabilities** that need to be developed in your teams



By having an aligned approach to the digital initiatives we work on, it will generally mean that the path for most of the initiatives have been cleared of roadblocks, we have IT/OT/Security considerations dealt with and at least a basic training and support framework in place.

DIGITAL FOUNDATIONS THE PILLARS FOR SUCCESS

Building the on ramps

Data & Advanced Analytics

Data is constantly being generated with increasing volume and complexity in multiple different disparate systems. It is becoming cheaper to gather and easy to store. The **value** of data is realised when it is transformed into **information** that can be **readily shared and accessed** so that it can be used for making **informed decisions** quickly.

Advanced analytics leverages **large amounts** of data, sophisticated tools and algorithms and the availability of processing power for the same objective

Connected Workers & Workplaces

A Connected workplace simplifies and **improves** the way **people work** with **each other** and **equipment** through digital experiences. In the manufacturing context its about using these technologies to **connect workers** to **data** assets in the field where the **work is done** and the information is needed. Using the digital assets to achieve **smarter, easier** ways of working.

Situational Awareness

The purpose of situation awareness is to help you make **faster** and **better decisions**. It goes beyond mere dissemination of data because it requires that someone is able to synthesize the **multiple sources** of input **data** to develop a holistic picture of what is happening. Situational awareness means knowing what is going on so that you can **decide what to do**.

Innovation

Digital transformation is the **integration** of **digital technology** into all areas of business resulting in fundamental **changes** to how we **operate** and **deliver value**. It's about enabling our workforce to **work better, smarter** and **more productively**. Clearly this will need us to use the tools we have **differently** or **invest** in new digital tools. Innovation will drive this.

DIGITAL FOUNDATIONS THE PILLARS FOR SUCCESS

Building the on ramps



Building Capability

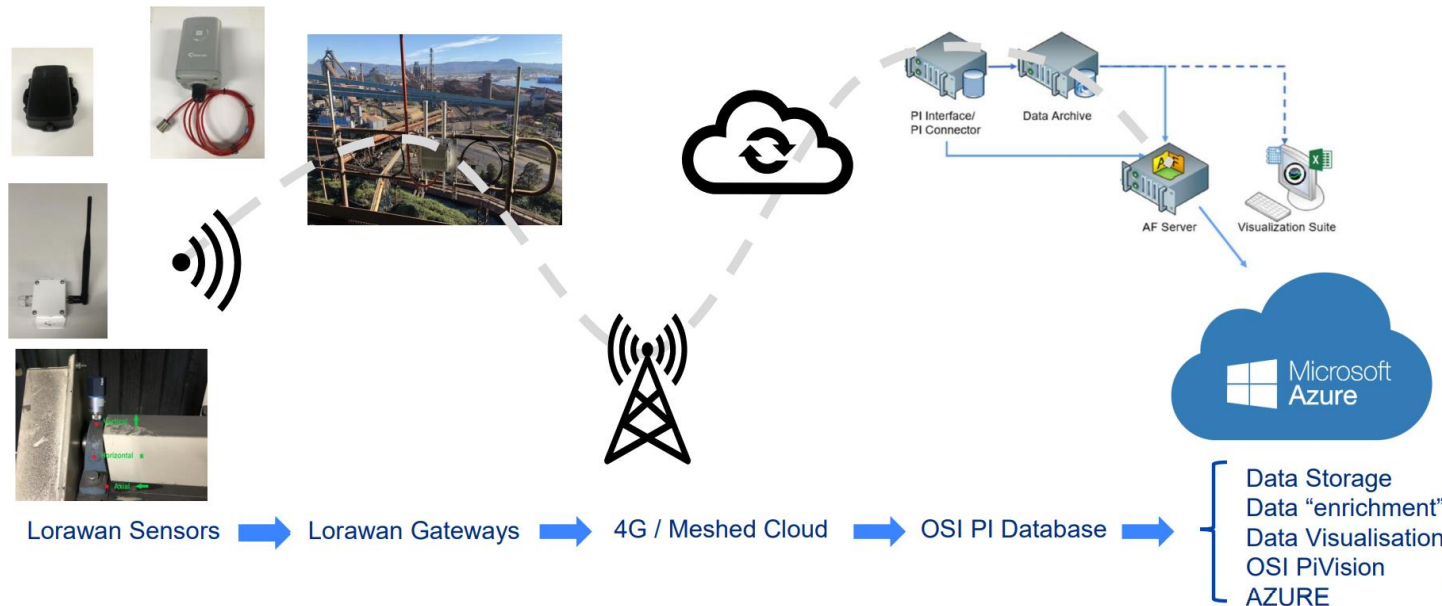
Digital transformation is as much about **people** and process as it is about technologies!

If we want to change the way we work to take advantage of the digital opportunities our people must also change the way they work. This will **require** a technically data literate workforce with **new capabilities** and different **competencies**.

ASP MANUFACTURING EXAMPLE – THE INFORMATION LAYER

LORAWAN network and IOT Sensors

The LoRawan Network has been setup so adding sensors is “Plug and Play”. The devices come from supplier configured and will immediately connect to the network.



LoRaWAN (Long Range Wide Area Network) is a Wide Area Networking (LPWAN) system that fills a gap between local Wi-Fi & 4G technologies.

- It is designed to connect low-cost battery operated Internet of Things (IoT) devices, such as sensors, to networks for several years.
- LoRawan utilises unlicensed RF spectrum - 900Mhz. Outdoor coverage over the air distances up to 15km, with indoor penetration. Optimised for small and intermittent data rates.
- It has a large footprint, simple connectivity, Low Power, Low Bandwidth.

ASP MANUFACTURING EXAMPLE – THE INFORMATION LAYER

Sensors enriching our data and filling Gaps

Water Meters

Bluescope site has 139 individual water meters

52 were manually read every month

Coverage provides visibility of water leakage and early indication of supply issues



ASP MANUFACTURING EXAMPLE – THE INFORMATION LAYER

Sensors enriching our data and filling Gaps



High Voltage Switch Monitoring

Lorawan sensors are being used to monitor the battery condition of 50 HV switches across the plant and alarm on low voltage.

