OOLUX Greenhouse Gas Emissions Reduction

The OOLUX solar lighting system is meant to replace fuel-based lighting systems which contribute substantially to global greenhouse gas emissions. The latter can be greatly reduced by the use of sustainable energy systems such as the OOLUX kit. This appendix presents a quantification of the greenhouse gas emissions reduction associated to each unit of OOLUX used.

Carbon Footprint of the OOLUX Kit

While no greenhouse gas is emitted when using a solar product, the manufacturing of such devices is much more carbon intensive than that of fuel-based lighting system. This section presents the greenhouse gas emission associated with manufacturing an OOLUX kit. It is expressed as the quantity of CO_2 that would yield the same greenhouse effect. The main contribution is that of the solar panel which is quite energy intensive to produce. The second contribution is that of the electronics which also consume a substantial amount of energy in the manufacturing process. The overall emissions associated with the production of an OOLUX kit together with its shipment to end customers is equivalent to 76kg of carbon dioxide. The different

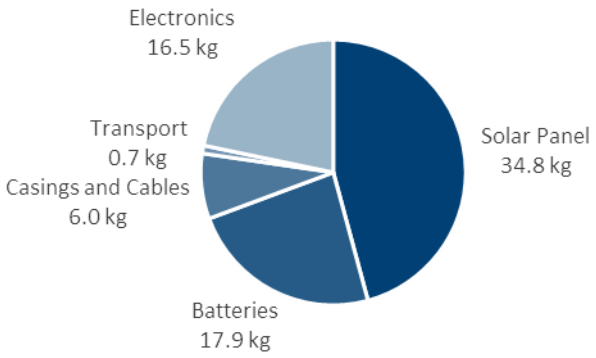

Figure 1 – Equivalent CO2 emissions embedded in an OOLUX kit

contributions are presented in Figure 1.

Baseline Emissions

The carbon emissions embedded in the OOLUX kit is to be compared with the technology it replaces. A survey of OOLUX customers conducted in East Africa identified the sources of lighting that were used prior to the purchase of the OOLUX kit. These included kerosene lamps, torches powered by disposable batteries, grid electricity and smaller solar products. For the two latter cases it is assumed that the previous source of energy is still used after the purchase of the kit and the purchase of the kit does not yield any emission

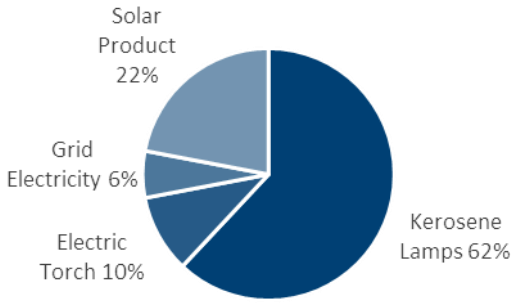

Figure 2 – Technologies used prior to the purchase of an OOLUX kit

reduction.

Kerosene lamps

Fuel-based lighting systems typically have a low manufacturing carbon footprint and it will consequently be neglected. Operating such devices however emits significant amount of carbon dioxide. It also emits other by-products originating from poor combustion. Wick lamps are the most used and produce significant amount of black carbon[1] which has a greenhouse

[1] Jacobson et al. (2013). Black carbon and kerosene lighting: An opportunity for rapid action on climate change and clean energy for development.

effect that is 450 to 700 times stronger than that of CO_2[2].

Based on observation made on the field, it is estimated that customers replace in average 1.5 wick lamps with the OOLUX kit. Accounting for four hours of daily use this amounts to annual emissions equivalent to 1,639kg of CO_2. An additional 8kg is annually emitted by charging phones in phone charging kiosks using solar panels or generators (see Table 1).

Electric Torches

The operation of electric torches powered by disposable batteries require frequent battery replacement. Assuming four hours of daily uses, batteries have to be changed every 6 days. Accounting for an average carbon footprint of 142g of CO_2[3] for an alkaline cell and an average of 1.8 batteries per torch[3], the annual CO_2 emissions of electric torch is 15kg of carbon dioxide. Phone charging also contributes to 8kg annually.

Greenhouse Gas Emission Reduction

The expected lifespan of the product is 4 years which allows a substantial reduction in emissions of greenhouse gas. Table 2 presents this reduction which account for the different technologies replaced. Emission reductions over the first year of use is also presented on Figure 3. It is particular observed that the carbon footprint of the OOLUX kit is offset by less than a month of use. The emission reduction associated with the purchase of an OOLUX kit is equivalent to the average swiss citisen's car emission for more than 3 years[4,5]. Taking into account the replacement of technologies OOLUX customer used before the purchase of an OOLUX solar power kit (see Figure 2).

[2] Lam et al. (2012). Household light makes global heat: high black carbon emissions from kerosene wick lamps.

[3] Olivetti et al. (2011). Life Cycle Impacts of Alkaline Batteries with a Focus on End-of-Life

[4] Eurostat – Average carbon dioxide emissions per km from new passenger cars 2014

[5] Federal Statistical Office – Mobility and Transport: Pocket Statistics 2015

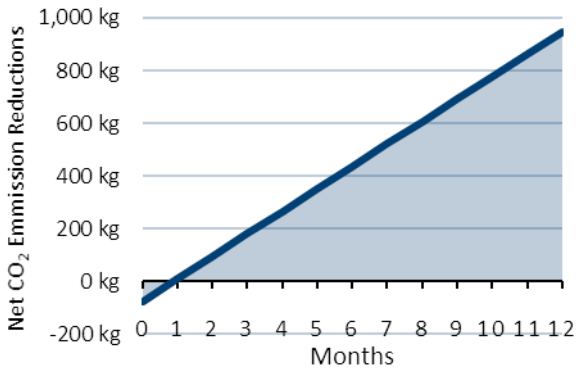

Figure 3 – Equivalent CO2 emission reduction on first year

	Kerosene Lamps	Electric Torch
Annual lighting emissions	1'639 kg	15 kg
Annual Phone Charging	8 kg	8 kg
Total Annual Emissions	**1'647 kg**	**23 kg**

Table 1 – Baseline CO_2 equivalent emissions

Baseline CO2 Emissions	4'092 kg
OOLUX Kit embedded CO2	76 kg
Net Emission Reduction	**4'016 kg**

Table 2 – Net equivalent CO2 emission reduction during life time