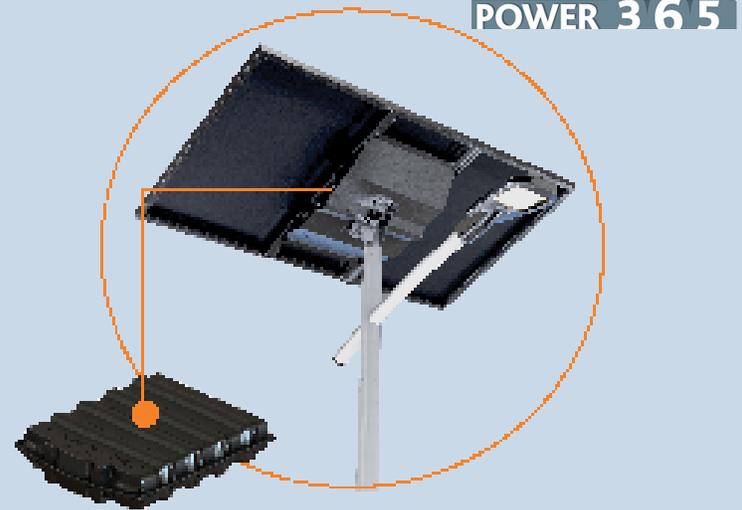


# BATTERY CAPACITY

WWW/FONROCHESOLARLIGHTING.COM/SMARTLIGHT



## How can we use smaller power centers and deliver superior battery life and reliability?



### A NEW APPROACH

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#### Conventional Approach:

- Lots of VRLA battery capacity
- Low DoD (AKA 5 or more days of storage)
- Adequate PV power to slowly build state of charge after cloudy periods

#### SmartLight Approach:

- Advanced, non-toxic, battery that does not require a low DoD
- PV power to quickly replenish the battery
- High efficiency luminaires to reduce load for optimized sizing and photometry

### WHAT MAKES US SO CONFIDENT?

As of today, over 175,000 Smartlights have been deployed worldwide.

Each project goes through a design process using PV Sys data. During this process we evaluate hourly solar irradiation values for worst case periods to make sure you have enough energy keep your battery charged through the winter. We design for worst case performance against actual averages (not a theoretical “no sun” condition).

Further, over 20,000 systems are being monitored daily with Fonroche Connect, our LoRa wireless networking system. With this network, we provide data and alerts to our customers.

With this tracking, we have also developed a huge database that verifies our design assumptions about energy management and performance. This also allows us to confidently promise all night lighting 365 nights a year and ten-year battery life.

It also provides feedback that will help our systems deliver even more efficiency and reliability.

# THE IMPACT OF DEPTH OF DISCHARGE AND TEMPERATURE ON BATTERY LIFE

A battery's life is measured in charge-discharge cycles for a given "Depth of Discharge" (DoD). In the case of solar streetlights, each cycle generally corresponds to a day of charging from the sun and a night of running the light from the battery.

Several factors will determine the actual life of a battery in the field. Depth of Discharge and temperature are the two biggest.

## Depth of Discharge

For some batteries, a deep depth of discharge means a short battery life. Although it's a little more complicated, think of depth of discharge as the percentage of battery capacity needed for your lighting each night. As the percentage used each night increases, the number of available nights of lighting decreases. For example, if you discharge the battery by 50% each night, you have two available nights of lighting in the battery (2 days of storage) and if you discharge the battery by 20% you will have five available nights in the battery (5 days of storage).

While DoD has some effect on all batteries, the effect is much greater for lead acid batteries than for NiMH and Lithium batteries.

The actual life cycles will vary by brand, format, temperature and rate of discharge from the load.

Generically, a lead acid battery using all or most of this capacity each night will only deliver a few hundred nights of lighting before needing replacement. Compare this to Lithium Iron Phosphate and Nickel Metal Hydride chemistries that are capable deeply cycling and still delivering 10 or more years of life.

## Temperature

As with discharge depth, lead acid batteries are more susceptible to high temperatures than their Nickel and Lithium counterparts. Consider this, when a lead acid battery operates at 10°C over 25°C (77°F), its estimated cycle life is cut in half. There is a much smaller impact on Lithium Ferrous Phosphate and NiMH batteries. Both field testing and specifications show that temperatures have only a small impact on our battery life expectations. Freezing temperatures are not friendly to Lithium Iron Phosphate batteries.

	VRLA GEL/AGM	NICKEL METAL HYDRIDE NiMH	LITHIUM IRON PHOSPHATE LiFePO4 OR LFP
EXPECTED LIFE 80% DOD   25°C / 77°F	Less than 1 Year	10 Years+	10 Years+
EXPECTED LIFE 20% DOD   25°C / 77°F	10 Years or Less	10 Years +	10 Years+
EXPECTED LIFE 20% DOD   35°C / 95°F	5 Years or Less	10 Years+	10 Years+
EXPECTED LIFE 20% DOD   45°C/113°F	2.5 Years or Less	10 Years+	10 Years+
EXPECTED LIFE 50% DOD   50°C/122°F	0.5 Year	9-10 Years	4 Years

## Autonomy

With our new approach, a smaller battery capacity and longer battery life doesn't mean sacrificing day to day reliability. Between our design practices and our unique controls, you'll enjoy 365 days of lighting in all types of climates and conditions.

Our systems are sized to make sure that your SmartLight will quickly replenish its battery, even in less than perfect weather. If conditions fall outside of historical norms, the controller's anti-blackout algorithm steps in to make the necessary adjustments.

The result is trouble-free lighting everyday, all year long.