A Guide to Solar Powered Lighting
Rising concern about the environment plus the many benefits of green energy have resulted in increased adoption of solar power for outdoor lighting, security systems, emergency power and more. Green energy means lower carbon emissions, no monthly utility bills and the availability of lighting when the power goes out.

Using solar (or wind) power for lighting also means that lights can be installed wherever they are needed, regardless of whether there is electric power in the area. Solar powered lighting is great for municipal streetlights, to light paths and parks without existing power, for parking lots, and for adding decorative lighting in a city center without having to disrupt sidewalks or landscaping.

It also works well for corporate or university campuses, for rural facilities where the cost of bringing power in is prohibitively expensive and for many other areas. But it isn’t limited to just lighting, as solar power is being used to power security systems and other devices. In fact, installing off-grid systems anywhere where it would be expensive or disruptive to install on-grid systems makes perfect sense.

**Solar Lighting Advantages**
- No carbon emissions, better for the environment
- Emergency lighting: The lights stay on if the power goes out
- Lower install costs
- No disruption to existing pavement or landscaping
- No monthly utility costs
It is only recently that it made sense from both a cost and reliability perspective to implement solar powered lighting broadly. Advances in technology and rising sales volumes have resulted in a huge reduction in the cost of solar panels and LED lights. New Smart Off-Grid technology ensures high reliability and optimal lighting performance by delivering the ability to monitor, control, and proactively service lighting systems over the Internet from a PC or smartphone. We’ll examine Smart Off-Grid later in this eBook.

Let’s compare the major cost differences of electric lighting vs solar-powered lighting.

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<tr>
<th>Electric Lighting</th>
<th>Solar Lighting</th>
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<tbody>
<tr>
<td>Trenching</td>
<td>Solar panel</td>
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<td>Cabling</td>
<td>Battery</td>
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<td>Grid connection</td>
<td>Controller</td>
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<td>Concrete foundation</td>
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<td>Monthly utility charges</td>
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The process and cost of installing lighting in a new location varies greatly between electric (on-grid) lighting versus solar (off-grid) lighting. Off-grid systems are usually cheaper for a number of reasons. Most importantly, the cost of installing new electric cabling can be huge. This includes the cost of trenching and cabling, and connecting to distribution.

As the chart below shows, doing so overground costs over $4000 from pole to pole, assuming the poles are 100’ apart. Underground cabling is a lot more expensive – close to $10,000 per 100’. This doesn’t consider disruption and the cost to repair existing landscaping or concrete.
Solar lighting eliminates monthly utility bills, with its ever rising costs.

Beyond the pole, light arm and light that both systems have, solar lights require one of more solar panels, batteries and a charge controller. The controller manages the rate at which current flows into and out of the battery, and should also prevent overcharging, short circuits, and optimize battery life.

With an off-grid light, the only consumable costs are batteries, which typically have a useful life of five to seven years but are likely to be replaced by even better technology in the future.

Generally, the total component cost of a solar light will be higher than an electric light, but the overall cost, when including installation, maintenance and monthly electric costs, is usually significantly lower.
The 5 Keys to Success

Solar lighting has been used throughout the world for many years, but not always successfully.

The major causes of solar lighting project failures can be categorize as follows:

1. Not engineered properly
2. Installation and commissioning issues
3. No remote monitoring or management.

Let’s examine each of these briefly:

1. Engineering
Proper planning and analysis is critical to ensure that the amount of light provided is sufficient year round. The analysis must be based on the specific installation location, changing lighting requirements throughout the year, the local weather conditions and other environmental factors. This includes such things as the amount of sun throughout each month of the year, shading in the local area (which can change if trees are present) and other seasonal variations. It is crucial that these factors dictate the actual configuration of the lighting system - e.g. the number of solar panels needed and their placement, the number of batteries and their capacity, the lighting profiles that can be implemented and whether other loads such as a security camera are needed to be powered.

To ensure success, the lights must be engineered as a system, where all components have been properly sized and tested to meet the specific needs of each project.

2. Installation and Commissioning
Once the light has been properly engineered it needs to be properly installed and commissioned. Simplicity in design is key to proper installation, so the
lights can be installed by untrained personnel. When evaluating lighting alternatives, look for products that have been designed with ease of installation in mind, systems that do not require training, special skills or special tools. An example is color-coded connectors in wiring harnesses, to ensure wires are connected properly. Incorrect wiring that is ungrounded is a leading cause of faulty installations, causing added expense and delayed availability and worse.

The other key is that proper installation must be confirmed onsite, before the installer leaves. This requires full validation capabilities that are easily performed by the installer.

3. Remote monitoring and management
Let’s assume the light has been properly configured and installed. On an ongoing basis, how can you be sure everything is working properly and at maximum efficiency? How do you ensure long battery life? How can you be sure lighting is still delivered in periods without a lot of sunshine? If there is a problem, how do you know what the cause is, or what part may need to be replaced?

Most solar lighting systems on the market have minimal or no automatic monitoring or management capabilities. Light owners depend on someone to notice when the light doesn’t come on and notify them. Then the problem is troubleshooting the issue. Some vendors provide primitive ways of checking for problems but only when a maintenance person is sent to the pole, often requiring an expensive trip with a bucket truck. Without data history for each component, it is almost impossible to be sure what the cause of a problem is.

The 5 Keys to Success:
1. Proper upfront design - as a system
2. Proper environmental assessment
3. Validated install and commissioning
4. Smart Off-Grid monitoring and control
5. Smart Off-Grid load and battery management
The Era of Smart Off-Grid

Smart Grid has become a powerful force in the world of energy generation. Now Smart Off-Grid is changing the world of green energy systems.