- To monitor battery banks and trip coils – using Elsys ELT2



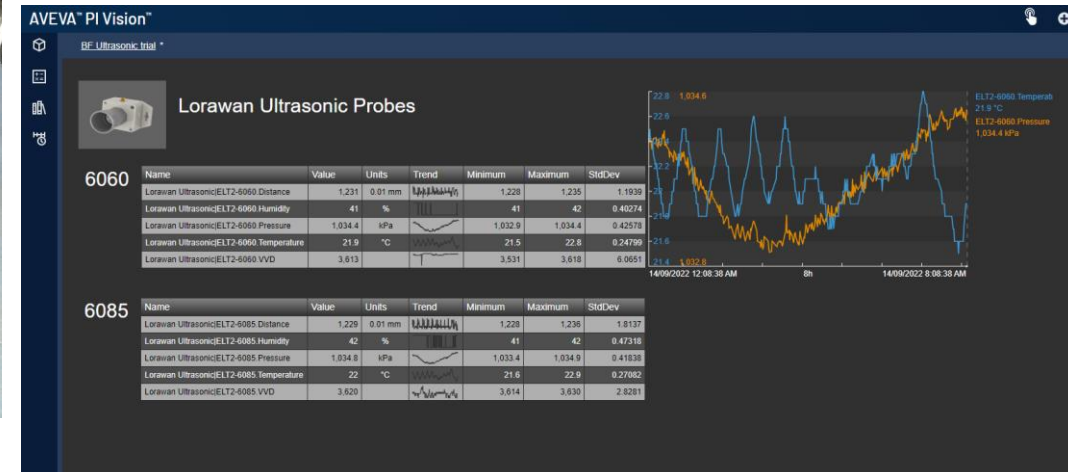
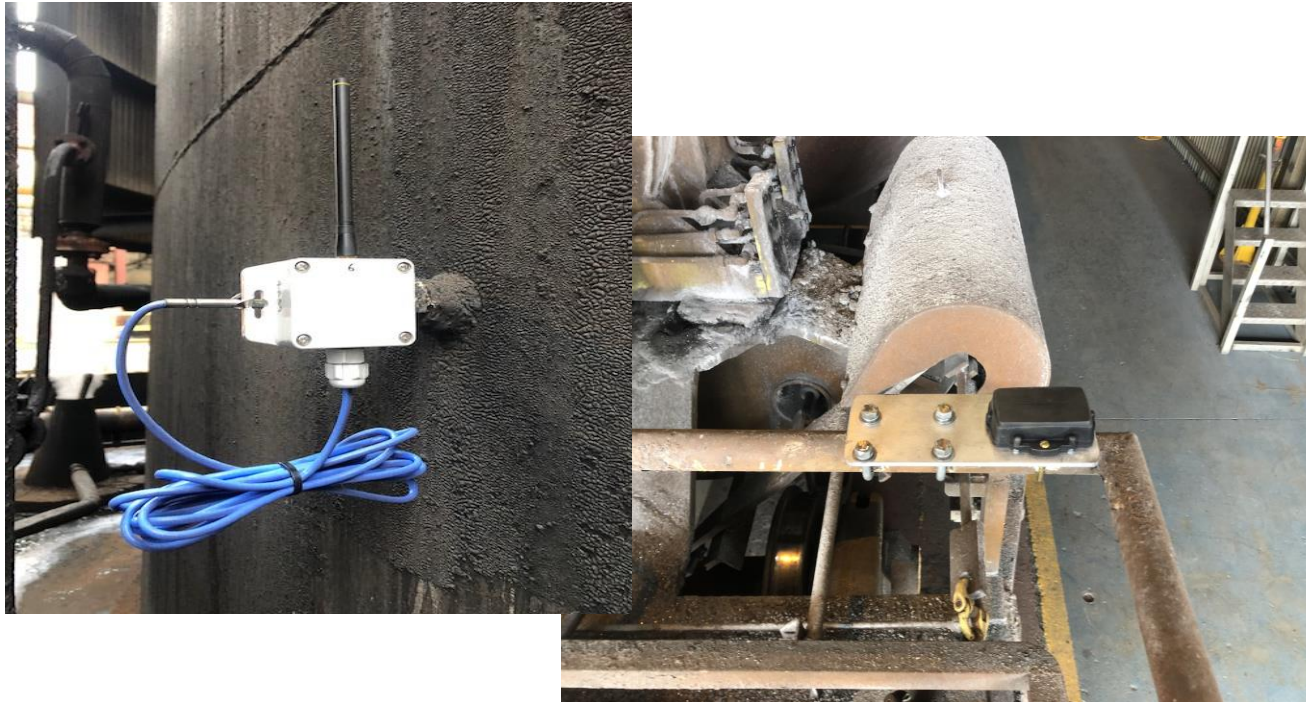
ASP MANUFACTURING EXAMPLE – THE INFORMATION LAYER

Sensors enriching our data and filling Gaps

Process Monitoring

Used to monitor process temperature/ Humidity/ gas composition, level, location...

Example as diverse as Tar Tanks, Rolls, bearings, pipes ...



ASP MANUFACTURING EXAMPLE - DIGITAL TWINS

GHG Emission intensity reduction

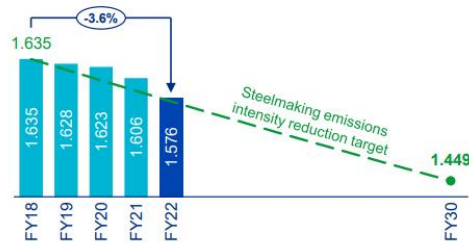
CLIMATE TARGET PROGRESS

Continuing our pursuit of emissions reduction projects in line with our 2030 steelmaking and non-steelmaking targets

Steelmaking target¹

(92% of total emissions)

GHG emissions intensity
(tCO₂-e per tonne raw steel)

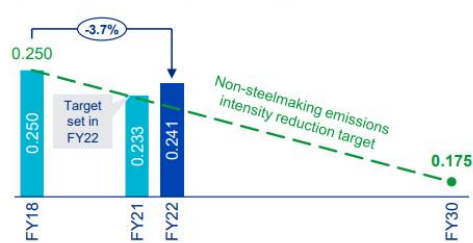


- Steelmaking emissions intensity tracking close to target with a 3.6% reduction since FY2018
- Progressing decarbonisation plans at our Glenbrook steelmaking site and actively evaluating technology options

Non-steelmaking target^{1,2}

(7% of total emissions)

GHG emissions intensity
(tCO₂-e per tonne despatched steel)



- Midstream emissions intensity decreased 3.7% from 2018 baseline
- Intensity increased in FY2022 due to lower despatch volumes across midstream operations on supply chain constraints and disruptions

1. Preliminary data. Final emissions intensity figures will be published in BlueScope's FY2022 Sustainability Report, due to be released in September 2022. All GHG emissions data are reported on an equity accounted basis.
2. Non-steelmaking emissions have been re-stated to amend for updated calculation methodology, and the inclusion of Tata BlueScope Steel's Jamshedpur site.



- Steelmaking is a carbon intensive industry.
- Bluescope has ambitious GHG emission intensity targets.
- Investment will be required to achieve these targets.
- We need to be sure we are making sound investments.

