



White Paper

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# Modernizing Manufacturing

How facility digital transformation improves  
overall performance, efficiency, and resilience

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## About Mantis

Mantis Innovation is the premier provider of smart, sustainable solutions that deliver better building performance, improved energy efficiency, and optimized budgeting through managed facility services and turnkey program management. Mantis leverages expertise from a vast array of professional disciplines in engineering, comprehensive data collection and analysis, technology-enabled solutions, and a network of trusted partners.

We offer a full suite of services including; strategic energy procurement and demand response; climate impact reduction and reporting; solar, roofing, building envelope, HVAC, and pavement, assessment, capital planning, design, and construction management; and lighting, HVAC/mechanical and building automation systems improvements and implementation. Mantis is headquartered in Houston, Texas, with office locations across the United States from Massachusetts to Washington.



# Manufacturing facilities embrace future-friendly production

**A critical pillar of the global supply chain, the US manufacturing sector stands on the verge of vastly improved performance, efficiency, and resilience — through facility digitalization and other steps forward.**

The manufacturing sector, a cornerstone of the global supply chain, is vital for today's economic health — and the sector's own vitality hinges on its ability to enhance organizational effectiveness, reduce downtime, and optimize energy investments.

United States manufacturing output has added more economic value globally than all other countries but China. The US remains a manufacturing powerhouse, and talk of an American manufacturing renaissance has persisted since 2022 — driven in part by American manufacturing sector growth that year, which outpaced the rest of the world. The US ranked first in aerospace exports, second in automotive manufacturing, and fourth in steel production globally.

But in 2023, American manufacturing slumped. Offshoring, persistent supply chain issues that worsened considerably during the Coronavirus pandemic, and significant training gaps in the face of increased automation, among other global difficulties, hit North American manufacturing hard.

Yet, buoyed by a strong economy and significant investments in modernization, including factory construction reaching \$200 million per month and substantial government grants, US manufacturers are deploying smart facility strategy updates to boost resilience, reduce disruption, and drive economic value in order to reinvigorate the optimism fostered during 2022.

**Digital transformation is a headline objective** according to several industry-centered reports, from [Deloitte](#) to [PwC](#) to [Forrester](#). The focus is warranted: According to a 2024 [survey](#) of 200 industry leaders conducted by the Manufacturers Alliance, 80% of respondents are either currently implementing or have already operationalized digital transformation technologies to improve manufacturing, production efficiency, and overall equipment effectiveness (OEE).

From a facilities perspective, this means incorporating more comprehensive controls and monitoring of facilities and their manufacturing process. From automotive and consumer electronics to heavy industry and food production, logistics companies, warehouse and distribution center owners, and plant managers alike are actively embracing facility transformation and digitalization. In so doing, these leaders are driving resilience in its many forms: resilience to unforeseen emergency capital expenditures, resilience to unexpected equipment failure or production interruptions, and resilience in the form of capturing available federal funds to future-proof plants.

Leading factors driving manufacturing facility modernization include global competition, regulatory compliance, economic change, volatile energy rates, aging infrastructure and excessive scrap/defect, higher-efficiency performance goals, and sustainability.

Meanwhile, an ongoing challenge is to accomplish all of this while **doing more with less...** (Deloitte analysis [states](#) that the manufacturing sector was in contraction for most of 2023) ...and **with fewer people** (according to the [US Chamber of Commerce](#), as of January 2024, roughly 622,000 manufacturing job openings were yet to be filled).

Yet the moment is also prime for manufacturers to smartly invest capital to address those challenges, reducing operating costs, improving sustainability, and ultimately becoming the heroes of the sector.

**The writing is on the loading dock wall: modernizing energy, facility, and sustainability strategy is key to staying competitive.**



## Diverse manufacturers scaling up facility, energy, and sustainability efforts

With a [marked shift](#) toward digitalization and sustainability, manufacturers of all sizes are leaping toward the future by making prudent facility decisions today. From investing in industrial automation and carbon neutrality strategies to embracing AI and the Internet of Things, companies across a range of subsectors are getting primed for a future of higher performance, efficiency, and resilience across facilities.

