KIGHT

OFF GRID SOLUTIONS

KIGHT LTD.


KV1
KIGHT LTD.

Off-Grid Solar Street Lighting - Product Specifications (KV1)

Standalone DC, off grid, LED Street Lighting Luminaire coupled with solar PV, solar charge controller, battery storage and smart lighting control & monitoring.

Our range of standalone, off-grid solutions have many unique selling propositions, such as our patented solar holder. Our unique design means that our solar panels sit vertically down the column shaft and can be stacked to provide additional renewable energy generation and increase the output power of the lantern, to meet various operational requirements. The positioning of the solar holder also ensures it captures the maximum available solar radiation, especially during winter days, when the sun is low in the sky.

Our innovative design means that our solar panels require no maintenance, as they are self-cleaning, do not collect dust or snow like traditionally mounted solar panels, ensuring sufficient solar generation, without large solar panels sticking out of the column, whilst at the same time guaranteeing the lantern is operational throughout the year.

In operational deployment our solutions measured lumen output and lighting spread outperforms traditional grid connected, comparable street lanterns, from both an output and spread perspective. In addition, our lantern and solar holder are both rotary moulded from recycled plastic, which can also be fully recycled at the end of its very long life, making our solutions truly green.

The nature of the construction of our lanterns and solar holder means that they are extremely robust, exceeding the IK10 specifications, making our solution vandal proof and perfect for city wide, off-grid and coastal deployment. In addition, being rotary moulded, means our lanterns and solar holders do not require powder coating, ensuring our solutions maintain their appearance without degrading throughout their very long lifetime.

1. **Solar PV cells 36** - 2.6W / 125x125mm / Relative efficiency at low light 97.3% / Si Polycrystalline. Producing 93.6w / 0.4% annual degradation

2. **Solar Charge Controller -** MPPT / 99% efficiency

3. **Battery Storage** - 192Ah of useable energy / 95% Round Trip Efficiency / li-ion / 1% annual degradation.

4. **Luminaire -** Vision 12v ID producing 183 lumens per watt. (Total Lumen 2200)

Die Cast aluminium
Ingress Protection: IP 67
Impact rating: IK10
Weight: 1.5kg
Wind factor: 0.026

<u>LED data:</u>
LED model: LUMILEDS LuxeOn REBEL 5050
CRI: 80+
CRI shift over life: 3%

<u>Lifespan characteristics*:</u>
LM80/TM21 data:

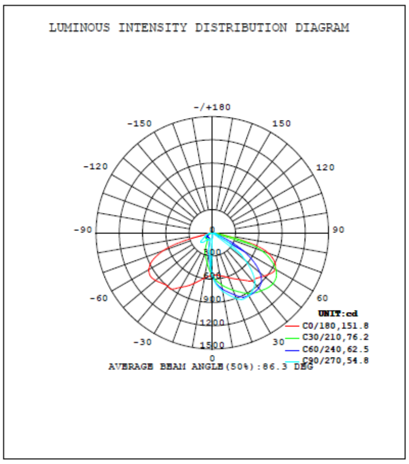
<u>Accreditation:</u>
CE certification

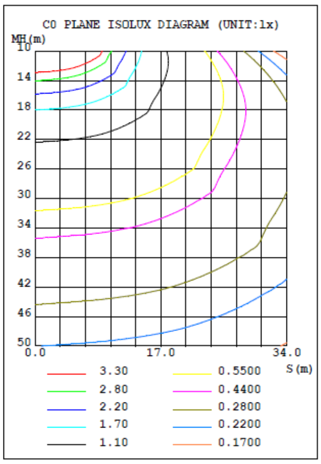
L90: 102,000 HRS
L80: 114,000 HRS
L70: 120,000 HRS
Failure rate:
B10: 110,000 HRS

