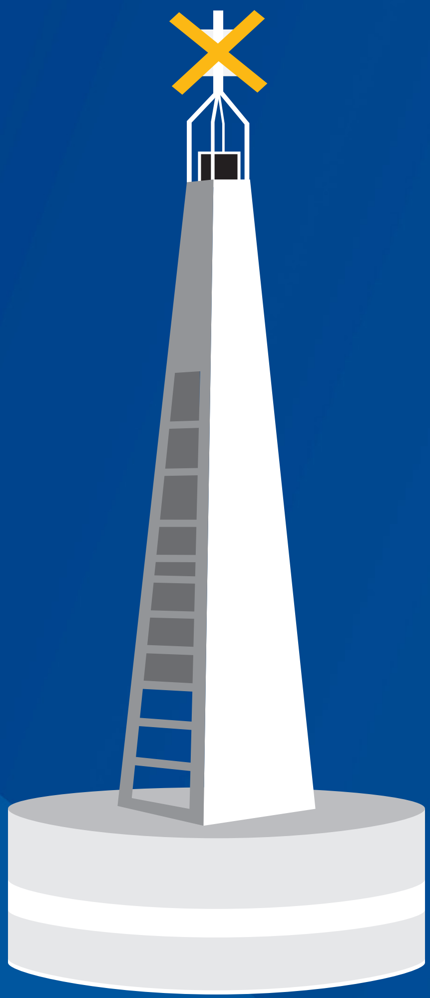
SABIK MARINE
QUICK GUIDE



Self-Contained lanterns
QUICK GUIDE
to equipment selection for fairway managers and port authorities

www.sabik-marine.com

SELF-CONTAINED LANTERNS QUICK GUIDE
to equipment selection for fairway managers and port authorities

About this guide

Self-Contained (SC) solar lanterns, often referred to as Carmanah lanterns, are a plug-and-play alternative to conventional standalone marine lanterns that need no external power source. Powered by solar energy from an integrated solar panel, they charge during the day and act as navigational aids during the night. SC lanterns require no external intervention and, like other battery-powered marine lanterns, are mounted on buoys, beacons, and other structures to mark fairways, port entrances, and obstructions.

The unit size will depend on the application and location, and can range from highly compact to relatively large. Although not appropriate for all applications, where applicable they represent a cost-effective, low-maintenance, and durable alternative to lanterns powered by a primary battery and standalone lanterns with a separate solar power system. In this guide we'll look at the various essential and optional components of an SC lantern, how they are affected by the functionality needed, and how they affect power needs. Finally, we'll introduce our helpful calculation tool that will help you match your specifications to the right solution.

Quick facts

- *SC lanterns typically have a range of less than 10 nautical miles*
- *They draw power from the sun during the day and use the stored energy to operate as aids to navigation at night*
- *The amount and size of solar panels and batteries required depends on the lantern's functionality and location*
- *SC lanterns are a cost-effective solution that require minimal external intervention for a range of fairway and port-marking applications*
- *Because they form a complete integrated package, SC lanterns are also easy to deploy*

COMPONENTS OF SC LANTERNS

In this section we'll take a closer look at the various components of an SC lantern and the important things to consider when thinking about which options are right for your application.

Solar panel

SC lanterns get their energy from solar panels that turn radiation from the sun into electric current. The number of panels needed, their placement, and their size, depend on many factors, most notably the power needs of the lantern and associated components as well as its geographic location.