Such momentum is not limited by size or scope, either. Companies of all sizes and budgets are seeing fresh value in making calculated moves forward.

### ▲ FACILITY PERFORMANCE

**Teaming up to accelerate building performance:** The [High Performance Building Coalition](#), comprising more than 200 manufacturers, nonprofits, standards development organizations, trade associations, and other stakeholders, has teamed up to support policies that advance high-performance buildings and that make good economic sense.

Their vision is that by investing in higher-performing buildings with innovative building technologies, manufacturers can help protect life and property, enhance US economic competitiveness, increase energy and water efficiency, and together contribute to more sustainable and resilient communities.

### ▲ DIGITAL TRANSFORMATION

**And the winner is... leadership in digital transformation:** The two top winners recognized by the [Manufacturing Leadership Council's 2024 Manufacturing Leadership Awards](#) were each celebrated for advancements in digital transformation, including investing in smart factory technologies.

**Optimizing production with artificial intelligence (AI):** On the manufacturing front, early adopters are [using generative AI](#) to drive productivity by using root cause analysis to predict failures and reduce defects, and offer live, AI-supported troubleshooting and operational guidelines. [Buzz](#) is also mounting around AI use in energy optimization, demand forecasting, and sustainability strategy.

In fact, according to a Manufacturers Alliance 2024 [AI-focused study](#), half of the manufacturers surveyed are starting to use AI for predictive maintenance analytics and another 25% expect to do so within the next two years. Moreover, the vast majority (93%) have added new AI initiatives over the past 12 months, with another 6% planning to launch such initiatives soon.

**Facility tech solutions aren't just about software:** Major companies like [BMW and GE Aviation](#) are using drones for aerial inspections in their factories, among other [manufacturing-specific drone tactics](#), while Registered Roof Observers help facility leaders poke and prod as well as visually inspect. Hardware sensors also figure prominently in optimizing facility management, helping plant managers keep the proverbial lights on when needed — no more and no less.



## ▲ SUSTAINABILITY

**Stepping up corporate sustainability (and reputation):** The Manufacturing Leadership Council [polling](#) found that 58% of respondents in 2022 believed sustainability is essential to future competitiveness compared to 38% in 2021. Also in 2022, [68%](#) were actively implementing extensive, corporate-wide sustainability strategies versus 39% in 2019.

And those manufacturing leadership awards mentioned earlier? Intertape Polymer Group, the Large Enterprise Manufacturer of the Year, also received accolades for “noteworthy strides in sustainability through reductions in both energy usage and waste.”

Consumer demand is helping move the needle toward more sustainable manufacturing, too: According to a PwC [survey](#) in spring 2024, consumers are willing to pay a 9.7% sustainability premium — in spite of active concerns about inflation and cost of living.

**Reducing emissions by the truckload:** Tesla, Proctor & Gamble, IBM, General Electric, and Patagonia may be some of the best-known examples of [manufacturers going green](#). But heavy industry leaders are also making bold progress in reducing emissions in typically high-emitting sectors. Case in point: steelmaker [Nucor](#) uses lower-emissions electric arc furnace (EAF) technology and a circular process that is far less emissions-intensive than conventional extractive processes. By recycling scrap instead of mining raw materials, it also keeps carbon-rich materials in the ground.

Domestic clean energy manufacturing is [growing rapidly](#) as well, adding further momentum to sustainable production. According to [American Clean Power](#), 164 manufacturing facilities or expansions have been announced since August 2022, totaling [\\$488 billion](#) of investment in domestic, utility-scale clean energy production, as of early 2024.

Examples of green energy procurement in the automotive industry include [Rivian](#) and [GM](#), both founding members of the [Emissions First Partnership](#), a coalition of companies committed to reducing emissions with impactful clean energy projects.





