Helios
Portable Solar Chargers
Giving Power to Tertiary Students in Nigeria

TEAM 36:
Abdulganiy Abdulqudus Oluwaseun - (Nigeria; English 1st)
Melanie Davis (Leader) - (New Zealand; English 1st)
Tisha Bettina Sezibwa - (The Netherlands; English 1st)
# Table of Contents

1 Executive Summary ........................................................................................................... 3

2 Business Overview ............................................................................................................ 3
   2.1 Issue ................................................................................................................................. 3
   2.2 Objectives ........................................................................................................................ 4

3 Product Overview ............................................................................................................. 4
   3.1 Product Description ........................................................................................................... 4
   3.2 Technical Design ............................................................................................................... 5
   3.3 Product Creation ............................................................................................................... 5

4 Market Analysis ................................................................................................................ 5
   4.1 Target Market ................................................................................................................... 5
   4.2 Target Consumer ............................................................................................................. 6
   4.3 Marketing Strategy ......................................................................................................... 6
   4.4 Current Competitors ...................................................................................................... 7

5 Financials .......................................................................................................................... 7
   5.1 Initial Investment ............................................................................................................. 7
   5.2 Forecasted Sales and Costs ............................................................................................ 7
   5.3 Taxation .......................................................................................................................... 8

6 Future Outlook .................................................................................................................. 8

7 References .......................................................................................................................... 9
1. Executive Summary

Nigerians have suffered immensely in trying to power their homes and devices through accessing electricity (Journal of Studies in Education, 2012). Students in tertiary education often have to overcome dangerous situations and be exposed to fumes in order to charge the devices needed for their education (Akinosun, 2017). With the historical use of generators that emit harmful fumes and the current country-wide solar panel adoption, there is a gap in the market of Nigeria where we at Helios, plan to intervene.

We propose a solution to these students by offering a product which will decrease the current barriers they face when gaining access to electricity. Our product is a portable solar panel charger which is durable and easy-to-use. Only requiring three hours of sunlight to fully charge, students can then plug their devices in and dedicate more of their time to what really matters, their education. To market this product, we aim to integrate a variety of marketing avenues to ensure those who need it will benefit the most from it. Choosing four universities to partner with, we hope to advertise through their website/domain, through postering around the institutions and through educating students on how we will decrease potential harm done to them. With an investment of $6,435 required by each member of this global team, we will be able to produce and distribute 1,000 units in our first year at a selling price of $42. This will allow us to forecast our future needs and the needs of our customers. This venture is estimated to make a return on investments of $88,044 by our sixth year of production.

The proposal highlights how tackling just a fraction of a larger issue is the means necessary to make a sustained positive impact on a country. Our idea here is specific in terms of product and target market but we at Helios aim to make large changes to Nigeria, one incremental step at a time.

2. Business Overview

2.1 Issue

Electricity in Nigeria is commonly referred to as a scarce resource (Journal of Studies in Education, 2012). In 2016, 59.3 percent of Nigeria's population had access to electricity, with those in urban areas more likely to have access than those in rural areas (The World Bank, 2018). This percentage tends to fluctuate when existing technology is replaced or discontinued in use (The World Bank, 2018). Despite the statistics indicating half of the population has access to electricity, there are no statistics outlining the problems, issues or barriers that these people have to overcome to get that initial access. Figure 1 is the map of Nigeria, segregated into its territories, with corresponding population statistics. Of the approximated, 186 million people across the country, an estimated 84.3 million have occasional access to the internet (The Statistics Portal, 2018). However, with the above statistics on access to electricity, this access will also be limited, dangerous and costly to maintain (The Statistics Portal, 2018).

Access to electricity has become hazardous, specifically for those in tertiary education (Journal of Studies in Education, 2012). With aspirations to study and make their mark in the world, these students have barriers to overcome in order to fulfill their potential. Electricity generators have been the main source of electricity for a long time now, however, they pose threats to human health (Akinosun, 2017). Generator fumes, specifically carbon monoxide, can have detrimental effects on those who maintain and have access to them (Akinosun, 2017). 2014

Figure 1: Map of Nigeria with Population (Geo, 2018)
statistics claimed there were 14,000 deaths in Nigeria, directly related to generator fumes (Akinosun, 2017). The Nigerian government tried halting the importation of generators, however, they are widely accepted and used by businesses and families as they generate constant, often-reliable energy (Akinosun, 2017). The tertiary education cohort is impacted the most due to their heavy reliance on technology to enhance their education (Journal of Studies in Education, 2012). To source electricity, they are not only subjected to the fumes from generators but also expose themselves to dangerous situations at night to power their devices (Journal of Studies in Education, 2012). As a way to combat such issues, Nigeria is now adopting solar panel technology as an alternative to generator electricity (Akinosun, 2017). This technology has only been adopted on a large-scale, not accounting for individuals or their families. We at Helios see this as a gap in the market and an opportunity to differentiate ourselves from the existing solar panel market.