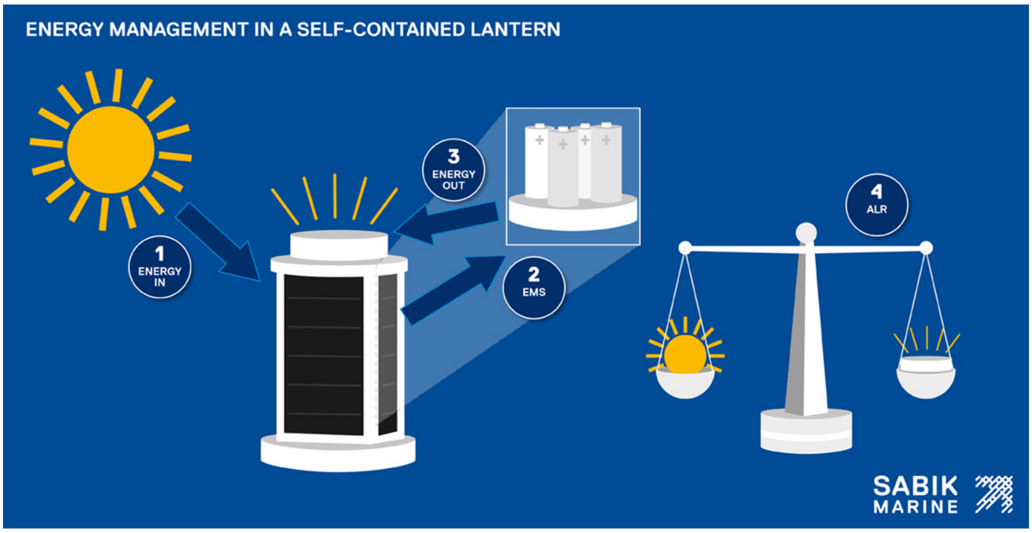
There are two different solar panel technologies on the market: monocrystalline and polycrystalline. Monocrystalline panels contain solar cells made from a single crystal of silicon, while polycrystalline solar panels contain solar cells made from many silicon fragments melted together. Both have similar durability, but the primary difference is that polycrystalline panels are cheaper, while monocrystalline are more efficient. This means that more polycrystalline panels are needed to produce the same amount of energy as with

SC 160 AIS in Turkey

SC 160 AIS

monocrystalline panels. Because there is limited space on a buoy, monocrystalline panels are therefore usually the better option.

Depending on the latitude of the lantern's location, the panels should be aligned north or south, toward the direction of the sun. However, if mounted on buoys, which are constantly on the move due to currents, multiple panels are needed to ensure sufficient exposure to sunlight regardless of the orientation. If the lantern is installed near the equator the panels can be positioned horizontally on top of the buoy, while at higher or lower latitudes they need to be placed at an angle on the sides of the unit. When installing solar panels even partial shade to the panels should be avoided, as it excludes array of cells from the circuit. Marine Selector Tool helps to estimate the amount and size of solar panels required based on NASA's solar radiation database from locations around the globe.



In a self-contained marine lantern an enclosure houses the solar panels, batteries and LEDs.
This compact design simplifies installation—just mount and configure the light to turn on at night. But how does it work?

1. ENERGY IN
Even when it's cloudy, the sun's energy generates power. When sunlight hits the solar panel, it excites the electrons, creating a DC current flowing into the battery. The battery stores energy with enough backup for even the darkest months.

2. ENERGY MANAGEMENT SYSTEM (EMS)
The EMS regulates the flow of energy from panels to batteries and from batteries to LEDs. Thanks to our unique EMS design, our solar lights have a small footprint while meeting light intensity requirements.

3. ENERGY OUT
Batteries power the LED light and the EMS, ensuring the light shines and/or flashes at the required intensity from dusk to dawn.