▲ Mantis Partner Spotlight:

## Upgrading major manufacturer's heating systems boosts performance and curbs costs

**Challenge:** A large Connecticut wire and cable manufacturer knew that its aging heating systems was holding it back from meeting efficiency goals. Corporate leaders partnered with Mantis to update system using air handling units that could not be moved due to the location above a production floor.

**Opportunity:** Mantis identified significant available incentives and then designed and drove the project, installing four new rooftop heaters to replace the existing steam generator and heat exchanger.

**Outcome:** The new system saves over \$50,000 per year and pays back within three years. An additional benefit of this new heating system is the ability to take in 100% cooler outside air at night during the spring, fall, and even summer seasons to pre-cool the building, providing a more comfortable environment during the day.





# Four reasons to shift from ‘good manufacturing’ facility processes, to great ones

Modernizing manufacturing facilities is not just about keeping up with the Joneses (or the NVIDIAs). Several business drivers make it central to big-picture organizational success.

## 1 Greater cost optimization

With delivery of goods and profits heavily susceptible to the unpredictable forces of the global supply chain, manufacturing organizations are continually searching for insulation from these forces and sources of protection from costs and pricing instability. That means the pressure is on to mitigate costs related to energy, facility operations and maintenance, and equipment repair.

By modernizing facility management and energy use, manufacturers gain budget clarity, including understanding total cost of ownership for their real estate. These insights help them manage energy price exposure and lower maintenance and repair costs, ultimately ensuring that when they look back in 15–20 years, they know their plants spent the least but performed the best.

A variety of potential incentives also contribute to cost optimization, such as Inflation Reduction Act (IRA) federal tax credits for improvements like electric vehicle infrastructure and onsite charging.

## 2 Operational efficiency and agility

Many manufacturers face challenges with staffing and resources, often struggling with under-resourced teams and outdated technology that hinders performance across large facility portfolios. Aging infrastructure poses another challenge, with the built environment often seen as a critical yet depreciating asset.

To maximize manufacturing profits, operational optimization of these resources is a must. This means harnessing continuous data collection and diagnostics to maintain production continuity and avoid unplanned downtime. By forecasting and scheduling the right work at the right time, manufacturers can avoid unnecessary replacements and emergency repair costs, leading to improved operational efficiency, agility, and sustainability. Proactive facility management practices also enhance the experience for factory workers, ensuring a comfortable and safe working environment.



### 3 Risk mitigation and regulatory compliance

It's no secret that manufacturers are among the most heavily regulated, with well-established operating standards and broad enforcement mechanisms. Companies need to know the cost of compliance not only for existing regulations, but for those likely on the horizon as well.

Sustainability-related risk mitigation and compliance issues are increasingly top of mind for today's manufacturers. Scope 3 emissions considerations are gaining prominence more broadly, with [more than half](#) of global Fortune 500 companies addressing supply chain Scope 3 emissions in some form.

And with large buildings increasingly subject to [facility performance regulations](#), many manufacturers will need to meet new requirements for building performance in the near future — or risk higher costs down the line.

### 4 Competitive edge

As one of the most globalized sectors, the manufacturing industry is directly influenced by both domestic and international market forces, making it susceptible to being undercut on price. To stay ahead of the competition, companies need new ways to strengthen profitability, from reducing scrap and maintaining operational continuity, to bolstering brand reputation among investors and customers.

Investors are increasingly looking for companies that can create value efficiently, while customers now often expect investments in sustainability. Like most industries, manufacturing organizations are attempting to achieve the balance of offsetting global environmental impact while realizing the inherent economic advantages of contemporary sustainable business practices.





▲ Mantis Partner Spotlight:

## Efficiency upgrades reduce energy spend for major East Coast bakery

**Challenge:** A food production company sought to reduce energy use and spend within its 280,000-square-foot manufacturing facility.

**Opportunity:** Mantis conducted extensive energy-efficient lighting upgrades and installed a building management system — while securing cost reductions through available incentives.

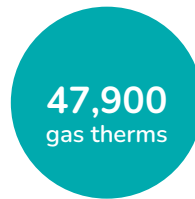
**Outcome:** The project achieved significant savings with a payback period of less than three years. Beyond the energy and financial savings gained, the upgrades provide a better working environment for facility employees.