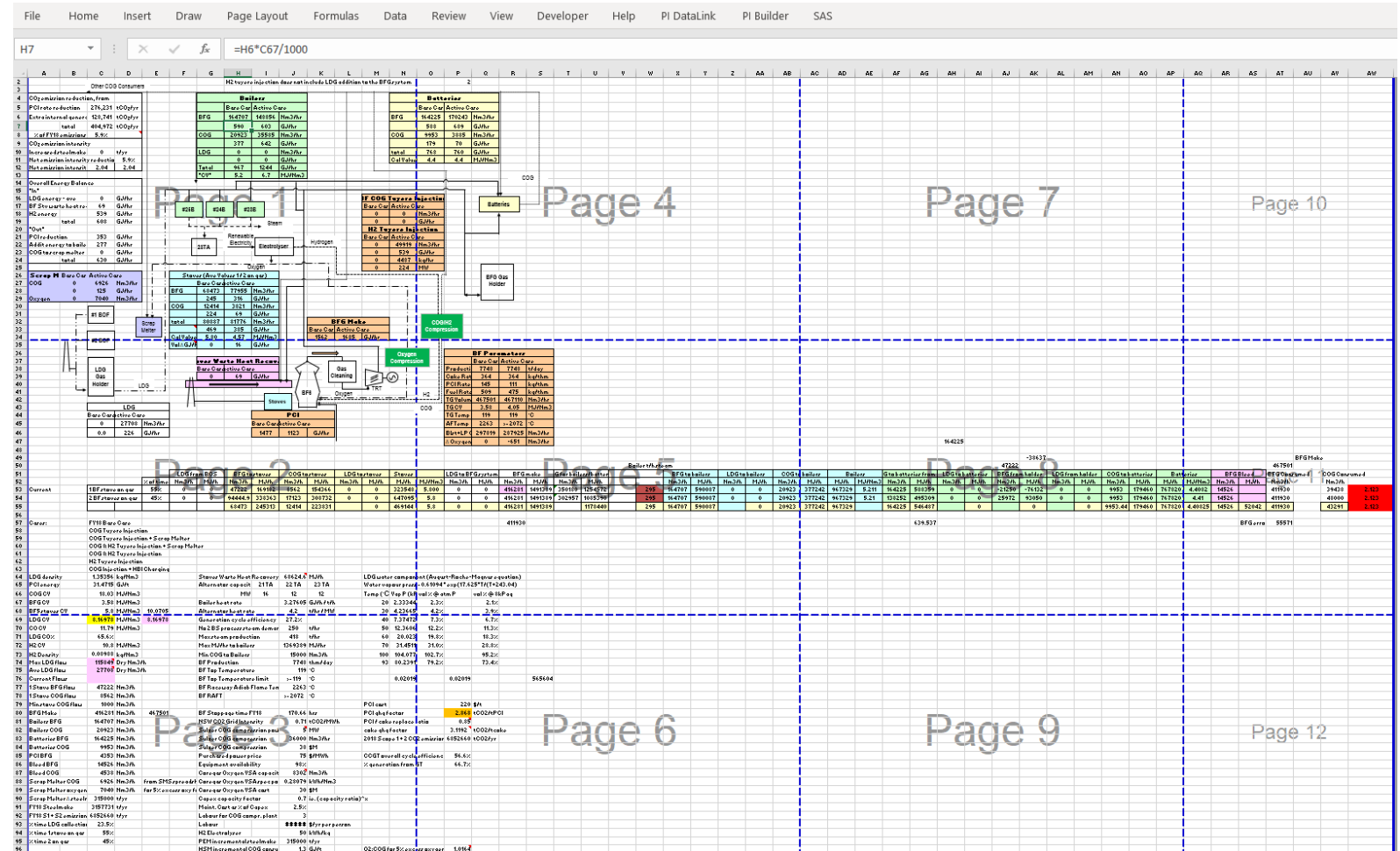


Scenario modelling to ensure we understand the **benefits** and **risks**

DIGITAL TWINS – ASSESSING POTENTIAL SCENARIOS

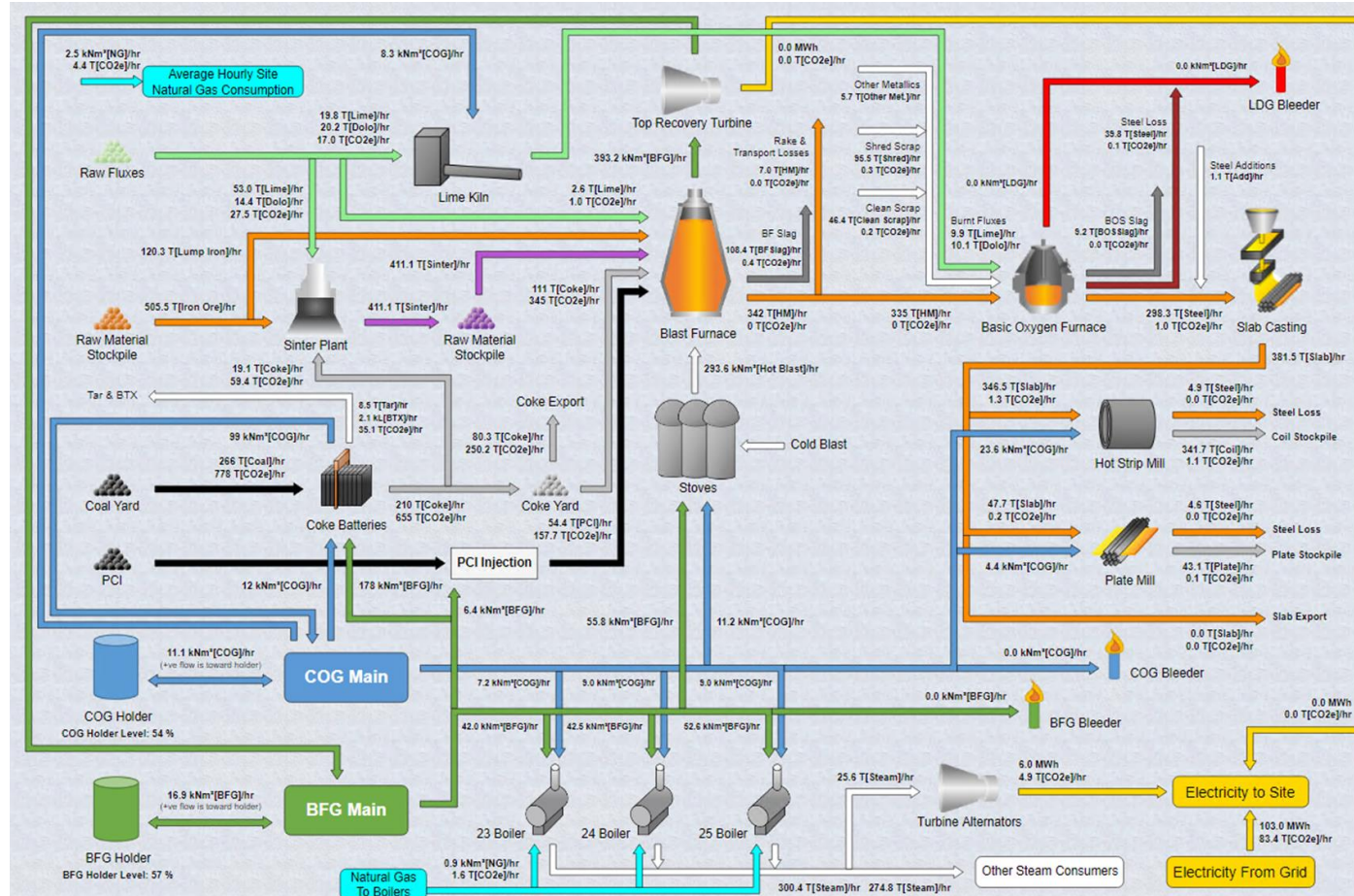
The “Traditional” way

- Excel Spreadsheet
- 8 page summary report
- 17 different sheets of calculation
- Working of heavily averaged data sources (monthly / yearly data)
- Significant upstream and downstream assumptions to reduce complexity
- 3-4 weeks effort for a single scenario evaluation
- Only 1 person understood how the spreadsheet works (and transitioning to retirement)



DIGITAL TWINS – ASSESSING POTENTIAL SCENARIOS

Using a digital twin



- The **complex** carbon balance of the Port Kembla site can be modelled using **Digital Twin** tools
- **Real** high frequency **operational data** from different operating periods representing **different operating conditions** is combined with our **control logic** to **simulate** actual plant operation under given scenarios.
- Once developed, the Digital Twin is capable of running **8 simulations simultaneously**, evaluating the scenario over a full years worth of operational data in around **30 minutes**.

DIGITAL TWINS – MODEL RUNNING VIDEO

PKSW Carbon Abatement ModelGeneral ParametersKey Site ParametersCarbon Parameters

The PKSW Carbon Abatement model is a dynamic mass and energy balance model of the indigenous gas network at BlueScope's Port Kembla Steelworks. The purpose of this model is to quantify the dynamic gas and energy demands of the site over time. These demands are essential to evaluate the carbon emissions of the site under different operational scenarios. This information can then be used to assess the performance of the overall steelworks on a carbon emissions basis.

This model has been designed to forecast the performance of the site according to an initial basis defined by the user. Key operational parameters can be manipulated by the user to define this basis. The user is therefore able to perform scenario studies of the site as well as conduct 'What if?' analysis and stress testing of the plant. In future iterations of the model, additional functionality will be added to allow for digital road testing of the proposed carbon abatement projects.

The scope of the current 'Beta' model includes modelling of both the major and minor process units on site. Modelling centres around the utilization of indigenous such as COG and BFG. The major process units key to this modelling are the coke batteries, the blast furnace, the furnace stoves, the boilers, the basic oxygen furnace, the lime kiln, the sinter plant, slag casting, the plate and strip mills, and the gas holders.

Basic modelling of the natural gas, steam and electricity systems are present in the model to provide a broader account for the CO₂-e emissions of imported electricity and natural gas. This also provides information on the steam utilisation for internal power generation.