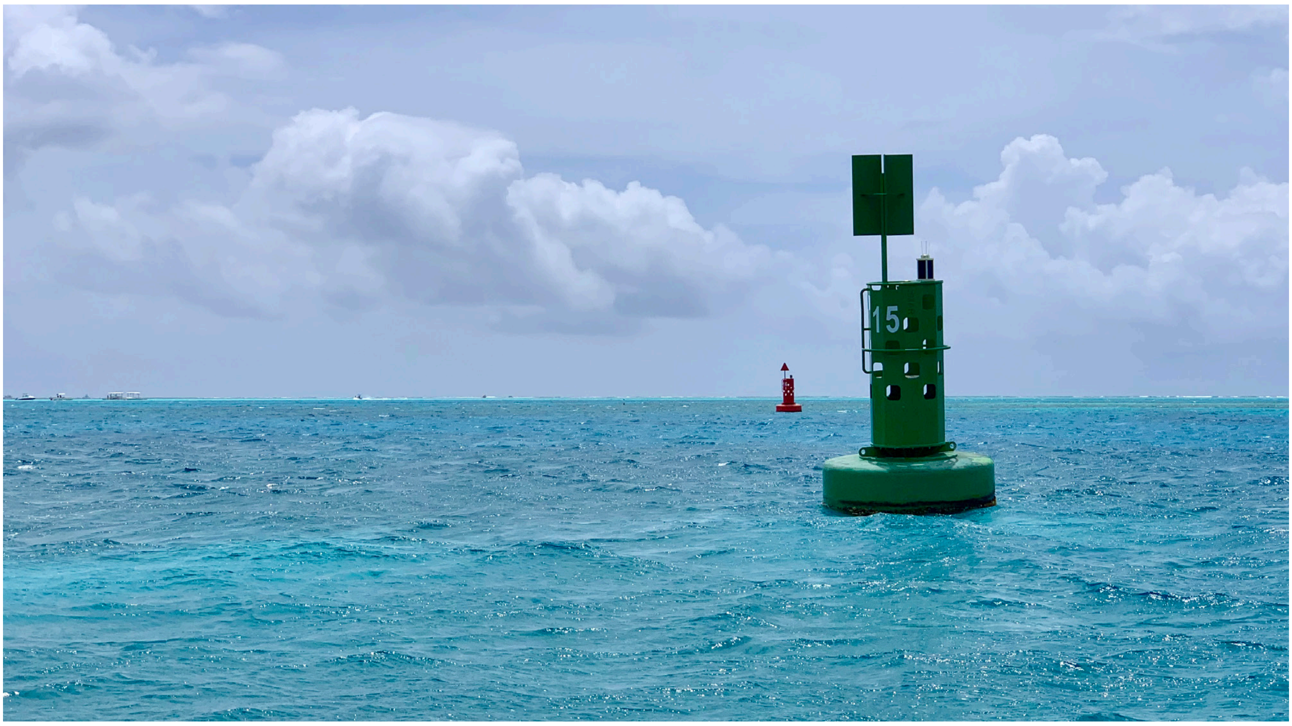
4. ARRAY TO LOAD RATIO (ALR)
A properly sized solar light has a higher ENERGY IN than ENERGY OUT. This means the system converts more of the sun's energy into electricity than it requires to power the light. A proper ALR ensures the system works consistently and doesn't consume more energy than it can create.

Solar charger

Before reaching the battery, the energy produced by the solar panels passes through the solar charger, which regulates charging mode to match battery technology. As with solar panels, there are two alternative technologies to choose from: MPPT (maximum power point tracking) and PWM (pulse width modulation). In general terms, a PWM charger cuts the wattage after the safe limit is reached and releases the excess energy as heat, meaning that the full energy-gathering potential of the panel may not be used. PWM charger has a kind of valve operation, and simultaneously MPPT is a kind of DC-DC converter that need to dissipate heat produced during charger, than for PWM. An MPPT charger is more efficient because it monitors the maximum power point of the panel, which varies during the day with the sun strength and angle, and uses an algorithm to optimize the power point where the voltage and amps correlate. Again, with the limited space available on a buoy, it makes sense to go for the most efficient option.

