TURNING INSIGHT INTO ACTION

PHYSICS-GROUNDED AGENTIC AI...

...AS AN OPERATIONAL RESILIENCE LAYER FOR ENERGY SECURITY

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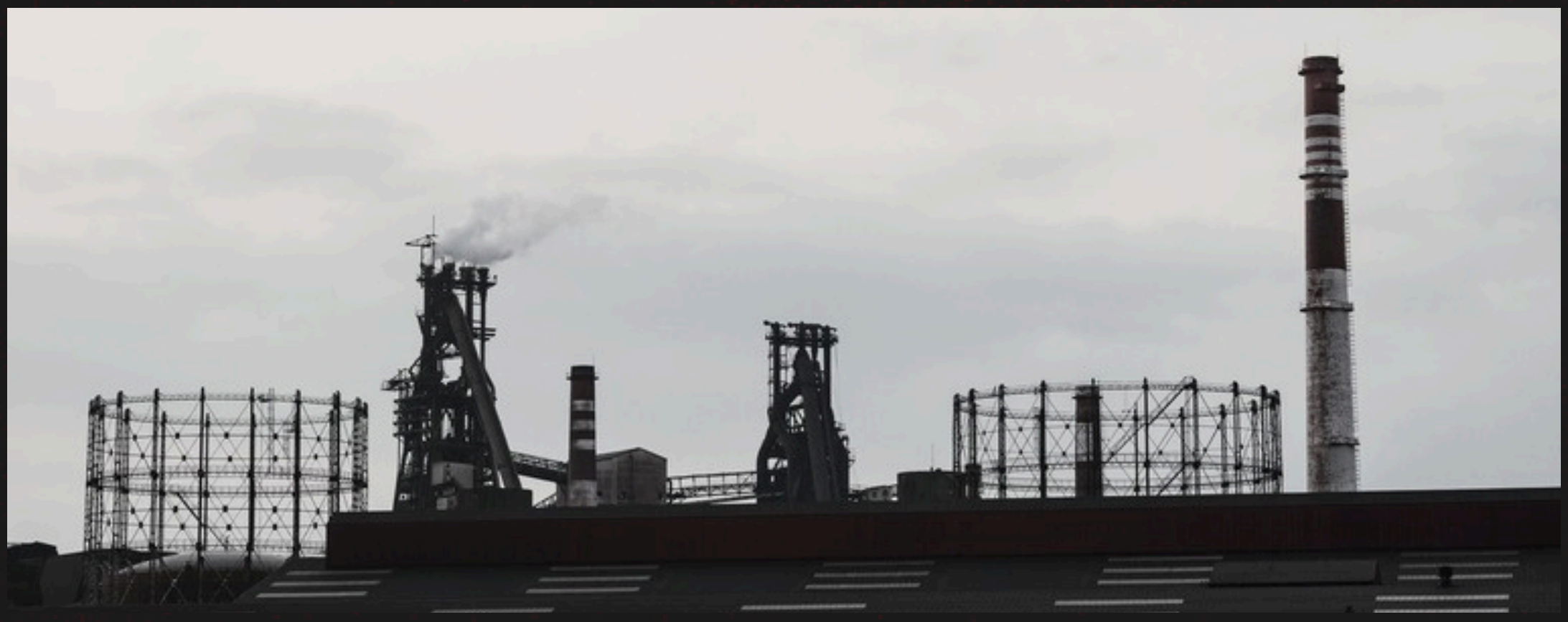

GLOBAL ENERGY SECURITY IS ENTERING A STRUCTURALLY MORE COMPLEX ERA.

Conventional digital transformation approaches like dashboards, predictive analytics, standalone generative AI, all improve visibility but do not reliably convert insight into bounded, auditable action in safety-critical operations.

This paper presents a new Energy operating model for the AI era.

INTEGRATED COMPONENTS 5

1. **IT/OT data integration:** Historians, SCADA, ERP, engineering, maintenance, & production planning;

2. **Agentic orchestration:** Specialised agents coordinating anomaly triage, drilling dysfunction diagnosis, production optimisation, & maintenance prioritisation;

3. **Physics-based validation:** headless digital twins and physics-informed ML to confirm feasibility within process and equipment boundaries

4. **Policy & control guardrails:** approval thresholds, human-in-the-loop escalation, audit trails, & risk-tiered autonomy;

5. **Execution pathways:** Routing approved recommendations into existing workflows or bounded operational control loops.

REAL SCENARIO DEPLOYMENTS

42%

In a drilling dysfunction diagnosis workflow, the architecture reduced time to diagnosis by **42%** versus the expert-led baseline, preserving explainability & decision traceability throughout.

A complementary production optimisation deployment demonstrated a sustained uplift of **6–8%** over a conventional digital-only baseline of less than 4%.

6 – 8%

Across both use cases, the same governed loop; perception, reasoning, physics validation, policy enforcement & execution proved transferable, confirming the architecture as a reusable operational layer rather than a workflow-specific tool.

SOLVING FOR REAL WORLD COMPLEX SYSTEMS

The primary contribution is a formally structured autonomy taxonomy.

Trusted agentic AI is not a productivity tool layered onto existing operations. It is an operational resilience layer with structural capability that determines whether energy systems can act reliably on the intelligence they already generate.

Ben Owen
CEO of ATELIC

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