

Improve Operational Efficiency With Energy Optimization

Jim McMahon, sustainability and renewable energy writer

The rising cost of energy has forced many manufacturers to focus their sights on innovative ways to optimize energy consumption and improve operational efficiency in their manufacturing, product lines, distribution, and administrative operations. Switching to fluorescent or LED lighting, replacing HVAC to a more efficient system or upgrading to integrated process controls architecture to streamline production – these, and scores of other initiatives can be undertaken to make product manufacturers more energy efficient, productive, and sustainable. Energy management, process efficiency and incorporating more sustainable procedures are critical for maintaining a competitive edge in today's markets. Indeed, the need for streamlining energy usage and providing creative solutions for sustainability issues has never been stronger.

In the manufacturing of material handling equipment, for example, 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. These product improvements in energy reduction are significant. But despite the necessity for better energy management, too many companies that manufacture these highly energy-efficient material handling systems have made only nominal strides in energy optimization to their own facilities, and are still running their plants, warehouses and administrative offices from traditional energy sources that are non-renewable, and increasingly costly.

One equipment manufacturer that has made the move to renewable energy is [OPEX Corporation](#) [1] (OPEX), known worldwide for its high-speed mail handling and document imaging systems and sorters, and automated goods-to-person picking systems for warehousing. OPEX has recently 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, New Jersey. Not only is OPEX now effectively a net-zero user of electrical power from traditional energy sources, its conversion to sun power makes it the largest solar installation in the state of New Jersey operated by a privately-held company. 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

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

“We were spending a lot of money on electricity, and were constantly battling to reduce those costs,” said 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.”

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

Although many companies do not consider with a high level of detail what the optimal next incremental investment is to enhance their energy management and sustainability, 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.

“Admittedly, we did not know much about solar energy,” continued 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 Utilization

Each of the 8372 solar panels at the OPEX facility is capable of producing up to 250 watts of electricity. In mid-2010, OPEX selected [H2 Contracting, LLC](#). [2] (H2), of Marlton, New Jersey 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 technologies that could be utilized, assembled costs and a phasing schedule to stagger the introduction of the solar array technology.

Going into the project, OPEX’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.

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Solar power is the conversion of sunlight into electricity. 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 outlet power or for selling to the grid.

“The solar system installed at OPEX is not a typical design,” said 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 better 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,” explained 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 administrative offices. At any time when energy consumption exceeds that which is produced by the solar installation, the company supplements 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 25-year lifespan.

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 all aspects of its operations.

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“We work diligently to reduce energy consumption and integrate sustainable procedures in our products, processes and facilities,” said 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. All scrap materials and oils used in manufacturing, and paper products in the company’s administrative offices, are recycled. OPEX dug its own 175-foot well to irrigate its 8 acres of open land on its campus, which it replanted with native fescue grass, requiring 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,” added 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.”

Jim McMahon writes on renewable energy and sustainability. His feature stories have appeared in hundreds of industrial and technology publications throughout the world and are read by more than 5 million readers monthly. He can be reached at jim.mcmahon@zebracom.net [3].

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