For model configuration, the general configuration parameters are available to the right, otherwise detailed configuration can be specified in the tabs seen above.

Scenario Run Duration (mins):



Enter Name for Output Excel File:

Must only use valid file name characters such as letters, numbers, spaces, etc. Existing files with the same name in the Output folder will be overwritten.

Preview Output File Name:

Enter a file name

Global Input Parameters

Hot Metal Production Aim (THM/day):	7800.0
Scrap Per BOF Heat (T[Scrap]/heat):	72.7
Oven Push Rate Battery 5 (Ovens/day):	85.1
Oven Push Rate Battery 6 (Ovens/day):	122.2
Oven Push Rate Battery 7A (Ovens/day):	61.6
Slab Percentage To HSM (%):	87.6
Fuel to Hot Metal Ratio (kg[Coke-e]/T[HM]):	482.1
Coke to Hot Metal Ratio (kg[Coke]/T[HM]):	352.7
Crude Steel Carbon Content (kg[C]/T[CS]):	1.0
Pig Iron Carbon Content (kg[C]/T[HM]):	45.0

Global Calculated Output Parameters

Estimated Annual Raw Steel Production(T/yr):	3,232,632
Estimated Heats Per Year (BOF Heats/yr):	11,685
Estimated Scrap Per BOF Charge (% of Charge):	23.50

▶

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⏮

x5

⏭

⏪

⏩

⏮

Idle

⏭

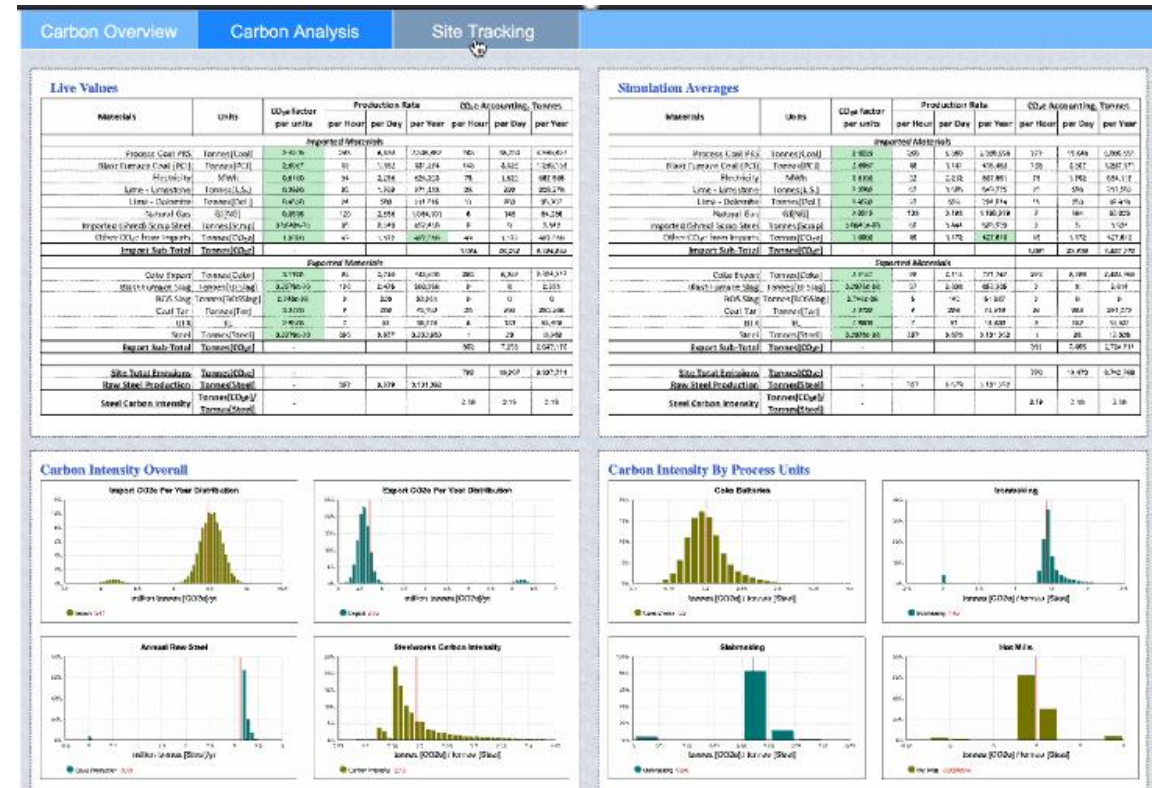
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DIGITAL TWIN – RESULTS

Not just a single value

Not only does the Digital Twin give significantly **faster** (more) scenario modelling than the traditional approach, the results are **richer**.

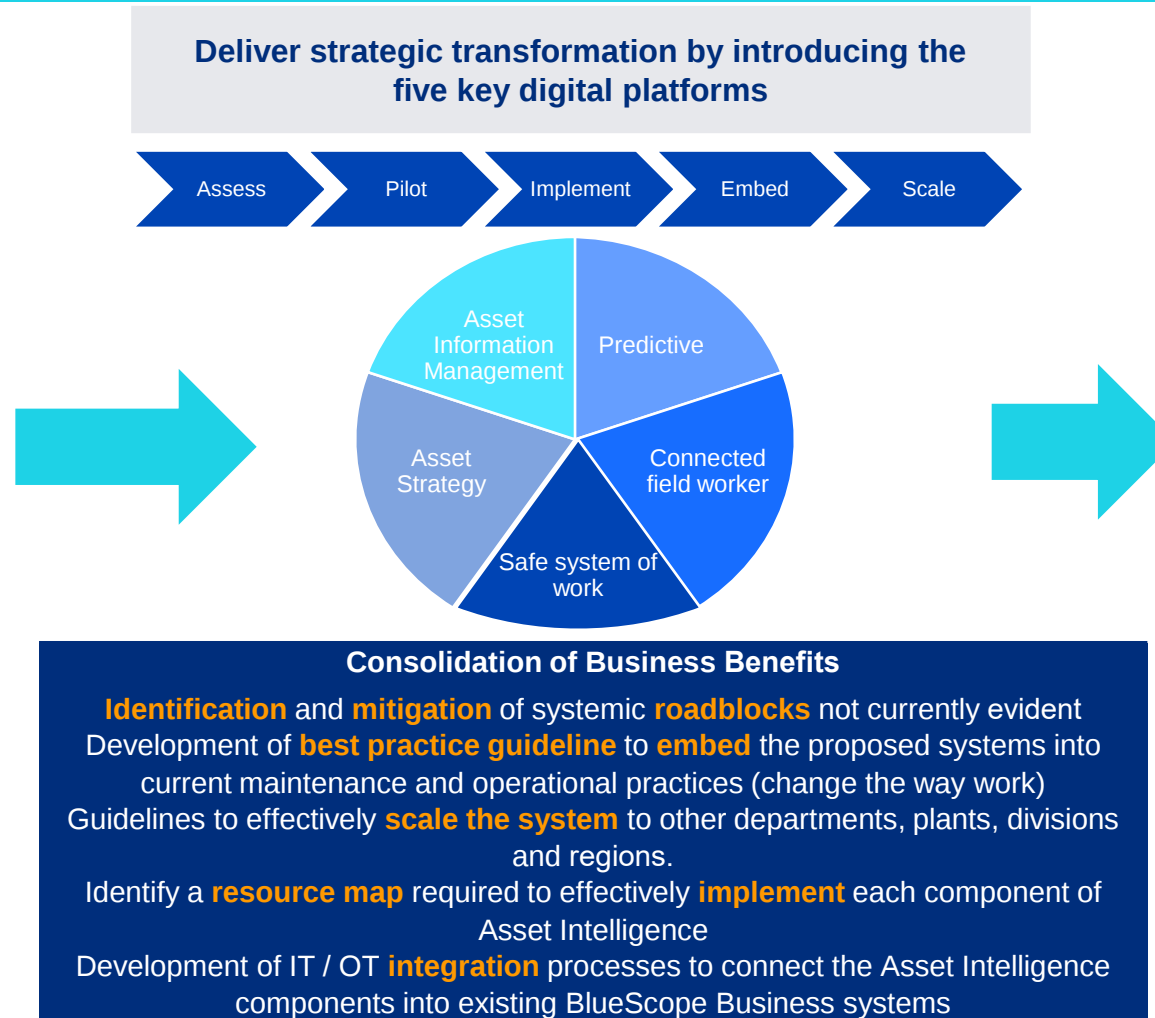
Traditional excel spreadsheet gave average results
In contrast the Digital Twin uses 1 minute data →
Smaller time step, means that **opportunities** (and risks) **don't get lost in the average** results.



