



# Net-Zero Energy Use in Manufacturing

**OPEX Corporation went off the power grid and converted its manufacturing/warehousing facility to solar power.**

BY JIM MCMAHON

**E**nergy costs have forced many manufacturers to focus on innovative ways to optimize energy consumption and improve operational efficiency in their manufacturing, product lines, distribution and administrative operations. Lighting changes, replacing heating ventilation and air conditioning (HVAC) systems and upgrading process controls are among the top choices out of dozens available.

Switching to fluorescent or LED lighting can be relatively fast and easy. Replacing an existing HVAC system with a more efficient one is a little more complex. Upgrading to integrated process controls architecture to streamline production in manufacturing or workflow in distribution requires some planning. These and scores of other initiatives can be undertaken to make manufacturers more energy efficient, productive and sustainable.

Energy management, process efficiency and incorporating more sustainable procedures are critical to

maintaining a competitive edge in today's environmentally aware and sensitive markets. Indeed, the need for streamlining energy usage and providing creative solutions for sustainability issues has never been stronger.

OPEX Corporation, a manufacturer of material handling equipment, provides an example of how such changes can benefit nearly any manufacturer. Almost any manufacturer of highly automated systems has incorporated some degree of improved energy efficiency into their product lines, such as conveyors and sortation units with highly-efficient PLCs and servo-drives, laser-guided vehicles with rechargeable batteries, and high-speed AS/RS (automated storage and retrieval systems) and picking systems utilizing ultra-capacitors that store energy electrostatically.

Although these product improvements in energy reduction are significant, too many companies that manufacture these highly energy-efficient material han-



Each of the 8,372 solar panels at the OPEX facility is capable of producing up to 250 watts of electricity.

ding systems have made only nominal strides in energy optimization to their own facilities, despite the necessity for better energy management. Many are still running their plants, warehouses and administrative offices from traditional energy sources that are non-renewable, and increasingly costly.

OPEX, known worldwide for its high-speed mail handling and document imaging systems and sorters, and automated goods-to-person picking systems for warehousing, has taken up the challenge and has made the move to renewable energy. It has taken its sustainability initiatives to a new level by integrating a 2.77 megawatt (MW) solar array system capable of producing more than 100 percent of the electrical energy needed to operate its 250,000 square-foot manufacturing, distribution and administrative complex located in Moorestown, N.J. Not only is OPEX now effectively a net-zero user of electrical power from traditional energy sources, its conversion to solar power makes it the largest solar installation operated by a privately-held company in the state of New Jersey. In effect, power required to manufacture the company's entire product line of automated material handling systems is now derived, 100 percent, from a sustainable source.

### Focus on Energy Reduction

Before switching its facilities to solar energy, OPEX had undertaken a number of initiatives to reduce its energy consumption and to embrace sustainability.

"We were spending a lot of money on electricity and were constantly battling to reduce those costs," says Dave Andrews, facilities manager at OPEX. "We had installed energy efficient fluorescent lighting throughout our entire 250,000 square-foot manufacturing and warehouse/distribution areas and in our administrative offices, and added motion-sensitive lighting in other areas. We also installed a computer-based programmable system for our 100-plus HVAC rooftop units to run on a more energy-efficient user-occupied basis. These changes produced significant savings."

After achieving measurable success in reducing its energy demand by late 2009, OPEX began, under the direction of the company's president and CEO, Dave Stevens, exploring solar energy as an option to further decrease its energy draw while expanding its sustainability influence.

Although many companies do not carefully consider what their optimal next incremental investment in energy management and sustainability should be, OPEX conducted a systematic analysis of the cost interdependencies and optimized energy benefits of converting to solar, taking into account the long-term business and sustainability goals of the company.

OPEX 30-acre manufacturing warehousing and administrative campus in Moorestown, New Jersey.







OPEX employees can access complimentary solar-generated electricity for their electric vehicles from charging stations located within parking pavilions.

“Admittedly, we did not know much about solar energy,” continues Andrews. “But this was a logical next step for us. As we started learning about it, the potential of putting solar into our operation began making good financial sense. The incentives looked really attractive, including a 30 percent rebate offered by the federal government at the time. We realized that it was something worth pursuing. By early 2010 we started the process of identifying several prospective installers and sent out requests for proposals.”

### Optimizing Solar Energy Use

In mid-2010, OPEX selected H2 Contracting LLC (H2) of Marlton, N.J., to act as general contractor for the design and build of its solar energy project. H2, which provides construction management and general contracting with a focus on renewable energy and sustainability projects, closely investigated workable technologies and then assembled costs and a phasing schedule to stagger the introduction of the solar array technology.

