Blue Waymark
راه‌نشان نیلی

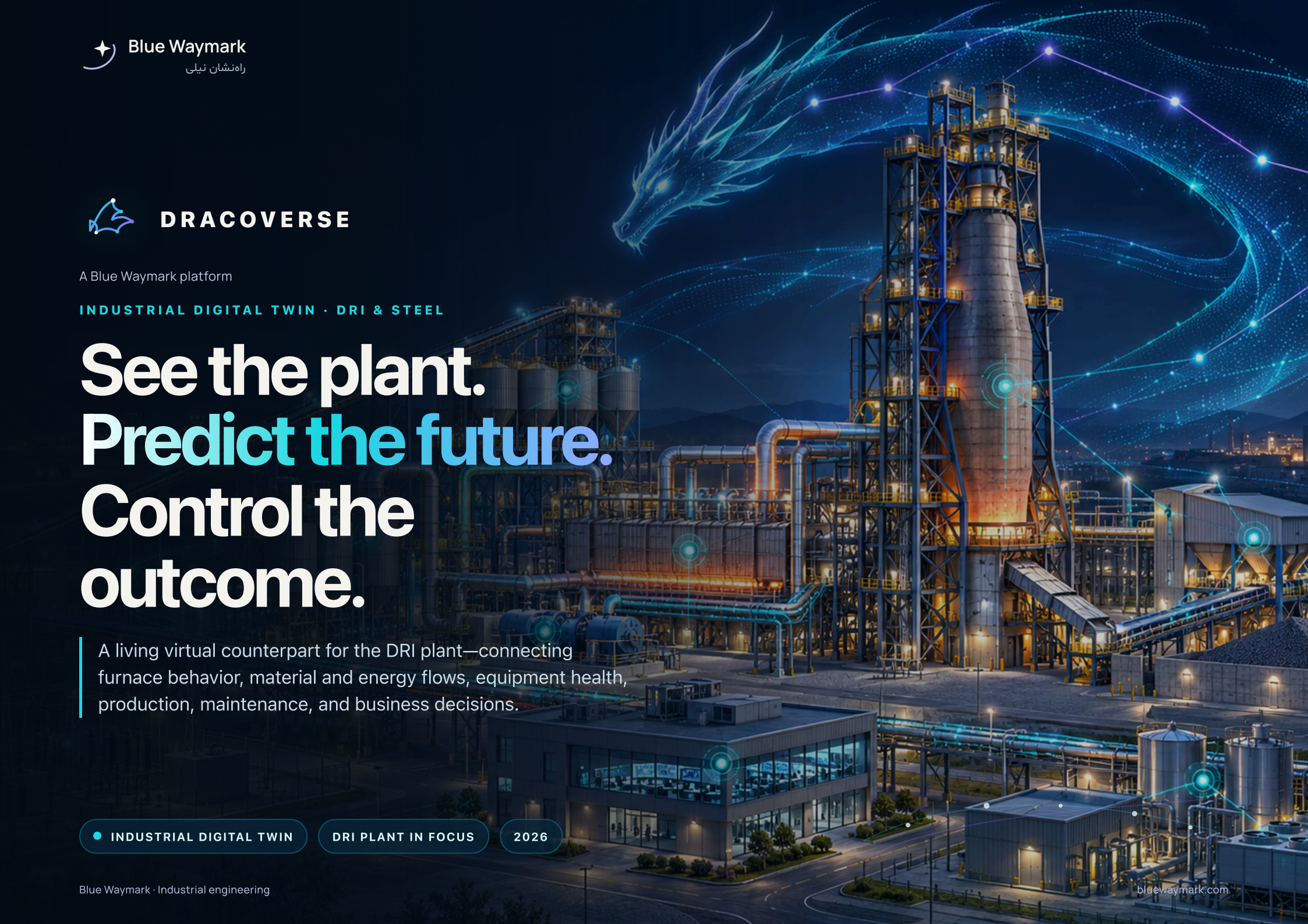
DRACOVERSE

A Blue Waymark platform

INDUSTRIAL DIGITAL TWIN · DRI & STEEL

See the plant. Predict the future. Control the outcome.

A living virtual counterpart for the DRI plant—connecting furnace behavior, material and energy flows, equipment health, production, maintenance, and business decisions.



INDUSTRIAL DIGITAL TWIN | DRI PLANT IN FOCUS | 2026

THE CHALLENGE

A DRI plant is not a collection of machines. It is one connected operating system.

Ore quality, reducing gas, furnace state, utilities, rotating equipment, maintenance, production, and cost interact continuously. A local change can improve one KPI while destabilizing another.

