+ E-BOOK

Solar-Plus-Storage for the Manufacturing Industry

9-MINUTE READ

Contents

Manufacturing accounts for about a third of total U.S. energy consumption, making it one of the most energy-intensive sectors in the economy. Electricity costs have climbed steadily alongside that consumption, with commercial and industrial rates rising 5-7% annually over the past several years.

For operations and facilities leaders working to control costs, improve resilience, and meet sustainability targets, onsite solar paired with a battery energy storage system (BESS) has become one of the smarter investments available.

Solar-plus-storage does more than generate clean energy. When designed and operated well, these systems cut utility bills, protect against grid outages, open new revenue streams, and give manufacturers something concrete to show when customers and investors ask about environmental progress. These systems also help restore control over energy costs during a time of increasingly unpredictable pricing.

This e-book covers the challenges that make energy such a persistent issue for manufacturers, how solar and battery systems can make a decisive difference, and why manufacturing facilities are often ideal candidates for this technology. We'll also look at how PowerFlex helps facilities across the country implement these systems and get the most out of them.

Manufacturing Industry Challenges

Before getting into the benefits of solar-plus-storage, it helps to understand the challenges that make energy management so difficult for manufacturers.

High Onsite Power Demands

The equipment that keeps modern production running draws heavy electrical loads throughout the day and often well into the night.

The biggest power consumers include:

- Motors, compressors, pumps, and fans that run continuously
- Process heating and cooling systems, welding equipment, machining centers, and assembly lines
- HVAC and ventilation systems sized to maintain air quality and temperature for workers and products
- Testing and quality control equipment that runs alongside production

Many manufacturers run extended hours, with multiple shifts keeping production going into the evening or around the clock. In food and beverage, pharmaceuticals, and automotive, 24/7 production is the norm. All those operating hours add up, making energy one of the largest controllable expenses on the annual budget.

Fluctuating Price of Electricity

Beyond the sheer volume of electricity manufacturers consume, costs have become harder to predict. Time-of-use rates mean that production during high-rate periods can cost 2 to 3 times as much as during off-peak hours. Demand charges hit especially hard when high-load equipment cycles on and off or multiple systems ramp up simultaneously. These charges are based on your highest usage spike during the billing period, so even a single 15-minute peak can inflate the bill for a whole month. Manufacturers also face volatile wholesale energy and capacity prices with unexpected swings, adding another layer of uncertainty to budget planning.

The Cost of Power Disruptions and Downtime

Manufacturing facilities stand to suffer steep financial consequences when production stops unexpectedly. A 2024 Siemens report found that unplanned downtime costs the automotive sector up to $2.3 million per hour, with the average across all manufacturing at roughly $260,000 per hour.

When the grid goes down, work-in-progress can be damaged or ruined. Finished goods can also spoil or degrade if climate control fails, especially in food, beverage, and pharmaceutical operations. Once equipment shuts down unexpectedly, it often requires lengthy restart procedures, recalibration, and quality checks before it can safely resume production. For

manufacturers serving just-in-time supply chains, even a few hours of downtime can ripple through multiple tiers of customers and partners, jeopardizing delivery commitments and important relationships.

The Push for More Sustainable Supply Chains

For most manufacturing facilities, purchased electricity is the largest single contributor to their carbon footprint. Large OEMs, global brands, and institutional buyers increasingly expect suppliers to demonstrate real environmental progress. They want lower emissions, transparent reporting, and ESG commitments backed by real action. Manufacturers that fall behind risk losing business to competitors who were wise enough to invest in sustainability earlier.

The Benefits of Solar-Plus-Storage for Manufacturers

Solar-plus-storage addresses these challenges directly by giving manufacturers more control over how they generate, store, and use electricity. That control translates into meaningful financial and operational benefits throughout the life of the system.

Utility Offset

Rooftop and ground-mounted solar can cover a significant share of a plant's annual electricity use. Facilities that run most of their production during daylight hours benefit the most from solar, since generation peaks with consumption. Onsite solar also locks in a portion of your electricity costs over the system's 25-plus-year lifespan. Utility rates will continue to rise, but the cost of electricity from an owned solar system stays flat or even decreases over time as the initial investment is recouped. Solar also pairs very well with efficiency upgrades you may already have in place or are planning, like variable-speed drives, high-efficiency compressors, and LED lighting. Manufacturers with multiple sites can compound their savings from solar-plus-storage by rolling out across several facilities.

Cost-Saving Strategies With Battery Energy Storage

A BESS unlocks savings beyond what solar alone can deliver by storing energy when it's cheap or abundant and releasing it when rates spike. That flexibility makes several cost-saving strategies possible, depending on your utility's rate structure and system size.