TOTAL INCENTIVE



TOTAL ANNUAL SAVINGS



ANNUAL SAVINGS



ANNUAL ELECTRICITY SAVINGS



## An integrated ‘warehouse’ of facility performance drivers

It takes an innovative, integrated approach to fulfill the bucket list of operating cost reduction, energy supply, sustainability, enterprise-wide scalability, and operational improvements.

Traditionally, facility management has taken a too-narrow view that looks just at energy supply, project focus, and a single-site focus. By expanding the potential with scalable stops on the assembly line to modernization, manufacturing leaders can steer their portfolio to success, one plant success story at a time.

### 1 Energy strategy management and procurement

Energy rates can be [volatile](#); a mild winter last year might have kept them low then, but conditions like those are unpredictable to say the least. With hybrid procurement, manufacturers can mitigate risks now, while retaining flexibility to lock in favorable rates if the market dips. Since energy is one of the top five operating costs for most manufacturing facilities, procuring and [managing it effectively](#) can make a very positive impact on long-term financials.

### 2 Renewables, storage strategy, and procurement

Energy cost volatility issues can also become a thing of the past when companies invest in onsite solar or wind power. [Rooftop solar](#), for one, can put all that industrial rooftop space to work, bringing down electricity costs and giving factory employees another source of pride in their workplace. Plants can also reduce Scope 2 emissions and energy costs with offsite [renewable energy](#) procurement, renewable energy certificates (RECs), and no-risk/high-reward [demand response](#) strategies.

### 3 Physical facility asset management

Manufacturers need to optimize mechanical budgets and work toward sustainability goals — while staying up to code and making strategic 20-year investments that take advantage of utility incentives. But too often, they’re held back by a reactive “run-to-fail, then replace” approach to equipment maintenance. The quick-win fix? Use low-cost preventative maintenance to get ahead of disruptions and issues. From roofs and pavement to HVAC systems, proactive management enables you to save costs and build room in the budget to do the right work at the right time. The next step is to invest in corrective management solutions, harnessing predictive analytics to monitor equipment, predict problems, and plot most-strategic replacement schedules.

Consider an aging roof, for example. With a reactive approach, a complete replacement might be the only foreseeable option. With preventative and corrective maintenance, facility leaders can extend the life of the asset and open up other possible ways forward, such as recovering the roof at a fraction of the cost of outright reconstruction.



## 4 Energy efficiency and building optimization

Modern, efficient building systems can streamline production, helping reduce scrap and/or facility downtime — while saving energy, operations, and maintenance costs. Ways to optimize facilities include:

- **The [building envelope](#), physical shell, and pavement:** What happens on a facility’s exterior has implications inside, too. Roofs, walls, windows, and even surrounding pavement all play a role in regulating the amount of energy used to heat or cool industrial spaces and avert the risk of expensive water/moisture damage.
- **Energy-efficient [lighting](#) for efficiency, safety, and experience:** Lighting retrofits with LEDs and advanced controls are often a cost-effective and low-hanging fruit way to save energy while improving safety and experience for plant employees.
- **Building management systems (BMS):** Manufacturers can spark efficiency with [building automation systems](#). Using data-driven management tools, facility teams can save time and labor by resolving issues remotely. They can optimize energy use by ensuring systems operate only as needed. Upon deployment, advanced BMS can yield immediate energy savings of 10-15% while also reducing scrap and defect, paving the way for higher performance and value down the line, too.

## 5 Load management and optimization

In modern manufacturing, managing energy consumption and distribution is essential to boosting efficiency and reducing costs. This typically involves balancing the supply of electricity with demand by adjusting the demand for power rather than the power supply, and can be done through real-time interventions, frequency-sensitive relays, time clocks, or other advanced controls.

By integrating controls and IoT devices, facility teams can monitor energy use in real time, enabling swift adjustments and optimization across various systems. For example, during certain outdoor temperatures the loading dock doors can be open to enable a whole facility ventilation through the roof to provide “free” cooling.