01

Disconnected data

PLC, DCS, historian, laboratory, maintenance, production, and enterprise records rarely speak one industrial language.

02

Hidden furnace state

Critical internal conditions cannot all be measured directly; operators must infer them from partial and delayed signals.

03

Reactive intervention

Degradation, drift, and process interactions are often recognized after quality, throughput, or availability has moved.

04

Scenario uncertainty

Teams need to test feed, gas, equipment, production, and maintenance decisions before they touch the live plant.

THE COUPLED DRI REALITY

Pellet variability → Furnace response → Quality + energy → Production + margin

THE OPPORTUNITY

One living twin. Plant-wide foresight.

THE SOLUTION

From raw signals to a plant-wide decision engine.

Dracoverse gives every tag, asset, process state, event, and business outcome a shared context—then turns that context into prediction, simulation, and action.

01 · OPERATIONAL TECHNOLOGY

PLC · DCS · SCADA · historian

Temperatures, pressures, flows, analyzers, drives, valves, alarms, events, and trends.

02 · ENTERPRISE CONTEXT

MES · ERP · CMMS · LIMS

Production orders, quality, maintenance, inventory, energy, cost, and laboratory results.

→

03 · TWIN CORE

Asset + process graph

Site → area → unit → equipment → component → tag, linked to material and energy streams.

04 · MODEL LAYER

Physics + data intelligence

Mass/energy balance, state estimation, soft sensors, degradation, forecast, and scenarios.

→

05 · DECISION SERVICES

Predict · simulate · optimize

Operating envelope, quality forecast, anomaly detection, maintenance, and energy optimization.

06 · ROLE-BASED EXPERIENCE

Operator to management

Live cockpit, engineering analysis, maintenance workbench, and enterprise performance view.

Sense → contextualize → predict → decide → learn

CLOSED LEARNING LOOP • MEASURED OUTCOME ↻ MODEL UPDATE

Physics grounded

Balances and engineering limits keep analytics connected to process reality.

Operations connected

Process, equipment, quality, maintenance, energy, and cost share one timeline.

Built to scale

Start with DRI; extend across pelletizing, steelmaking, utilities, mines, and other plants.

THE DRI VIRTUAL COUNTERPART

One shaft furnace. Four synchronized realities.



Physical plant ↔ living virtual model

Furnace state, gas circuit, material movement, equipment condition, and performance evolve on the same timeline.

Asset twin

EQUIPMENT

The connected hierarchy, condition, history, and failure behavior of physical plant assets.

Furnace · Reformer · Compressors · Scrubber · Conveyors · Utilities

Process twin

PHYSICS

Material, gas, heat, chemistry, pressure, residence time, and internal furnace-state estimates.

Mass balance · Energy · Reduction · Gas loop · Thermal profile

Operations twin

PERFORMANCE

Production, quality, energy, alarms, constraints, campaigns, and operator actions in context.

Throughput · Metallization · Carbon · Energy · Availability

Economic twin

VALUE

How process and asset decisions translate into production plan, maintenance cost, margin, and risk.

Cost / t · Downtime · Inventory · Plan · Margin

HOW IT THINKS

A closed-loop engine for state, prediction, and action.

TWIN INFERENCE

Estimate + predict

Reconstructs hidden process state and forecasts plant response from synchronized operational evidence.

- State estimation
- Soft sensors
- Anomaly score
- Quality forecast
- Equipment health
- Uncertainty

DECISION INTELLIGENCE

Simulate + optimize

Tests candidate actions against process, equipment, safety, production, and business constraints.

- Setpoint advice
- Gas balance
- Feed strategy
- Energy use
- Maintenance window
- Production plan

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minimize: energy + fuel + downtime + quality deviation +
emissions intensity
subject to: safe limits ∧ equipment capacity ∧ product
targets ∧ production plan
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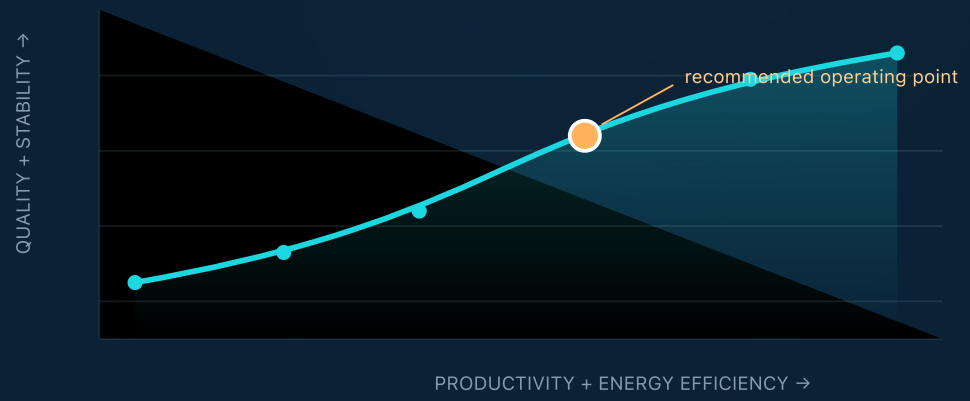
Illustrative operating envelope

Feasible · Recommended

Conceptual view — plant data and validated models will define the real envelope.