SOLAR SHIFTING

Solar panels generate the most electricity around midday, but production schedules don't always line up with that curve. Storage captures excess energy and dispatches it later, when the facility actually needs it. Common applications include:

- Powering late-shift production or overnight testing runs
- Maintaining process loads as solar output tapers in late afternoon
- Covering energy-intensive changeovers and cleaning cycles that run after solar output drops

ENERGY ARBITRAGE

Energy arbitrage involves charging batteries with grid electrcity when rates are low and discharging them when rates are high. In markets with aggressive time-of-use pricing, this strategy alone can deliver significant savings. Another approach is to charge when solar output is high and loads are moderate, then discharge during peak periods while production continues. Either way, you bring down your average cost per kilowatt-hour (kWh).

PEAK SHAVING

As covered earlier, demand charges triggered by spikes in consumption are a significant cost driver for manufacturers. Battery energy storage smooths those spikes by automatically kicking in when demand jumps. Common triggers include large motors and compressors starting up, multiple high-draw processes running simultaneously, and seasonal HVAC loads. Flattening these peaks with stored energy can significantly cut demand charges month after month.

NET METERING

In markets that allow net metering, you can sell surplus solar or stored energy to the grid and earn bill credits. However, net metering policies have shifted in many states, and the economics now increasingly favor using stored energy on site

instead of exporting it. This is especially true for plants with high, consistent loads that can absorb most of their onsite generation.

Revenue Opportunities

Beyond all the cost savings, solar-plus-storage can generate income through demand response and grid services programs. Utilities and grid operators pay facilities to reduce load or discharge stored energy during periods of high demand. Participating typically means curtailing or shifting non-critical loads for short periods (often less than 30 minutes) while keeping production on track. Revenue from capacity payments or event-based incentives can be substantial, and many manufacturers reinvest these earnings in plant improvements, automation projects, or more sustainability projects.

Reduced Emissions

Every kilowatt-hour generated onsite is one less kilowatt-hour purchased from the grid, which in most regions still relies heavily on fossil fuels. That translates to measurable reductions in Scope 2 emissions and tangible progress toward net-zero targets. As large buyers scrutinize supply chain emissions more closely, clean energy becomes a competitive advantage. For contract manufacturers and suppliers, having cleaner operations is increasingly an important differentiator. Solar installations and clean energy data can appear in annual sustainability reports, customer scorecards, supplier audits, and investor communications.

Energy Resilience and Business Continuity

Battery storage is, at its core, a resilience asset. When set up as part of a microgrid, batteries keep critical operations running during outages that would otherwise shut you down. Solar-plus-storage with microgrid capability lets you direct power where it matters most during an outage, whether that's critical production lines, quality systems, IT infrastructure, or safety equipment. While a facility's existing backup generators are still needed to supplement solar production, they run less frequently and more efficiently, reducing fuel consumption and emissions.

Why Manufacturing Facilities Are Ideal for Solar-Plus-Storage Deployment

Beyond the financial and operational benefits, manufacturing facilities often have physical characteristics that make solar-plus-storage installations very practical and cost-effective.

Long, Flat Roofs for Solar Arrays

Many manufacturing facilities, warehouses, and fabrication buildings have large, flat (or low-slope) roofs with good sun exposure and few obstructions. These expansive roof areas can accommodate high-capacity installations capable of generating a significant amount of energy. That unused roof space becomes a productive asset that will continue reducing operating costs for decades.

Ample Site Space for Ground-Mounts and Battery Enclosures

Not every facility has a roof that works for solar. Structural limitations, existing rooftop equipment, or shading issues can rule out rooftop installations — but ground-mounted systems offer a great alternative. Manufacturing campuses and industrial parks often have adjacent land, underutilized lots, or even former brownfields that can host solar panels. Battery enclosures can be placed near existing electrical infrastructure, keeping interconnection costs down.

Aligning Clean Energy With Manufacturing Operations

Solar-plus-storage fits naturally with how manufacturing facilities already operate. Plants with continuous or multi-shift production have predictable, high loads that work extremely well with solar generation and BESS dispatch.

That predictability makes it easier to optimize battery cycles, squeezing even more value out of your investment.

As manufacturers electrify more processes and transition vehicle fleets to electric, onsite solar and storage can also absorb those new loads. Building clean energy infrastructure now positions facilities to handle higher demand without depending entirely on grid upgrades or utility capacity additions.

Get the Most Out of Solar-Plus-Storage With PowerFlex

Implementing solar-plus-storage is a significant undertaking, and the value you get depends heavily on how well the system is designed, financed, and operated. PowerFlex leverages 30 years of renewable energy experience to achieve the best possible outcomes for customers.

End-to-End Services

PowerFlex manages solar-plus-storage projects from the initial assessment through ongoing asset management and optimization, taking on all project complexities so your team can stay focused on production. We handle:

- Portfolio screening to identify solar and storage potential across your facilities
- Site validation covering structural review of roofs, electrical capacity, and available space for ground-mounted arrays and battery enclosures
- Engineering and design matched to your process loads, existing backup systems, and safety requirements
- Construction and commissioning scheduled around production, changeovers, and maintenance windows to minimize disruption
- Long-term asset management to keep systems performing as designed throughout their lifespan

Incentive and Policy Expertise

The incentive and policy landscape for solar-plus-storage is complicated and always changing. PowerFlex structures every project to capture maximum value from each program available, such as:

- Federal tax credits, including the Investment Tax Credit (sunsetting for solar in 2026, but still available for storage)
- State and utility programs for solar, storage, and demand response
- Interconnection rules and tariffs that affect project economics

For multi-site manufacturers spread across several states, getting the timing and structure right is even more important. Different locations qualify for different incentives, and it takes careful planning to take full advantage of these benefits. PowerFlex handles that coordination so you don't leave incentive dollars on the table.