## 6 Financial forecasting, rebate/incentive capture, and cross-budget coordination

Effective capital planning in manufacturing calls for an integrated approach to decision-making and portfolio optimization. Manufacturers need clear visibility across a range of categories to avoid costly disruptions, boost performance, and cut emissions — in individual sites as well as across multi-site footprints. By gathering and tracking accurate data on assets and operations, facility teams can prioritize maintenance, repair, and replacement tasks based on how well each action aligns with the bigger financial picture.





▲ Mantis Partner Spotlight:

## Driving resilience to energy price risk across multiple facilities

**Challenge:** A global information and communications technology leader needed help managing energy procurement in its U.S. facilities because rising costs were eating into the organization's bottom line.

**Opportunity:** Mantis helped reduce the company's energy costs and purchase it more strategically, adhering to specific contract term requirements.

**Outcome:** Over three contract cycles, the company saw its rates lowered incrementally by 11% and 25% compared to the previous term. All told, over the past 12 years, Mantis has helped the company navigate the complicated market to continually negotiate low market rates.



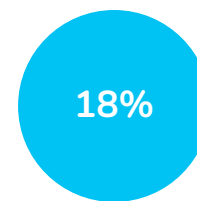
ANNUAL  
USAGE



EXECUTED  
CONTRACTS



GREEN  
ENERGY



AVERAGE  
SAVINGS  
BETWEEN  
CONTRACT  
RATES

▲ Mantis Partner Spotlight:

## Improved lighting systems for jobsite equipment manufacturer

**Challenge:** The makers of some of the world's most widely used jobsite equipment needed to improve their own jobsite by addressing failing LED lighting and poor light levels in their Illinois facility, which runs 24/7.

**Opportunity:** Mantis produced a scope that met the needs of the manufacturing plant manager, designed to avoid interruptions to plant operations, and the requirements of the company's finance team.

**Outcome:** The compelling savings and utility incentive funding met the Client's desired ROI. And thanks to close coordination between Mantis and on-site contacts, production continued seamlessly throughout the project.

\$98,334

TOTAL  
INCENTIVE

\$165,974

TOTAL  
ANNUAL  
SAVINGS

2.3  
years

PROJECT  
PAYBACK

1,569,815  
kWh

ANNUAL  
ELECTRICITY  
SAVINGS

679  
MT

CO<sub>2</sub>  
EQUIVALENT



## Assembling the manufacturing modernization playbook

It takes an innovative, integrated approach to fulfill the bucket list of operating cost reduction, energy supply, sustainability, enterprise-wide scalability, and operational improvements.

Traditionally, facility management has taken a too-narrow view that looks just at energy supply, project focus, and a single-site focus. By expanding the potential with scalable stops on the assembly line to modernization, manufacturing leaders can steer their portfolio to success, one plant success story at a time.

### 1 Get organized with data inventory

First things first: Manufacturers need to get visibility by gathering comprehensive data on their operations. This begins with taking stock of asset inventories, such as equipment age and condition, and reviewing current technologies like computerized maintenance management systems (CMMS), utility bill management, and energy management systems (EMS).

As part of a larger network of manufacturing sites, plant managers and corporate real estate teams alike can use those captured data points to benchmark any given plant against others for invaluable insights into where there may be room for improvement.

All this data can then help facility leaders pinpoint specific projects or new procurement strategies that will help further enhance performance and efficiency. Companies should also use this initial modernization phase to explore federal and local incentives as well as third-party financing opportunities to reduce costs and support sustainable practices.

### 2 Do apples-to-apples comparisons to gauge which projects to prioritize when

What are low- and no-cost opportunities for a fast start on facility modernization? Which plants are “leaders and laggards” in efficiency, performance, and resilience? The goal is to get a sense of total operational savings achieved by bringing laggards up to average in short order.

Manufacturers can then identify which actions are needed now or soon to avert risk, and which can be deferred. Using an integrated approach, companies can make consistent comparisons across different factory or warehouse locations, too, ensuring solutions are right-sized, and right-timed.

