

Solar Panel Power Requirements For United Kingdom

This document outlines the calculations for the power requirements of solar panels needed to support Airly Air Quality sensors operating in the United Kingdom. The primary assumption is that the system must operate throughout the entire year. Therefore, it must be optimized for the winter season, characterized by low solar power yield and lower temperatures, which cause batteries to decrease in capacity.

Calculations of the solar powered system:

- Solar panel power: 100W
- Battery capacity: 9 Ah @ 12V -> 108 Wh
- Average Airly sensor power consumption: 1.2W

- Shortest day in London: 7 hours 49 minutes (assuming effective hours as 5 hours)
- Optimal solar panel tilt angle: 14°
- Lowest solar panel efficiency in winter: 30%
- Battery capacity drop at -20°C: 40% decrease of capacity

- Daily energy consumption of the Airly sensor: $1.2W \times 24h = 28.8 Wh$
- Daily solar panel energy generation: $100 W \times 30 \% \times 5h = 225 Wh$
- Battery capacity after drop: 64.8 Wh

Summary:

In the United Kingdom solar panels with power yield at 100W are able to generate sufficient amounts of energy to support energy consumption of the Airly sensor. Battery capacity allows it to operate for more than two days without any sun charging the batteries. In the calculation presented above the situation is the worst case scenario and happens rarely in the field.