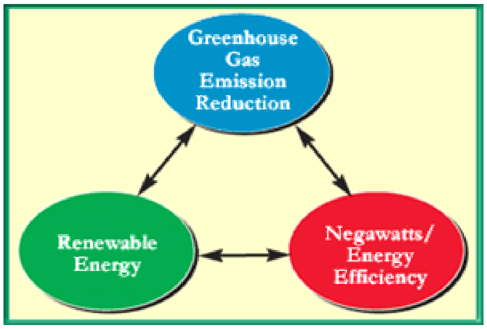
Nuworld Research & Development



Proof of Concept - Solar Energy DG – Distribution Warehouse

This is for a **proof of concept** for a high efficiency renewable energy lighting system at a Distribution Center in Rochester, NY. This LEED™ gold-rated facility is equipped with a lighting system that utilizes DC fluorescent ballasts, roof-integrated solar panels, occupancy sensors, and daylight sensors for the highest possible efficiency. The building, including the innovative lighting design, was designed by William McDonough and Partners of Charlottesville, VA.

Facility: The facility has 6,600 sq ft of office space and 33,000 sq ft of warehouse. The warehouse roof is equipped with skylights and 21kW of solar panels bonded to the roof material (SR2001 amorphous panels by Solar Integrated Technologies). A canopy in the office area is equipped with 2.1kW of Sharp panels.

Figure 1 - Sharp Panels - Canopy

The power from the solar panels is distributed in three ways:

- 2.2 kW is dedicated to the lighting in the office,
- 11.5 kW powers the lights in the warehouse,
- 11.5 kW is not needed by the lighting system so it is inverted to AC and used elsewhere in the building or sold back to the utility.

The entire system consists of 35 NPS-1000 Power Gateways. These devices take all of the available power from the solar panels and send it directly to the lighting without significant losses. Additional power, when needed at night or on cloudy days, is taken from the grid.

In the office, 6 NPS-1000's power 198 T-8, four foot fluorescent lamps, illuminating most areas at 1.1 watts per square foot. Each of the fixtures is equipped with one high efficiency DC ballast for every two lamps. Most of the fixtures are controlled by a combination of manual switches, daylight sensors, and occupancy sensors in 13 zones.

Figure 2 - Office Lighting

Figure 3 - Warehouse Lighting

In the warehouse area 29 NPS-1000's power 158 6-lamp T-8 fixtures. These fixtures have a low (2 lamps on), medium (4 lamps on), and high (all 6 lamps on) setting so that they can be dimmed by 3 daylight sensors and 30 occupancy sensors located throughout the area. The goal of the control architecture is to maintain a lighting level of .74 watts per square foot, using daylight when available, whenever the area is occupied.

The logic of the lighting system is designed for optimum efficiency. Sources of light and power are prioritized such that:

- First, daylight from the skylights is used.
- Second, if day-lighting is not sufficient and the area is occupied then power from the solar panels is added.
- Third, if daylight and solar power is not enough then the additional power required is taken from the grid.

Figure 4 - SensorSwitch Daylight, Occupancy Sensors

A number of factors contribute to the value of this system;

- Using the electricity generated by the solar panels to power the lighting eliminated significant inverter losses and improved efficiency by as much as 20%.
- The low voltage control capability of the DC ballasts enabled the innovative control system to be installed easily, without additional AC wiring.
- Roof-Integrated solar panels reduced installation costs and allow the cost of the roof to be recovered using a 5-year accelerated depreciation formula.