ASP MANUFACTURING EXAMPLE – ASSET INTELLIGENCE

Vision – Strategy

- Utilising **digital technologies** as a catalyst to move from **preventative time-based** maintenance to condition based **prescriptive maintenance**
- Deploying **smart wireless** devices to **constantly measure** and **monitor** all critical signals associated with our Assets.
- Using **Advanced Analytic** tools to continuously **evaluate** and **visualise** the health of all assets in **real time**
- Using **Digital processes** to **eliminate** or **automate** all regular routine tasks associated with Asset Management
- Transforming **Data** into **useful information** by eliminating paper-based inspections, transactions and records
- Developing our asset workforce into a team of **digitally literate practitioners** skilled in a range of i4.0 practices



Outcomes

- ✓ Prescriptive Maintenance
- ✓ Inspections minimised and remaining digital
- ✓ Smart sensors feeding data directly to Analytics and visualisation platforms
- ✓ Wireless Smart sensors embedded
- ✓ Digitised Strategy Optimisation based on risk and health
- ✓ Predictive condition-based strategies, digitally optimised
- ✓ Skilled Resources focused on value added initiatives
- ✓ Data automatically directed to Analytics and Visualisation Platforms to create Realtime equipment health displays and interface
- ✓ Digital Office
- ✓ Improved Uptime, waste eliminated and funds available to reinvest in the business

ASSET INTELLIGENCE - COMPONENTS

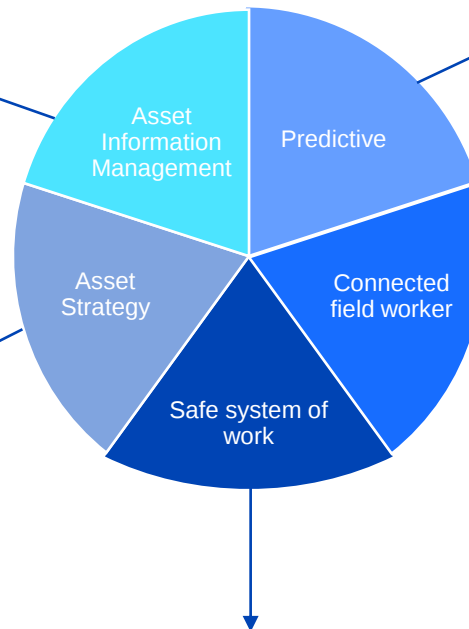
5 components – POC at MCL1 on 5 critical assets

Provide reliable and fast access to accurate information and documentation

- Commercial discussions in progress with preferred vendor

Transition from preventative time-based maintenance to condition based prescriptive maintenance

- Vendor selected – **Senseye**
- 5 critical assets select at MCL
- Cases being raised
- Integration to SAP in progress



Transition to paperless maintenance system

- Vendor selected - **Obzervr**
- BlueScope Sandbox available
- SAP integration nearly complete
- Non-SAP dependent templates available for use

Move to a common platform that will house BlueScope's Asset strategies in a digital format

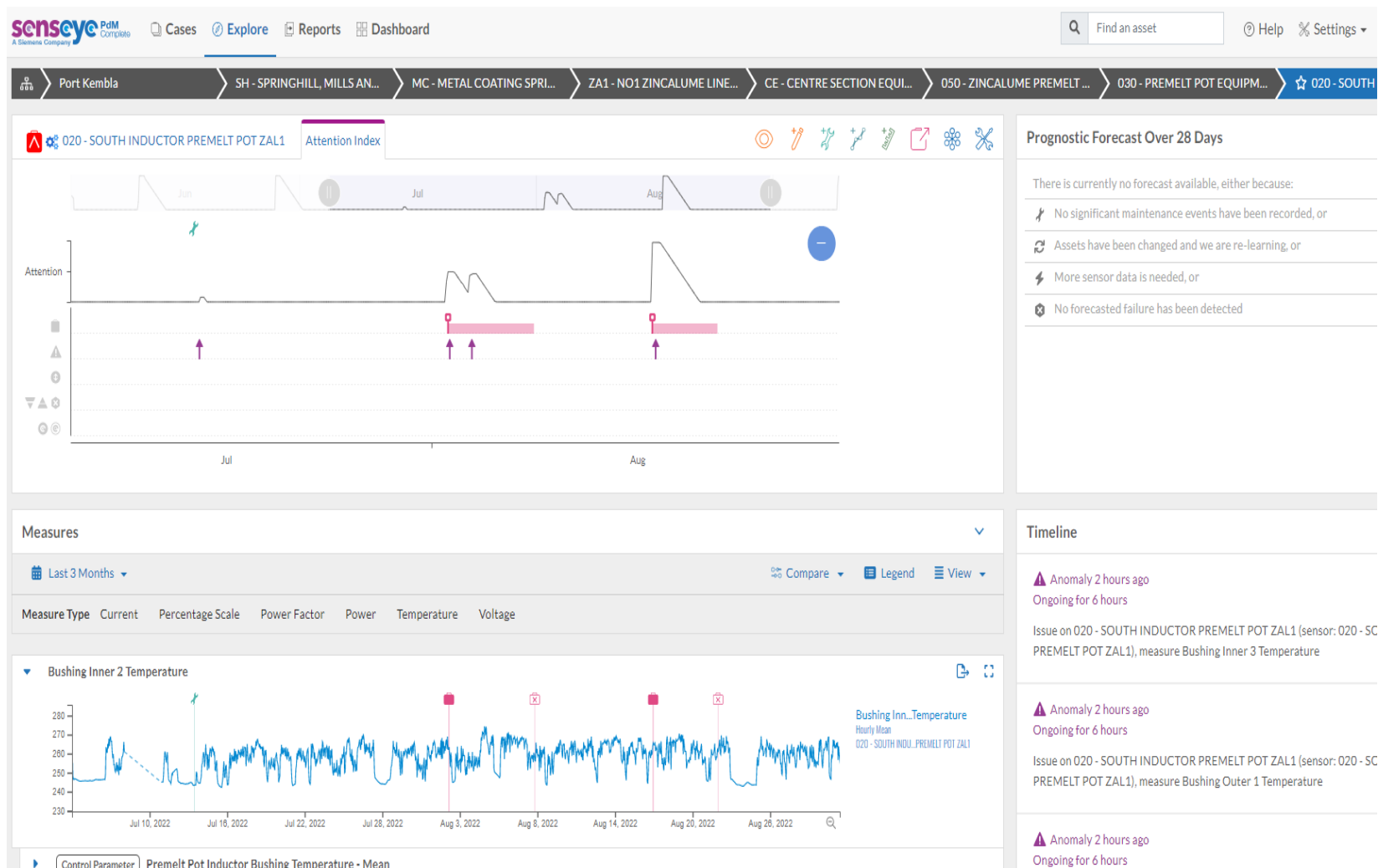
- Commercial discussions in progress with preferred vendor

The underlying SSW procedure will remain unchanged but will have all permits, workflows and approvals digitised

- Vendor selected **Adapt IT – IntelliPERMIT** platform
- Workshops complete
- Representatives from WP / PK business units
- Decision to be made regarding standardization