ROHS certification
LIAQA
ENEC

LUMINAIRE PHOTOMETRIC TEST REPORT

DATA OF LAMP		PHOTOMETRIC DATA Eff: 183.35 lm/W			
MODEL	SOLAR 12W	Imax(cd)	1075	S/MH(C0/180)	2.26
NOMINAL POWER(W)		LOR(%)	100.0	S/MH(C90/270)	0.29
RATED VOLTAGE(V)	230	TOTAL FLUX(lm)	2232.0	η UP,DN(C0-180)	0.0,77.6
NOMINAL FLUX(lm)	2232	CIE CLASS	DIRECT	η UP,DN(C180-360)	0.0,22.4
LAMPS INSIDE	1	η up(%)	0.0	CIBSE SHR NOM	1.00
TEST VOLTAGE(V)		η down(%)	100.0	CIBSE SHR MAX	1.05





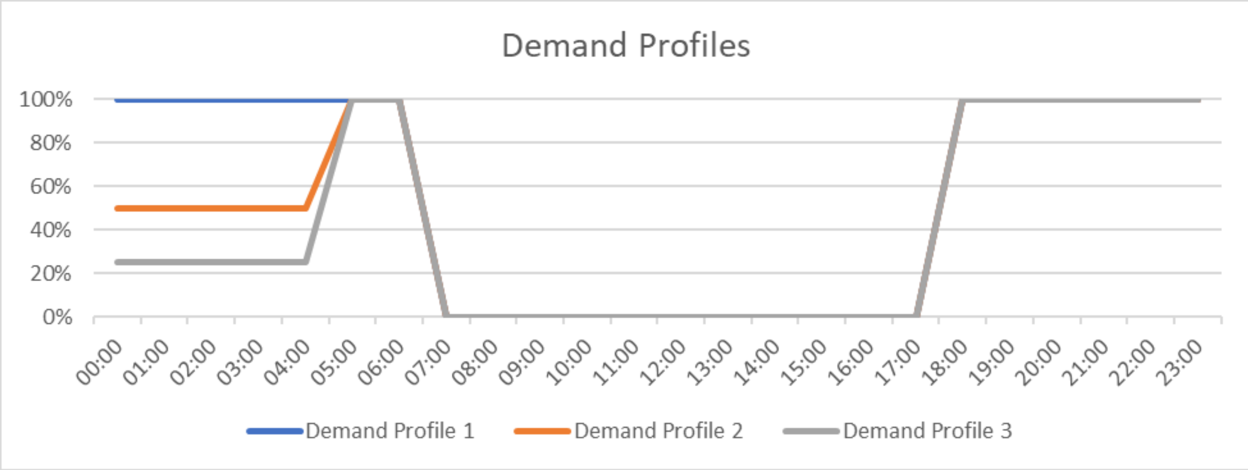
Example Deployment: Birmingham

Methodology

We have used three demand profiles for the lights. These are taken from the daily nautical twilight times for Birmingham.

1. profile 1 assumes the lights need to be on 100% of the time during nautical twilight *(up to 13 hours during winter)*
2. profile 2 assumes the lights are on 50% of the time during midnight to 5am and 100% for the rest of nautical twilight.
3. profile 3 assumes the lights are on 25% of the time during midnight to 5am and 100% for the rest of nautical twilight.

Figure 1 – Demand profiles



Results

- The generation potential using two different orientations, north and south facing.
- The energy demand from the two different demand profiles compared with the generation profile.

South Facing

Table 1 – Solar PV irradiation per module with south facing configuration

Period	Module output	243°	117°	0°	Total Whs
Jan	2.65	1,188	876	182	2,246
Feb	2.65	1,124	786	332	2,241
Mar	2.65	2,295	1,765	735	4,794
Apr	2.65	2,828	2,613	1,169	6,609
May	2.65	2,519	2,819	1,460	6,799
Jun	2.65	2,810	2,828	1,749	7,386
Jul	2.65	2,795	2,637	1,628	7,060
Aug	2.65	2,391	2,083	1,125	5,598
Sep	2.65	2,489	1,913	857	5,259
Oct	2.65	1,418	1,387	521	3,326
Nov	2.65	1,126	903	278	2,306
Dec	2.65	1,000	788	166	1,954
Total	**2.65**	**23,983**	**21,397**	**10,200**	**55,580**

