

How PalTech Enabled 20% Manufacturing Cost Optimization and Real-Time Fleet Operations for a U.S. Polysilicon Leader



Overview

A leading U.S.-based polysilicon manufacturer operates highly energy-intensive plants where production efficiency and operational precision directly influence margins. Historically, the organization relied on well-defined but manual and rule-driven processes to manage production scheduling and fleet operations.

As energy price volatility increased and operational complexity grew, these processes began to limit scalability. While production targets were met, cost optimization and operational efficiency were inconsistent, and decision-making remained reactive.

To address this, **PalTech** initiated a transformation focused on manufacturing cost optimization, production scheduling optimization, and fleet operations management-by evolving existing processes into agentic, context-aware workflows.

Business Challenges

The organization faced systemic challenges common in large-scale manufacturing and supply chain operations:

- Production scheduling optimization was limited, relying on static inputs rather than real-time electricity pricing and operational constraints.
- Energy optimization opportunities were missed, leading to higher production costs despite meeting output targets.
- Fleet operations and plant data existed in silos, limiting real-time coordination across logistics and production.
- Operational decision-making was manual, requiring engineers to reconcile scheduling, cost, and asset availability.
- Lack of integrated manufacturing analytics, making it difficult to correlate operational efficiency with financial outcomes.

These gaps highlighted the need for a data-driven, AI-enabled manufacturing system that could unify scheduling and fleet operations.

Making Production Scheduling Agentic

PalTech transformed the client's scheduling process into an agentic production scheduling system designed for manufacturing cost optimization.

- Encoded production constraints (inventory, labor shifts, ramp rates, machine availability) into mathematical optimization models.
- Implemented production scheduling optimization using GAMS and IBM CPLEX for deterministic decisioning.
- Built a Python-based scheduling engine that:
 - Consumes real-time electricity pricing.
 - Generates optimized schedules automatically.
 - Quantifies energy cost before execution.

This enabled energy optimization in manufacturing, allowing planners to shift production to lower-cost windows with precision.

Enabling Agentic Fleet Operations

In parallel, PalTech modernized the client's fleet operations management system, shifting it from passive monitoring to agentic fleet operations.

- Converted fleet telemetry (asset movement, utilization, throughput) into real-time operational signals.
- Built scalable systems to process high-frequency logistics data across plants.

- Enabled autonomous interpretation of:
 - Asset utilization
 - Bottlenecks and congestion
 - Idle capacity

This created a data-driven fleet management system capable of adapting operations dynamically.



Context-Aware Manufacturing Operations (Current Scope)

The current phase of the engagement focuses on connecting production scheduling and fleet operations into a unified, context-aware system.

- Scheduling systems now adapt based on real-time fleet availability and operational constraints.
- Fleet operations adjust dynamically based on production schedules and throughput requirements.
- Decisions are made using shared context across manufacturing analytics and logistics systems.

This enables:

- ✓ Real-time coordination between production scheduling and fleet management.
- ✓ Reduced dependency on manual reconciliation.
- ✓ Continuous optimization across manufacturing and supply chain workflows.

This is not a future state-it is the active transformation underway, where systems operate with shared intelligence instead of isolated logic.

Business Impact

- ✓ 10-20% reduction in energy costs, directly improving manufacturing margins.
- ✓ Faster production scheduling cycles, improving responsiveness to demand and pricing changes.
- ✓ Enhanced fleet utilization and operational efficiency.
- ✓ Reduced manual intervention across scheduling and logistics workflows.
- ✓ Improved manufacturing analytics and decision visibility.

Contact Us



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Operational Intelligence at Scale

This transformation demonstrates how manufacturers can move from process-driven execution to intelligent, adaptive operations.

By combining production scheduling optimization, fleet operations management, and context-aware decisioning, PalTech enabled a scalable foundation for modern manufacturing analytics and **AI-driven operations.**

If your organization is exploring manufacturing cost optimization, supply chain intelligence, or AI-driven operational systems, PalTech partners to deliver measurable outcomes - without disrupting existing workflows.

Tech Stack:

Python, LangChain, GAMS, IBM CPLEX, Azure Event Hubs, Azure Databricks, Azure OpenAI Service, Azure Functions, Application Insights