Once priorities are established, companies can leverage insights gained from these comparisons to recommend workflow changes, software adoption, handheld diagnostics tools, and/or tracking scorecards. As key stakeholders, plant managers also benefit from understanding their site’s performance relative to peers, fostering community engagement and promoting best practices by sharing performance data and discussing them in internal summits. In turn, these insights can directly support scalability planning for solutions that could be rolled out to other sites.





### **3 Unlock efficiency now by implementing low-cost ‘quick wins’**

It’s time to move on the fast-start solutions identified in the previous step, such as upgrading lighting and mechanical systems in plants where systems may be most vulnerable to equipment inefficiency or outright failure, and implementing preventative maintenance strategies.

Bringing underperforming sites up to the industry standard in terms of operational costs can deliver immediate savings, while helping make a strong business case for continued modernization. That case becomes stronger as manufacturers systematically capture and analyze results, demonstrating cost savings, efficiency, performance, and resilience.

### **4 Lay out a big picture modernization roadmap complete with capital planning**

With an overarching goal of implementing, managing, and monitoring interconnected facility assets and systems across the portfolio, manufacturers can develop a multi-year playbook for medium- and long-term projects. They need to consider how to allocate budget for strategic projects down the line, so they can spend capital most wisely and spread-out expenditures to the assets that need them, when they need them.

Using a decision-making matrix, companies can turn facility expenses into production drivers, by structuring a capital plan that optimizes investments and leverages incentives on the path to modernization.

### **5 Implement projects programmatically and monitor for ongoing improvements**

Playbooks come to fruition with expert project management to help disparate teams work together, reaching across budgets to get projects done. From the plant floor to the board room, making time for honest, data-informed conversations can help bridge gaps between facility assets, budgets, and people.

Through it all, monitoring and reporting are critical to achieving new wins over time, as facilities teams rally to bring their factories into a brighter, more efficient, and higher-performance future.



▲ Mantis Partner Spotlight:

## Driving sustainability and food safety in cold storage facilities

**Challenge:** The largest private-label cheese manufacturer in the U.S. sought to modernize humidity management and efficiency at 22 manufacturing locations and distribution centers comprising 3.1 million square feet of refrigerated space.

**Opportunity:** By troubleshooting what initially looked like an insulation problem, project leaders identified air infiltration and HVAC negative pressurization issues resulting in thermal transmission through the envelope. Updating refrigeration could reduce energy waste, improve operations and energy performance, and support food safety.

**Outcome:** Mantis devised a long-term solution to the problem — cold storage with a 20+ year engineered design life — delivering energy savings, food safety, and a significant reduction in maintenance and repair for equipment and roof leak response.



ENERGY  
REDUCTION  
LOAD



DEMONSTRATED  
FOOD SAFETY



## Modernizing manufacturing facilities: every plant (and portfolio) is unique

From an automotive assembly plant to a petrochemical production facility to a full-production garment factory, the path to manufacturing facility modernization varies widely depending on what's being made. A food manufacturer, for example, is likely to need high-reliability cold storage, requiring its own distinct set of equipment and processes for each product line.

What's more, a facility's layout, whether it is product/line, process/functional, or fixed-position, also directly affects operational efficiencies and resilience in different ways. For instance, a traditional assembly line where components move through specialized stations — such as moving down the line from welding to wiring — may differ significantly from facilities with multi-site operations that can adjust processes based on factors like power prices or grid reliability. Understanding spatial variations like these is crucial to modernizing facilities.

By tailoring facility updates to these diverse needs, manufacturers can tap into a range of benefits, from reduced operating costs, reliable energy supply, and enhanced sustainability practices, to more scalable operations across the enterprise.

A manufacturing facilities management expert can help you tailor a plan that's right for your plant and portfolio as a whole.

Learn more about how to drive resilience across your manufacturing facilities by [contacting a Mantis Innovation expert today](#).



Contact us to discuss smart, sustainable ways to improve manufacturing facility performance.



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