North Facing

Table 2 – Solar PV irradiation per module with north facing configuration

Period	Module output	58°	292°	180°	Total Whs
Jan	2.65	191	302	1,935	2,428
Feb	2.65	383	529	1,445	2,356
Mar	2.65	978	1,348	2,616	4,942
Apr	2.65	1,711	2,106	2,903	6,719
May	2.65	2,200	2,228	2,432	6,860
Jun	2.65	2,351	2,643	2,447	7,441
Jul	2.65	2,145	2,607	2,353	7,105
Aug	2.65	1,500	1,960	2,207	5,667

Sep	2.65	1,164	1,645	2,551	5,359
Oct	2.65	660	784	2,006	3,450
Nov	2.65	299	395	1,763	2,456
Dec	2.65	167	230	1,728	2,125
Total	**2.65**	**13,747**	**16,777**	**26,385**	**56,909**

From the results we can conclude that the north facing configuration generates the most energy (although only an additional 2%).

In the south facing orientation, the split of energy is 43% / 38% / 18% and for the north facing orientation the split of energy is 24% / 29% / 46%.

Demand Profile 1

Table 3 - Solar PV demand profile 1 (100% lighting during twilight hours)

Month	Generation (Wh)	Available Energy	Demand	Gen < Demand	Days - Gen < Demand	Average SOC	Days - Storage < Demand
Jan	2,428.03	2,283.56	4,776.00	- 2,492.44	29	2%	28
Feb	2,356.23	2,216.03	3,924.00	- 1,707.97	24	5%	21
Mar	4,942.30	4,648.23	3,588.00	1,060.23	8	85%	2
Apr	6,719.45	6,319.65	2,688.00	3,631.65	0	100%	0
May	6,859.90	6,451.74	1,788.00	4,663.74	2	99%	0
Jun	7,441.19	6,998.43	1,080.00	5,918.43	0	100%	0
Jul	7,104.92	6,682.18	1,464.00	5,218.18	0	100%	0
Aug	5,666.89	5,329.71	2,364.00	2,965.71	3	99%	0
Sep	5,359.24	5,040.36	3,156.00	1,884.36	8	93%	0
Oct	3,450.03	3,244.75	4,080.00	- 835.25	21	40%	11
Nov	2,456.41	2,310.25	4,560.00	- 2,249.75	27	3%	24
Dec	2,124.73	1,998.30	4,836.00	- 2,837.70	31	0%	31
					153		117

Demand Profile 2

Table 4 - Solar PV demand profile 2 (100% lighting except between 12-5am where is it 50%)

Month	Generation (Wh)	Available Energy	Demand	Gen < Demand	Days - Gen < Demand	Average SOC	Days - Storage < Demand
Jan	2,428.03	2,283.56	3,846.00	- 1,562.44	25	7%	20
Feb	2,356.23	2,216.03	3,084.00	- 867.97	21	15%	16
Mar	4,942.30	4,648.23	2,658.00	1,990.23	5	95%	0
Apr	6,719.45	6,319.65	1,788.00	4,531.65	0	100%	0
May	6,859.90	6,451.74	1,044.00	5,407.74	1	100%	0
Jun	7,441.19	6,998.43	540.00	6,458.43	0	100%	0
Jul	7,104.92	6,682.18	792.00	5,890.18	0	100%	0
Aug	5,666.89	5,329.71	1,470.00	3,859.71	2	100%	0
Sep	5,359.24	5,040.36	2,256.00	2,784.36	4	98%	0
Oct	3,450.03	3,244.75	3,150.00	94.75	15	60%	4
Nov	2,456.41	2,310.25	3,660.00	- 1,349.75	23	10%	17
Dec	2,124.73	1,998.30	3,906.00	- 1,907.70	29	2%	24
					125		81