Going into the project, the company’s traditional grid energy consumption for the Moorestown complex was 2,589,000 kilowatt-hours (kWh) per year. OPEX desired a solar energy capability that would cover 100 percent of the energy load of its facilities. To meet these specifications, H2 designed a 2.77 MW solar power installation consisting of 8,372 solar panels (each capable of producing up to 250 watts of electricity) covering the roofs of two buildings and two parking pavilions on the campus of the OPEX headquarters, along with a three-acre solar field array, for a total output of 2,772,000 kWh.

Sunlight can be converted directly into electricity using photovoltaics (PV). PV basically consists of solar panels (called modules) that contain multiple flat poly-silicon wafers (solar cells) which are charged with ions. When sunlight directly hits these wafers, the ions go into motion and generate direct current (DC) electricity. The solar panels are wired together to form arrays, and the electricity from the arrays is put through a series of inverters which convert the DC electricity to alternating current (AC), which can then be used for power or sold to the grid.

“The solar system installed at OPEX is not a typical design,” says Mark Heenan, president and LEED-accredited professional with H2. “Usually solar arrays are set up with all of the panels facing in the same direction and with the same tilt. With the OPEX system, because we mounted the panels on multiple rooftops, canopies and a field array, the 82,000 square feet of PV panels are situated in six different directions, and with various tilts to capitalize on available sunlight and space. We then integrated a technology called Satcon Smart Combiner to optimize the flow of electricity.”

“In a typical PV solar energy design, power in an array of solar modules will only be transmitted equal to the least performing solar module,” explains Heenan. “So if seven solar modules are in direct 100 percent sunlight, and one module in that array is in partial shade and only recording 10 percent of direct sunlight, then the output of the entire array will only transmit at 10 percent. Smart Combiner technology improves solar array monitoring and sensing, permitting all modules to transmit their recorded levels of sunlight regardless of whether the modules are in direct





sunlight or in shade. For OPEX, this has significantly optimized the performance of its solar energy capability.”

The solar energy produced is used directly in the company’s manufacturing and distribution operations and in their administrative offices. At any time when energy consumption exceeds that which is produced by the solar installation, the company can supplement by drawing energy from the grid. Conversely, when the solar panels are producing more energy than what is needed for the operation of the facilities, the surplus energy is put back into the grid.

Over the course of 12 months, the OPEX solar energy system is designed to generate 100 percent of the electricity needed to run its total operations, making OPEX a net-zero consumer of grid power. OPEX also benefits from substantial Solar Renewable Energy Credits (SRECs), an added benefit of the solar system design.

Completed in April 2012, the OPEX solar energy project was designed for an operational life of 25-years.

### **Embracing Sustainability**

OPEX continually looks at designs and concepts that will make its facilities more efficient and more productive to reduce the impact on the environment. This means taking a holistic approach to its operations.

“We work diligently to reduce energy consumption and integrate sustainable procedures in our products, processes and facilities,” says James Liebler, vice president of corporate and legal affairs at OPEX. “It is central to our mission to demonstrate that alternatives to conventional, waste-intensive manufacturing practices and energy generation not only exist, but can yield products,

processes and lifestyles that are more sustainable and in harmony with our environment.”

Within the company’s parking pavilions, for example, OPEX provides electric charging stations for employees who drive electric vehicles and wish to access complimentary electricity — also generated from the sun. OPEX recycles all scrap materials and oils used in manufacturing, and all paper products used in the company’s administrative offices. OPEX dug its own 175-foot well to irrigate the eight acres of open land on its campus — which it also replanted with native fescue grass that requires less water. Rainwater runoff from the company’s 22 acres of roofing and parking areas is funneled into the open ground to percolate into the aquifer.

Even the company’s automated mail sortation and material handling products are designed to be energy efficient and sustainable. Both the OPEX Mail Matrix sorter and Perfect Pick goods-to-person warehouse picking system rely on delivery vehicles known as iBOTS, which are equipped with energy recuperation modules that utilize onboard ultra-capacitors to recapture energy during operation.

“We have achieved a significant milestone,” adds Liebler. “Not only are our production and administrative facilities operating with net-zero energy from the grid, but our full line of automated material handling systems is now being manufactured using 100 percent solar energy.” **WT**

Solar panels in place on one of the two parking pavilions at OPEX.

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