Operating limits first · What-if scenarios · Multi-objective trade-off · Uncertainty aware · Operator-in-the-loop · Outcome tracking

THE CONNECTED PROCESS

The shaft furnace is the core. The loop is the plant.

The first Dracoverse implementation connects the solid feed path, reducing-gas circuit, furnace state, product quality, utilities, and equipment condition.

MATERIAL STREAM	**Pellet receipt** Quality, chemistry, size distribution, inventory	**Screen + feed** Screening, bins, weigh feeders, conveyors	**Shaft reduction** CORE Burden descent, heat, gas–solid reaction, residence time	**DRI discharge** Hot/cold product route, cooling, sealing, transport	**Product interface** Storage, briquetting or downstream steelmaking demand
REDUCING GAS LOOP	**Gas supply** Natural/process gas composition, pressure, availability	**Reform + heat** Reducing potential, temperature, fuel and combustion	**Furnace injection** CORE Flow distribution, pressure, bustle conditions	**Top-gas clean-up** Scrubbing, cooling, dust and water circuit	**Recycle + compress** Compression, split, purge, make-up and return

↻ Recycle closes the gas loop; the twin reconciles mass, energy, chemistry, pressure, and equipment limits across the full circuit.

Process	Quality	Asset health	Performance
T · P · flow · composition	metallization · carbon · fines	vibration · current · temperature	t/h · energy/t · availability

Current focus: DRI plant in progress

The exact process configuration, tag list, limits, and KPIs will be aligned to the real plant documents and control-system data—not assumed from a generic diagram.

ROLE-BASED DECISION COCKPIT

See the plant. Understand the why.

The cockpit connects live condition, predicted outcome, constraint, recommended action, and realized value—without hiding model confidence or data quality.

METALLIZATION

— %

actual · forecast · target

PRODUCT CARBON

— %

laboratory + soft sensor

SPECIFIC GAS

—

per tonne of DRI

PRODUCTION RATE

— t/h

actual + constrained forecast

FURNACE STATE

TO CALIBRATE

plant model + operating history

DATA CONFIDENCE

— %

coverage · freshness · quality

SCENARIO	QUESTION ANSWERED	PRIMARY MEASURES	STATE
Pellet variability	How will feed chemistry or sizing affect the furnace?	Quality, stability, rate	Model case
Gas constraint	What is the best response to gas quality or availability loss?	Metallization, energy, plan	Model case
Compressor degradation	How much risk remains before a maintenance intervention?	Health, efficiency, capacity	Model case
Production ramp	Which trajectory reaches target without destabilizing the shaft?	Rate, thermal state, quality	Model case
Maintenance window	When is intervention least costly to the integrated plan?	Risk, downtime, margin	Planning case
Outcome validation	Did the recommended action deliver its predicted value?	Error, confidence, benefit	Required gate

Dashboard values are intentionally blank. Plant-specific units, baselines, limits, and targets must be connected to the DRI project's approved instrumentation, laboratory, production, and engineering sources.

IMPLEMENTATION PATH

Start where value is visible. Scale where context is reusable.

The DRI plant and its shaft furnace are the first implementation focus. The same industrial twin foundation then expands through the steel value chain—and later to factories, mines, oil and gas, and power generation.

DRI	Shaft	4 layers	1 core
current plant focus	furnace-centered process twin	asset · process · operations · value	reusable industrial twin foundation

PHASE 01 · DEFINE

Map plant + value

Confirm use cases, PFD/P&ID scope, asset hierarchy, tags, KPIs, users, and success criteria.

PHASE 02 · CONNECT

Build the DRI context

Unify OT and enterprise data; establish quality, time alignment, balances, and operating states.

PHASE 03 · PROVE

Model + validate

Calibrate furnace and asset models; back-test predictions; run operator-reviewed scenarios.

PHASE 04 · SCALE

Steel → industry

Extend to pelletizing, steelmaking, forging and utilities; then mines, oil & gas, and generators.

Dracoverse

Draco—the dragon and constellation. Verse—the digital industrial world where every plant, process, asset, and decision has a living counterpart that can be understood before action.

OPERATE WITH FORESIGHT

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