Demand Profile 3

Table 5 – Solar PV demand profile 3 (100% lighting except between 12-5am where is it 25%)

Month	Generation (Wh)	Available Energy	Demand	Gen < Demand	Days - Gen < Demand	Average SOC	Days - Storage < Demand
Jan	2,428.03	2,283.56	3,381.00	- 1,097.44	24	16%	15
Feb	2,356.23	2,216.03	2,664.00	- 447.97	19	30%	14
Mar	4,942.30	4,648.23	2,193.00	2,455.23	3	99%	0
Apr	6,719.45	6,319.65	1,338.00	4,981.65	0	100%	0
May	6,859.90	6,451.74	672.00	5,779.74	0	100%	0
Jun	7,441.19	6,998.43	270.00	6,728.43	0	100%	0
Jul	7,104.92	6,682.18	456.00	6,226.18	0	100%	0
Aug	5,666.89	5,329.71	1,023.00	4,306.71	1	100%	0
Sep	5,359.24	5,040.36	1,806.00	3,234.36	4	99%	0
Oct	3,450.03	3,244.75	2,685.00	559.75	15	79%	0
Nov	2,456.41	2,310.25	3,210.00	- 899.75	22	21%	15
Dec	2,124.73	1,998.30	3,441.00	- 1,442.70	24	14%	21
					112		65

The tables above show the total amount generated by the solar PV. If generation is insufficient to meet demand then you have a negative value. There are some months that have a positive value for the month, but there are still days with insufficient generation. The average state of charge (SOC) looks at the capacity of the battery. If it is low that means it is struggling to get fully charged. The final column shows how many days demand cannot be met.

Conclusion

The current specification of 2.6W cells and 192Ah of available battery storage is insufficient to cover the winter months in all demand scenarios in the location selected. This is before taking into account the degradation of the solar PV and battery, which would reduce generation and storage capacity over time.

For this system to be suitable in the UK, wind should be considered, as the generation profile is more closely aligned with the demand profile for street lighting.

Example Deployment: The Gambia

Methodology

We used the current system to model the generation capacity in the Gambia. Unfortunately, there is no irradiation data available for the Gambia so we used the nearest location, which was Kaolack in Senegal, about 120km north of Banjul.

We used the south facing orientation prism (although in a north facing position for the southern hemisphere) with the 192Wh li-ion battery.

We took the nautical twilight hours and assumed the lights would be on 100% of the time to get our demand figure

Results

The table below shows the results of the simulation:

Table 6 – The Gambia solar PV results

Month	Generation (Wh)	Available Energy	Demand	Gen < Demand	Days - Gen < Demand	Average SOC	Days - Storage < Demand
Jan	6,665.51	6,268.91	4,092.00	2,176.91	1	101%	0
Feb	6,351.79	5,973.86	3,660.00	2,313.86	0	100%	0
Mar	6,951.50	6,537.88	3,720.00	2,817.88	0	100%	0
Apr	6,505.19	6,118.13	3,552.00	2,566.13	0	100%	0
May	6,540.18	6,151.04	3,348.00	2,803.04	0	100%	0
Jun	6,171.14	5,803.96	3,240.00	2,563.96	0	100%	0
Jul	6,372.90	5,993.71	3,444.00	2,549.71	2	100%	0
Aug	6,398.29	6,017.59	3,720.00	2,297.59	0	100%	0
Sep	6,264.59	5,891.85	3,900.00	1,991.85	3	100%	0
Oct	6,738.69	6,337.74	4,092.00	2,245.74	0	100%	0
Nov	6,446.11	6,062.56	3,960.00	2,102.56	0	100%	0
Dec	6,395.46	6,014.93	4,092.00	1,922.93	0	100%	0
					6		0

Conclusion

The irradiation allows for enough generation using the current solar PV cells to cover lighting requirements throughout the year. There are several days where generation is insufficient to cover demand, but the capacity of the battery ensures that there are no days without light.

For further enquiries please contact:

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