ASSET INTELLIGENCE – PREDICTIVE MONITORING

Predictive – Senseye – like having a thousand extra expert eyes monitoring your assets



- ✓ Lorawan sensors deployed transmitting data into Senseye
- ✓ AVEVA PI data integrated
- ✓ SAP integration in progress
- ✓ Models constantly learning
- ✓ Cases automatically being raised and reviewed
- ✓ Successful cases raised – prevented unplanned delay

ASSET INTELLIGENCE – CONNECTED WORKER

Obzervr connected field worker component of Asset Intelligence – like a personal assistant in your pocket

PRESSURE EQUIPMENT INSPECTION REPORT
NON CORROSIVE STATIC

SAP Equipment N°	SAP Equipment Description	Works N°	Identification N° Location	Volume L	Shell Cert Press kPa
PVES128U338	Horizontal GOX Vessel No 4	H001	Standpipe comp ring	51000	4344

EXTERNAL INSPECTION

INSPECTION TASK	RESULT A U NA	REMARKS
COATING	☒	
SHELL & NOZZLES	☒	
ENDS & NOZZLES	☒	
DRAIN	☒	
BOLTING	☒	
SUPPORTS	☒	
PRESSURE GAUGE	☒	
ID No LEGIBILITY	☒	
PRESSURE RELIEF DEVICE	☒	
SV SAFETY VALVE, PFN/FUSIBLE PLUG, LSP LIMITED SUPPLY PRESSURE	☒	
SV ☒ FP ☐ LSP ☐	☒	0x 2724 Mack Valve Size 25mm Set 3100kPa, Date 28-11-17 Shell Top.

INTERNAL INSPECTION

INSPECTION TASK	RESULT A U NA	REMARKS
COATING	☒	
SHELL & NOZZLES	☒	
ENDS & NOZZLES	☒	

COMMENTS

external condition is satisfactory

INSPECTION DATE: 27/10/2021 TYPE OF INSPECTION: ~~INTERNAL~~ / EXTERNAL*

CERTIFICATE OF INSPECTION MAY ~~NOT~~ BE ISSUED FOR THIS VESSEL

FOR CURRENT MASWP / MASWP OF ~~27/10/2021~~

THIS CERTIFICATE REMAINS IN FORCE UNTIL NEXT RECOMMENDED INSPECTION DATE: 27/10/2023

1281 INS 000 RELEASED BY CMA451: 20180408 3070404 OPERATION 0010

Manual effort – duplication of tasks

Duplication of effort

Data not able to be used for better decision making

Prone to human error

Data not available at time of inspection

Manual notification process

Difficult to track alerts / issues



1:33

← Demo Preview BlueScope Steel

WED THU FRI SAT SUN MON TUE

3 4 5 6 7 8 9

Thursday, 04 November 5

Clear Filters

9 Outstanding Task

ASSIGNED 0%

0411-2429-2DE5

Metal Coating Lines - Springhill

DCL3 Operational Equipment Inspections and Maintenance • 01:00 AM (Location: 12:00 AM)

SN

ASSIGNED 1 of 5

Task Routine

Streamline Inspections

Flag issues and create notifications in real time

Resolve quickly

Data capture at time of inspection and available to all stakeholders in electronic form

Data transferred to our CMMS

Historical data for trending health of assets

Allocate your inspections, checklists and safety forms with built-in tracking

ASP MANUFACTURING EXAMPLE - MACHINE LEARNING

Assisting where subjective judgements have significant consequences

Machine learning is a very popular and growing field, but it can be intimidating for us

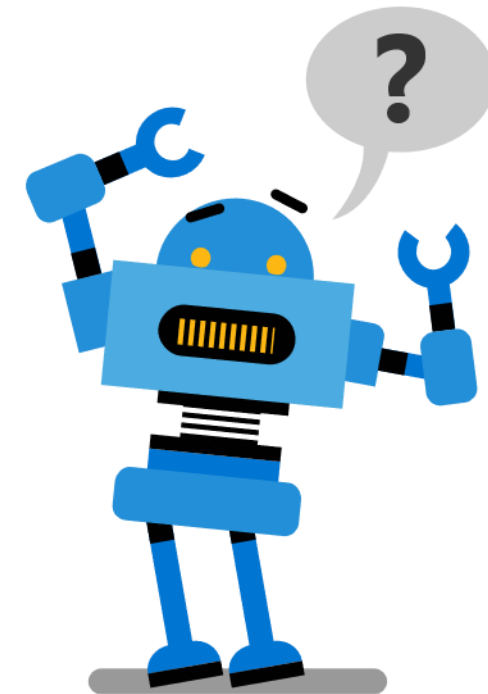
- There is a belief that to use ML you need to have a deep understanding in coding, mathematics and statistics and be a data scientist

But - Machine Learning has **two** disciplines:

- Machine learning science
- **Applied** Machine learning

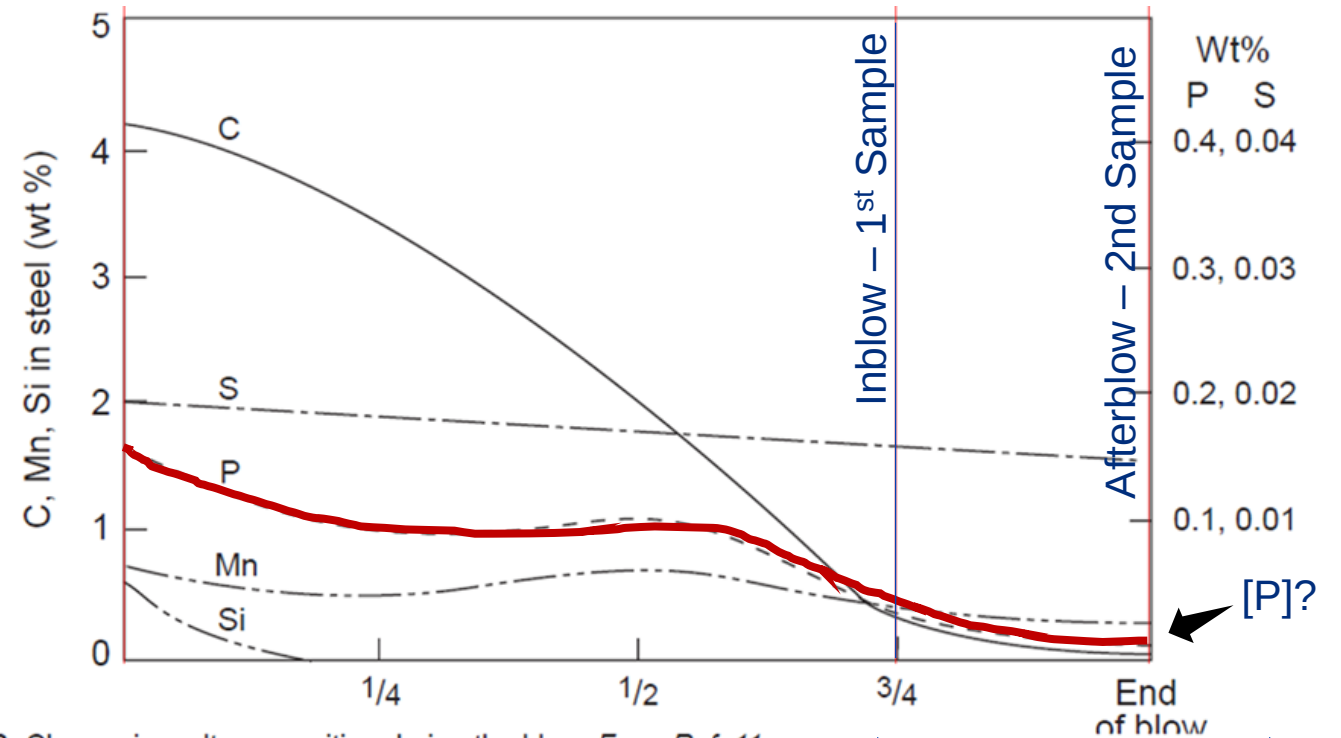
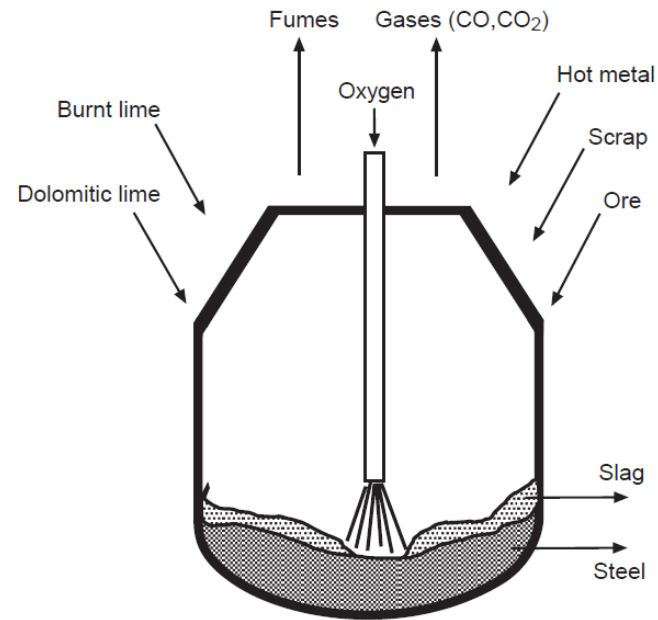
In ASP Manufacturing we are focused on **Applied** Machine Learning applications:

- Applying ML by developing Capabilities that get Machine Learning algorithms to work for us
- Integrate those ML systems into our business processes



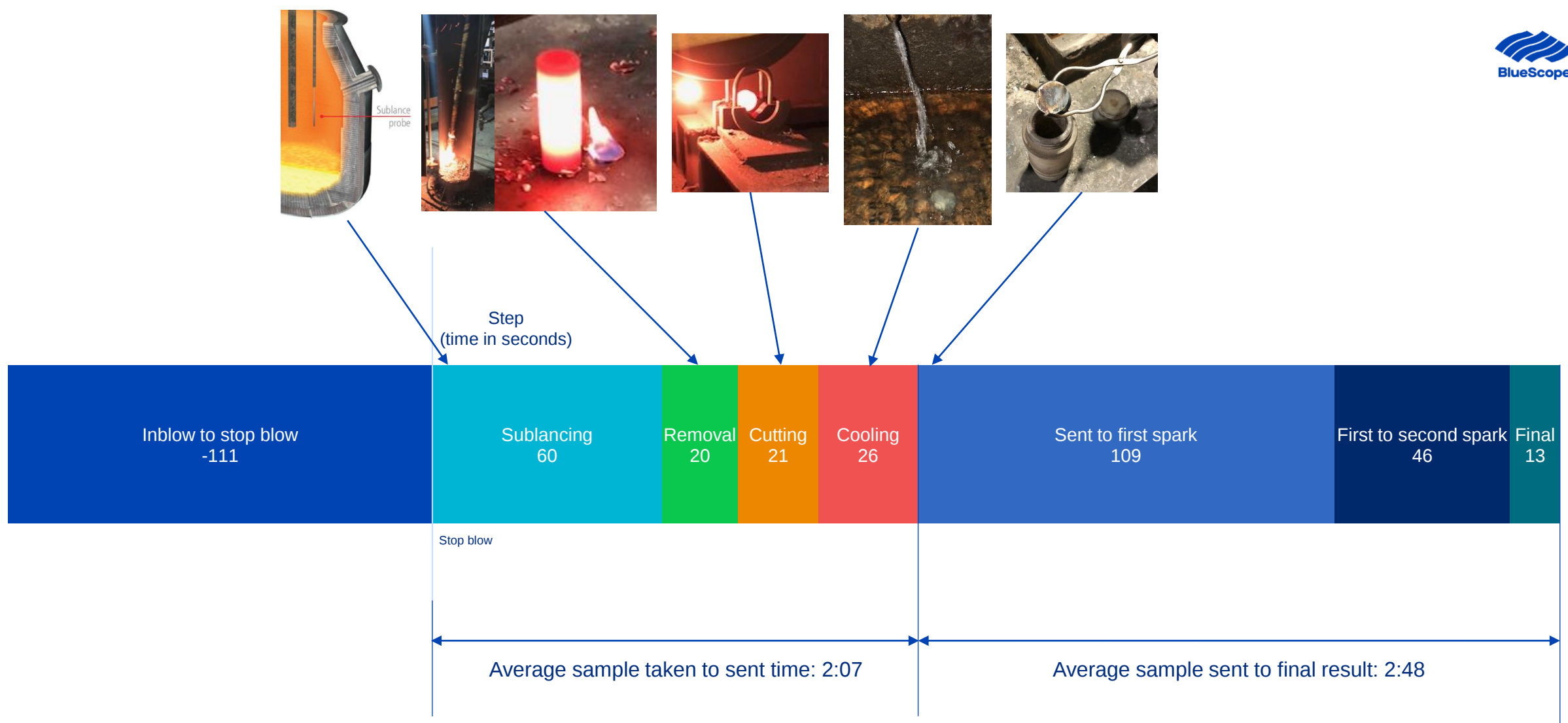
ASP MANUFACTURING EXAMPLE - MACHINE LEARNING

Reducing Idle at the end of the Oxygen Steelmaking process – Direct Tapping



9.8 Change in melt composition during the blow. From Ref. 11.

Area of model operation



Current sample processing timeline

MACHINE LEARNING – DEFINING THE PROBLEM

Idea came from the floor

- Original idea was to provide a series of guidelines for whether a heat should be direct tapped, based on experienced Controllters
- This was useful as a training tool but wasn't feasible for use in real-time decision making.
- What if we had a system that provided a single definite “traffic light” for whether a heat could be tapped at any point, using all the information available up to that point...?

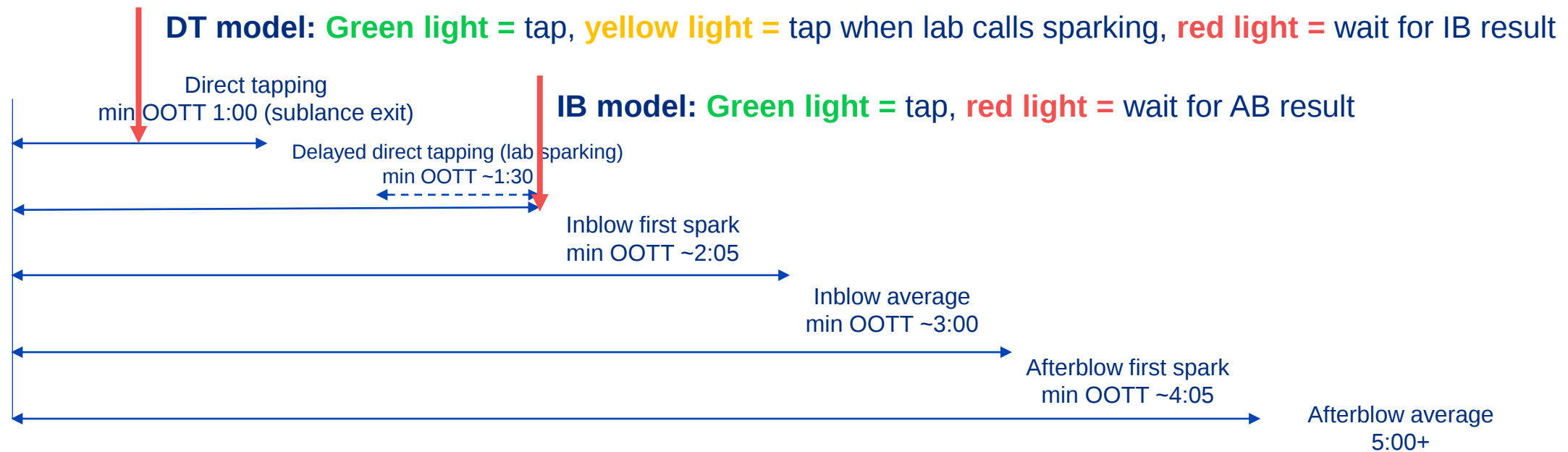


ASP MANUFACTURING EXAMPLE - MACHINE LEARNING

Assisting where subjective judgements have significant consequences

Two models are used:

- **Direct tapping:** running ~30 s after stop blow as the substance comes out, as soon as an O₂ result is received
- **Inblow result:** running as soon as an inblow first spark is received



- Both models are aiming to predict the **afterblow phosphorus result**. 95% of heats are tapped based on phosphorus as the critical element

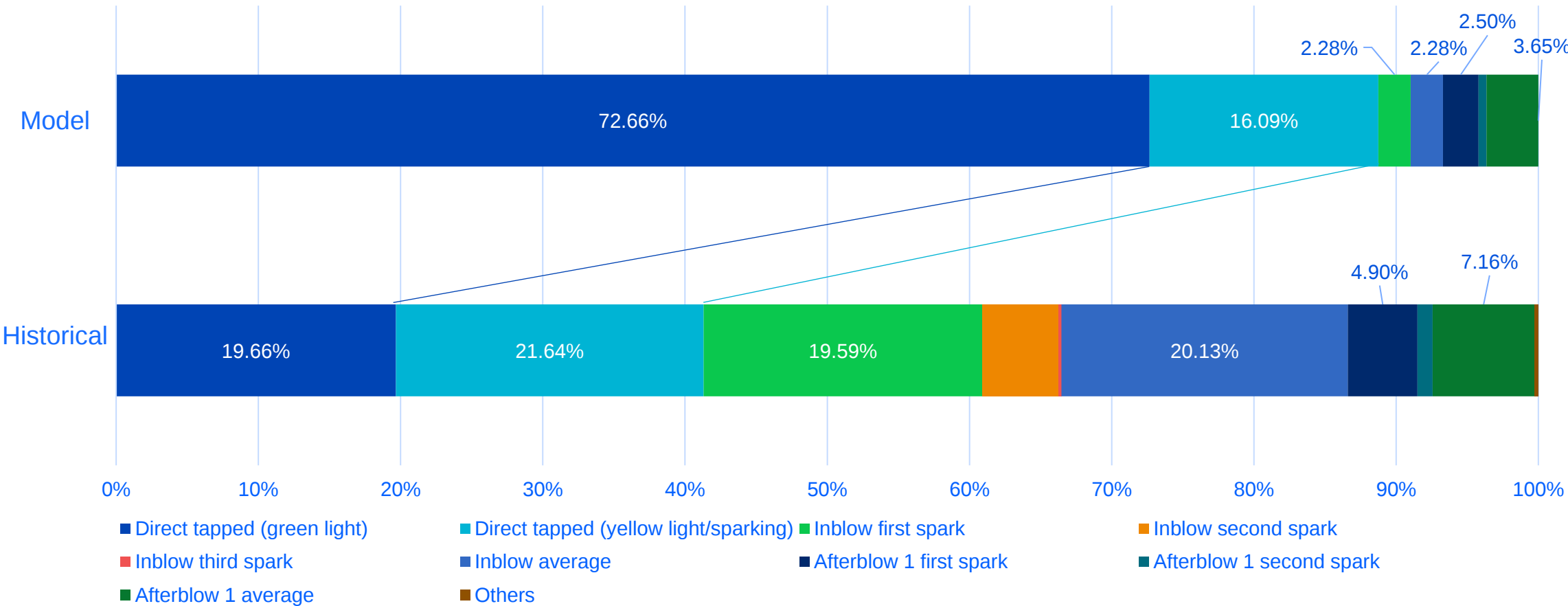


ASP MANUFACTURING EXAMPLE - MACHINE LEARNING

Assisting where subjective judgements have significant consequences

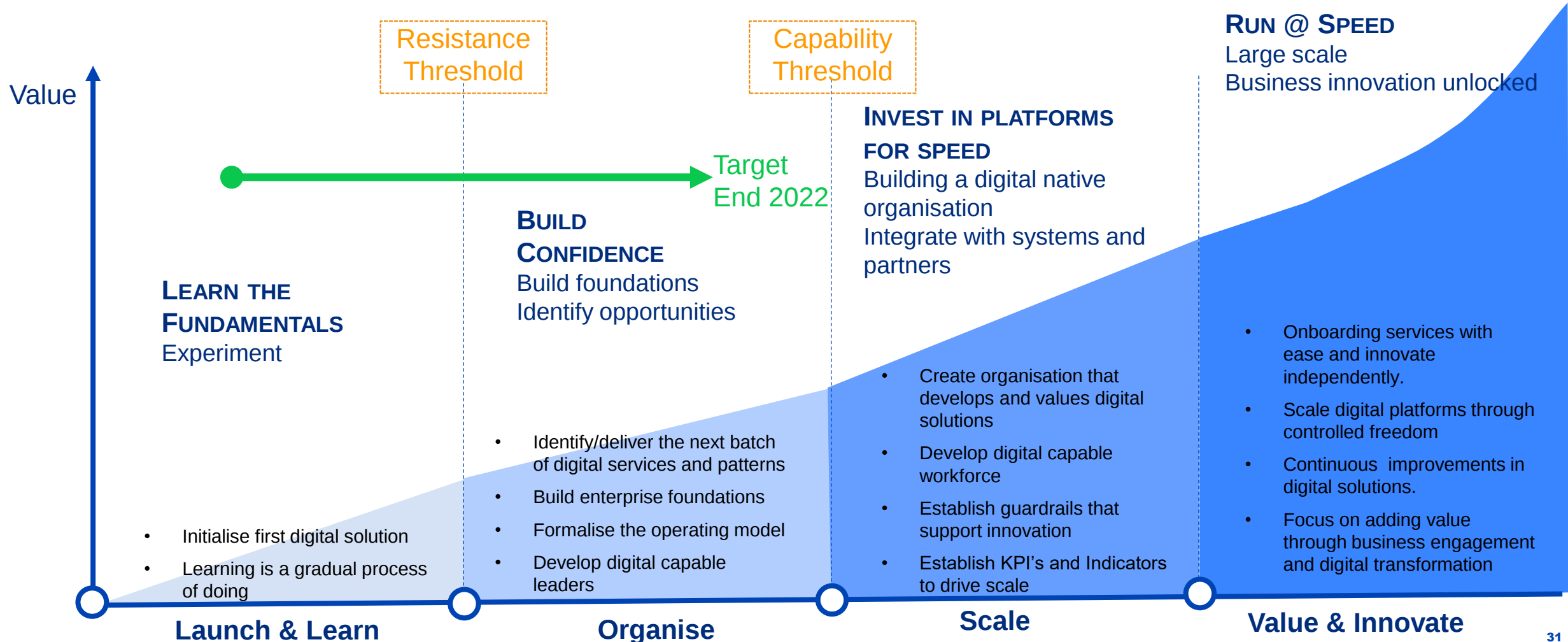
Current OOTT: 3:00, Model OOTT: 2:05 (55 second reduction)

(160t lower HM stocks / 5.5° HM temp / 1 t scrap per heat / 0.3% GHG intensity)



SUPPORTING DIGITAL TRANSFORMATION IN ASP MANUFACTURING

Its time to Organise, and build confidence in Digital Solutions



THANK YOU