Flexible Financing

PowerFlex offers several ways to structure solar-plus-storage projects, giving manufacturers a great deal of flexibility based on their capital availability and financial goals.

DIRECT OWNERSHIP

Manufacturers who own their systems outright can capture federal tax credits, depreciation benefits, and long-term savings. For companies that have the available capital, direct ownership will typically deliver the strongest returns as well as the fastest payback.

THIRD-PARTY OPTIONS

Third-party financing lets manufacturers access solar-plus-storage benefits without incurring high upfront costs. With a power purchase agreement (PPA), PowerFlex or an affiliate owns and operates the system while you purchase the electricity it generates at a contracted rate, typically lower than utility rates. There's no CapEx layout, and your energy pricing becomes more predictable — making PPAs an extremely attractive option. Leases work similarly, but you would make fixed payments for use of the system.

HYBRID AND CO-OWNERSHIP STRUCTURES

Shared ownership arrangements or structured buyout paths offer flexibility for manufacturers who want to own the system eventually but prefer to spread the investment over time. Manufacturers with multiple facilities can also mix financing models across their portfolio based on local incentives, facility priorities, and site-specific economics. A plant in one state might be a strong candidate for direct ownership, while a facility in another might work better under a PPA. PowerFlex works with you to determine the right model for each plant and for your overall portfolio.

Proven Technology

PowerFlex X™ is the adaptive energy platform that ties everything together. The system optimizes solar generation and battery charge and dispatch based on your plant's actual load profiles, adjusting in real time to maximize savings. Intuitive dashboards show energy performance, cost savings, and carbon reductions across facilities, giving operations and sustainability teams the visibility they need to track progress and report results. PowerFlex X is completely scalable, accommodating and co-optimizing other assets like fleet EV chargers as your energy needs expand.

Customer Success

PowerFlex has helped manufacturers across the U.S. implement solar and battery energy storage systems tailored to their specific operational and financial goals. Here are just a few examples:

CUBIC CORPORATION

Cubic, a technology and defense manufacturing company, partnered with PowerFlex to install an integrated energy system at its San Diego headquarters. Taking advantage of the facility's expansive parking lot, PowerFlex installed a 962-kilowatt (kW) solar carport that generates clean electricity while providing shade and shelter to vehicles parked below. The solar system was paired with a 280-kW / 539-kWh battery, allowing Cubic to store and extend the use of solar energy to reduce grid reliance and reduce electricity costs. The solar-plus-storage system is projected to save Cubic $93,000 annually and $3 million over its lifetime.

AMPHENOL

Amphenol worked with PowerFlex to transform a flood-damaged industrial site in upstate New York into a productive clean energy asset. PowerFlex designed and installed a 6.3-megawatt (MW) ground-mounted solar system engineered to withstand the region's most extreme flood conditions. The system generates over 7.4 million kWh annually, helping Amphenol avoid nearly 12 million pounds of greenhouse gas emissions each year while delivering substantial operational savings.

LUMENTUM

Lumentum, a global manufacturer of optical and photonics products, partnered with PowerFlex to install a 1.8-MW solar system at its San Jose headquarters. The installation combines rooftop arrays with solar carports across the campus, generating approximately 2.6 million kWh of clean electricity annually, supporting Lumentum's goal of achieving net-zero Scope 1 and 2 emissions by 2030. The project also includes EV charging infrastructure to support future fleet electrification.

Ready to explore what solar-plus-storage can do for you? **Talk to a PowerFlex expert** about your options.

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About PowerFlex

PowerFlex is a clean technology solutions company making the transformation to carbon-free electrification and transportation possible. Our adaptive energy optimization platform PowerFlex X™ monitors, controls, and co-optimizes onsite assets like EV chargers, solar, energy storage, and microgrids — reducing overall energy costs through patented algorithms that maximize distributed energy resources.

PowerFlex is the second-largest installer of commercial solar in the United States, with over 500 megawatts (MW) of total solar capacity plus 50+ megawatt-hours (MWh) of battery energy storage. Combined, our solar and energy storage projects offset 460,000 metric tons of CO_2 each year. We also manage more than 50,000 EV chargers nationwide, making us the second-largest EV charging provider in the U.S. in terms of Level 2 port management.

PowerFlex is backed by EDF power solutions and Manulife Investments.

Visit powerflex.com for more information, and connect with us on LinkedIn and YouTube.

MORE WAYS TO GET IN TOUCH


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