Performance – Occupancy and Daylight Sensors

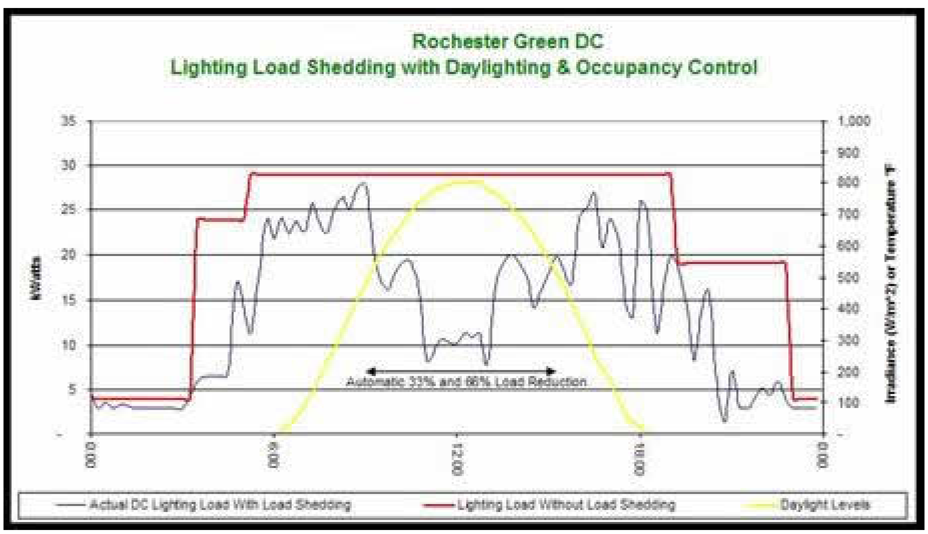


Figure 5 - Occupancy Sensors

- The Red line shows the lighting profile of the building without load shedding. Most of the lighting comes on at 3AM. All lights are turned on from 6AM to 6PM.

- The Blue line shows the lighting load with the occupancy and daylight sensors controlling the lighting.

- Between March and Mid-June 2005 between 20% and 30% savings have been achieved due to the controls.

Performance of the Power Gateway

In the chart below, power from the DC solar system is shown, along with the net utility power consumed by the lighting. Around noon, all of the power for the lighting is being supplied by the solar array. An important key here is that the efficiency of solar to lighting is nearly 100%. Only minimal wiring losses are encountered when no grid power is used.

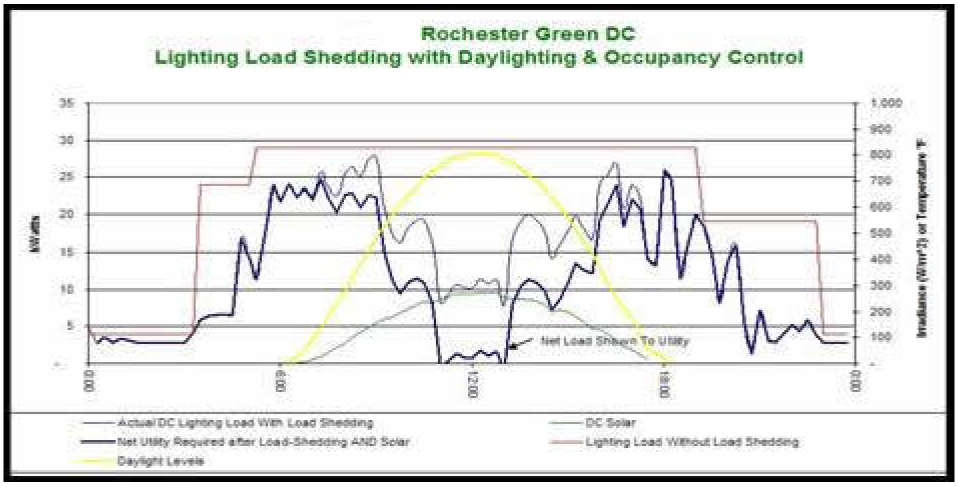


Figure 6 - Power Consumption by DC Lighting System

Monitoring – Web Based

The Web-based Data Collection and Monitoring system provides a web-based display of power generated, power used, weather, and more. Available through the NextekPower.com website in a password protected directory, this system not only displays performance data, but also identifies anomalies in the system such as burned-out lamps, and sensors that are not operating properly. In June, remote analysis identified an opportunity to improve the settings of the occupancy sensors. The new settings will generate additional savings in coming months.

Value

The “Green DC” – or “Green Distribution Center” has been a successful effort on this distribution center's part to bring more sustainable business practices into its facilities. The pay back on their investment at the Rochester location, after rebates and accelerated depreciation is approximately 12.6 years, as shown in the table below. The remaining system output will produce energy for 7.5 years, producing $60,000 in value at today’s rates in Rochester. It is important to note that, in areas where the avoided cost of peak power is higher than $0.10 per kWh, this Return of Investment can drop to under 6 years, meaning that, in those areas, the facility would enjoy free peak power from the solar PV array for at least 14 years after the investment is returned. That equates to an $112,000 benefit at today's rates. Either return-scenario grows in value as electricity prices rise, and the avoided cost increases.

System Cost After Rebate	$72,000
Approximate Power Savings per year	$4000
@ $0.10 per kWh	
Value of System Accelerated Depreciation, per year, for 5 years, at 30% effective CTR	$4320
Simple Payback	12.6 years
Where Avoided Peak Cost is $0.20 per kWh	
Simple Payback	**5.84 years**

For further information, please contact:

Madhu Chawla
Communications Coordinator
www.nuworldresearch.com