The U.S. Department of Energy has this to say about Smart Grid: “Smart grid” generally refers to a class of technology people are using to bring utility electricity delivery systems into the 21st century, using computer-based remote control and automation. These systems are made possible by two-way communication technology and computer processing that has been used for decades in other industries.”

Recent technological advances are now bringing the same concept to the world of off-grid systems. “Smart Off-Grid” uses wireless networking, data collection and streaming and cloud software to enable remote control and monitoring of solar powered systems over the Internet from a PC or smartphone. Smart Off-Grid is the key to delivering the reliability and performance that critical applications like lighting, security and emergency power require.

Combining Smart Off-Grid technology with solar lighting systems enables 24 x 7 system health monitoring and proactive maintenance while reducing maintenance costs and providing added capabilities such as dimming, motion sensing, and the ability to add and control devices such as security cameras.
During daylight hours, energy from the sun hits the solar panel and is stored in batteries located within the base of the pole. Lights may also have a wind turbine on the top, to capture wind energy and add it to the battery as well.

Within a compartment in the pole is the controller. The controller manages the charging process to most efficiently manage the panel’s voltage production to the battery pack. 1 or more batteries may be used depending on specific requirements at a location, and these store the energy the lights (or other loads like a security camera) require.
High lumen LEDs are used for lighting as they are very efficient and long lived. During night-time hours the controller draws electricity stored in the batteries to power the lights, using lighting profiles and preferences of light levels and protection modes.

Typically a security camera would need to be on constantly, so power would go to that device around the clock.

Communications and control technology is what makes the difference between a standard off-grid system and a Smart Off-Grid system. Smart Off-Grid lights come with wireless communications built in, and lots of information about the system is continually transmitted to the cloud software application. This can be done in one of several ways, such as cellular service from each pole or in a mesh network where multiple poles send data to a gateway device which then transmits the data using cellular service or over Ethernet (when available).

Smart Off-Grid is what provides around-the-clock monitoring, management and proactive maintenance capabilities to deliver unprecedented levels of reliability and performance while slashing installation and maintenance costs.
Illument, a division of Clear Blue Technologies, is the industry leader in Smart Off-Grid lighting.

As the first company to apply Smart Grid concepts to off-grid lighting systems, Clear Blue/Illument has developed the most advanced solar and wind powered lighting systems on the market. Our technology delivers the unique combination of the power of clean energy with the proven advantages of communications and cloud software to achieve unprecedented levels of reliability and performance while slashing installation and maintenance costs.

Illumience Smart Off-Grid software provides the real-time, 24x7, remote control, monitoring and management of all wind and solar powered lighting systems from Illument. Illumience turns an off-grid light into a proactively maintained system, giving owners peace of mind that all aspects of the system and the load are being monitored at all times. Illumience also lets owners control and manage their systems anytime, anywhere using an Internet-connected PC or smartphone.

How does an Illument Smart Off-Grid system compare to a standard solar streetlight?

<table>
<thead>
<tr>
<th>Issue</th>
<th>Without Smart Off-Grid</th>
<th>With Smart Off-Grid</th>
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<tbody>
<tr>
<td>Light working properly?</td>
<td>Wait for someone to notice and call.</td>
<td>Automatic alerts and alarms, SMS and email. 24x7 monitoring.</td>
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<tr>
<td>Power systems management, battery life</td>
<td>Minimal if any.</td>
<td>Proactive maintenance and optimization. Remote battery lifecycle optimization ensures long life. Detect and perform equalize charge remotely</td>
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<tr>
<td>Lighting profiles</td>
<td>Limited and fixed. No time of day option. Make changes at the pole only.</td>
<td>Set up and change over the Internet. Unlimited profiles including time of day. Weather forecasting, load management to optimize lighting profiles. Dimming, motion detection.</td>
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<tr>
<td>Troubleshooting</td>
<td>Multiple trips to the device, costly truck and personnel. No data available to find root cause, results in expensive components swapping.</td>
<td>Real time data on all components plus data history. Troubleshoot remotely from the office. Bring the right part if needed.</td>
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The Brightest Light in the Industry

Illumient advanced off-grid lighting solutions deliver the lowest cost of ownership and highest performance in the market. Higher wattage lights can be supported due to Smart Off-Grid sophisticated lighting management and flexible lighting profiles. With a wide choice of options, Illumient lights can also be customized to fit many different environments.

<table>
<thead>
<tr>
<th>The Choice is Yours!</th>
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<tbody>
<tr>
<td>• Spun concrete or metal poles, choice of colors and designs, decorative or commercial grade</td>
</tr>
<tr>
<td>• Pathway, parking lot or street light heights</td>
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<tr>
<td>• Many luminaires choices including King Luminaire, Leotek, LED Roadway, GE or others</td>
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<tr>
<td>• Engineered for high reliability, easy installation and quality fit and finish</td>
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<tr>
<td>• Single, dual solar or solar/wind hybrid</td>
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<tr>
<td>• Motion detection option</td>
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<tr>
<td>• Security camera</td>
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<tr>
<td>• Advertising option</td>
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<tr>
<td>• All with built-in Smart Off-Grid and integrated communications</td>
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Designed by UGE
FIND OUT MORE

Our vision is to bring the world of environmentally-friendly outdoor lighting into the technology age and deliver off-grid lighting solutions that are highly reliable, and easy to install, operate and maintain.

Contact us today.

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