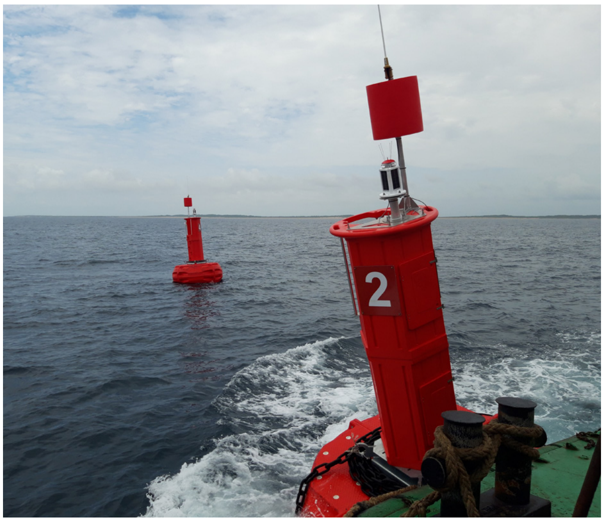
Battery

In terms of batteries, there are different technologies to choose from: lead acid, lithium ion, nickel-metal hydride battery and nickel cadmium, with the latter being less common in marine signaling applications. Due to its lower cost, lead acid is the most common type of battery used in SC lanterns, though it is heavier than the other two alternatives and has lower density (lower energy). Lead acid batteries typically last around six to eight years (less in hotter locations) so will need to be replaced two or three times during the lifetime of a typical SC lantern. Nickel-metal hydride batteries can have 2 to 3 times the capacity of nickel cadmium batteries of the same size, but also much less than lithium ion batteries. Lithium ion batteries are more expensive but have several advantages over their lead acid counterparts: they are lighter, typically last for the full lifetime of a lantern, and have a higher energy density. Due to the remote location of many SC lanterns, the benefits of time and money saved through maximized lifetime and minimized maintenance means lithium ion batteries often make the most sense.



Self-contained M860 lanterns in the sunny Caribbean.

M860



Installing self-contained VLB-5X lanterns in Kenya

VLB-5X

Payload

In addition to the components needed to power an SC lantern, there is additional payload to take into consideration. This includes the light source itself and the controller, as well as possible monitoring, synchronization, and communication components. The LEDs consume most of the power, but the needs of the rest of the payload also need to be considered when calculating the total power budget. The solar panel should supply the batteries with all the power they require for the night. The array-to-load ratio should be at least 1.1, with 1.2 being preferable, to produce more power than to consume to keep the battery charged.

The intensity, vertical divergence and flash duty cycle will all affect how much power is required. It is unusual to have always-on SC lanterns, but if the light is dim and low range, it is possible to deploy them for applications where this may be required.

Most SC lanterns also incorporate a light controller to monitor the amount of ambient light and determine whether the lantern should be on or off at any given time. Depending on its level of sophistication, the controller will also require some baseline current.

Remote monitoring via GSM or satellite also consumes power, with the exact amount depending on the communication frequency and whether it is one or two way. Two-way communication requires a receiver in addition to the transmitter. For typical applications one-way communication is almost always sufficient as it provides all the necessary reports on the lantern status; it also has the added advantages of requiring less power and being immune to malicious cyber-attacks. Two-way communication is only needed if the light has an on-demand function, meaning it can be remotely activated out of normal hours, in bad weather, or at the request of a certain vessel, for example.

GPS synchronization is another optional payload component. It enables a series of lanterns to flash in sync to more clearly delineate a fairway and, though it adds to the power budget, is quite a common feature as it makes the lanterns more conspicuous.

CHOOSING THE CORRECT SC LANTERN FOR YOUR NEEDS

M660 in Ireland

M660

Choosing the right SC lantern for your specific application can only be done after considering a wide range of variables. To begin with, think about the functionality you need from your lanterns. Do they need to have remote monitoring and GPS synchronization, for example?

Bear in mind both geographical and physical location of the lantern. At what latitude will it be deployed, how much sunshine will there be and how many days of autonomy (ability to function without sunshine) does it need? For example, at high latitudes such as in the Nordics, a lantern needs to be able to function for 30 days without sunshine to be considered autonomous, whereas nearer the equator, two weeks is considered sufficient. You will need to choose a battery with a capacity that can deliver the autonomy you need. The array-to-load ratio should be at least 1.1, with 1.2 being preferable, so more power can be produced than is consumed to keep the battery charged.

You will need to consider what the lantern will be mounted on and its buoyancy and stability, as this will affect how much weight can be added.

Putting it all together with an easy-to-use online calculator tool

With so many variables to balance, it's not hard to see why choosing the right SC lantern could become a bit of a headache. Sabik's online Marine Selector Tool is designed to make equipment selection as simple and quick as possible. Just enter your requirements (flash character, intensity, and color for example), location, and other variables, like desired autonomy time, and the tool will work out the required power as well as size of solar panels and battery capacity. The tool will also point you in the direction of the Sabik lantern that best fits the bill.

Try out the calculator for yourself at

www.sabik-marine.com/online-tools

or for more information, help, and advice please get in touch with your local Sabik representative.

CONTACT US

Sales@sabik-marine.com

www.sabik-marine.com