2.2 Objectives

Helios is aimed at reducing the dangers surrounding electricity supply in Nigeria. We seek to do this by manufacturing and distributing portable solar chargers for those undertaking tertiary study in Nigeria. With a length of 33cm, a width of 26cm and a height of 6cm, our portable solar charges are compact and reliable, only requiring a short three hours to fully charge (Alibaba, 2018). Once the portable solar panel device is charged, the user may simply plug their device in and gain one or two full charges for their laptop or device. Once we have established the market and have succeeded our predicted growth, we endeavour to create a variety of products for all types of needs.

We propose from the introduction of our device to the market in Nigeria that we will significantly reduce the level of exposure and the death rate arising from the inhalation of carbon monoxide. We seek to also reduce the level of rape, theft and other social vices for those in tertiary education. To do so, our products are made so that users will have the ability to charge their device at any location and at any time. The creation of this product will also generate decent work for those employed by Helios. We aim to offer a competitive salary to graduates we recruit from the universities we have marketed to. Decent work will also be generated by the contracted work we will delve in with manufacturers in Nigeria. These organisations will produce our designed product for a certain wage. This will, in turn, increase the economy in Nigeria.

3. Product Overview

3.1 Product Description

By analysing relevant data, Nigeria’s most common laptops for tertiary education are from the brands HP and Dell (Wabara, 2017). From this, we were able to determine that HP and Dell have internal batteries which range from 2500mAh to 8500mAh (Wabara, 2017). For the purpose of replicating these batteries as external to the laptop, we require a lithium-ion battery with 10,000mAh to be installed within the solar panel device. This will provide internal laptop batteries of less than 5000mAh to be charged twice, or a more powerful laptop to be charged once (assuming there is no energy transfer loss). To charge this battery to full capacity we require a 19.7W solar panel (20W) and an estimated three hours of direct sunlight (Jeff, 2017).
As outlined in figure 2, to assemble the product, the 20W solar panel will be connected to a charge controller. This charge controller is required to prevent the battery from overcharging by regulating the voltage. This charge controller is then connected to the 10,000mAh battery. This battery is then connected to an inverter which converts the variable direct current (DC) output of a photovoltaic (PV) solar panel into a utility frequency alternating current (AC). We are then required to attach the inverter to an outlet (this will be a female outlet so that users may plug their devices in). All components described here will be inside of the captivating, portable rectangular package in figure 3, with the 20W solar panel on top. The total cost of the above raw materials is $25.48, we aim to sell this product at a fixed price of $42.

3.2 Technical Design

Due to the portability of the product, it is not restricted in weight or design and can, therefore, be used anywhere there is sunlight in Nigeria. Due to Nigeria's positioning on the equator, it is a prime location to exploit the use of solar panel technology because it is closer to the sun and has direct radiation (Baker, 2016). The only requirements associated with this product is that the solar panels are subjected to at least three hours of direct sunlight a day (for more frequent use) or on a regular basis (for less frequent use). On average, even with the extended land mass of Nigeria, the sun is shining for approximately 11 to 12 hours a day (Time and Date, 2018). This is usually between the times of 6 am to 7 am and 6 pm to 7.30 pm (Time and Date, 2018). Generally, Nigeria is exposed to 43 percent of the sun in these hours with shade, haze or low sun intensity accounting for the other 57 percent (Time and Date, 2018). In saying this, solar panels tend to experience peak solar radiation when the sun is at its peak so consumers will be notified to expose their solar panels at noon most days (Baker, 2016).

3.3 Product Creation

As founders of Helios, this GEE team will serve as the core management team. We will source only a small team of technical engineers to serve as the production managers. This team will be recent graduates from within the university's we market our product to, this is because their understanding of technology will enhance the credibility these devices will hold. This team will need to be qualified because they will be dealing with the logistics of manufacturing and the design of future products. This technical level of expertise required will be reflected in their salaries. Two technical engineers will be assigned to Helios’ first contracted manufacturers in Nigeria. The manufacturers will be responsible for turning the raw materials into the products we require. In the initial start-up phase, we will assign two technical engineers to one manufacturing company, as we start to exhibit growth, we will further employ two more technical engineers and expand our manufacturing.

4. Market Analysis

4.1 Target Market

Tertiary education is aimed at improving the knowledge, skills, and values of young-adults and setting them up for their future endeavours. We at Helios believe that this form of education enhances the economy and increases the standard of living in Nigeria. We believe it is important for us to invest in tertiary education and their students because they are likely to make remarkable impacts on the future economy of Nigeria (Journal of Studies in Education, 2012). Helios is going to initially source our graduate
engineers from this market and then advertise our product to this specific cohort. This will ensure we establish a credible relationship and start to build our reputation in Nigeria. With over 40 federal universities, 44 state universities and 74 private universities, we will be required to narrow this target market down (Funmilola, 2018). The four universities we are going to focus our efforts on in the initial phase are the Tai Solarin University Of Education, the Federal University of Technology, the Kogi State Polytechnic and the Federal Polytechnic of Ilaro. These four have been chosen by Helios because their students face hardships with access to electricity (Journal of Studies in Education, 2012).

With a sales price of $42, we acknowledge that there is risk involved with targeting a cohort that tends to have less disposable income than other cohorts. We aim to reduce this risk through seeking partnerships with their tertiary educators. Perhaps, in the desire to decrease the danger associated with electricity in Nigeria, these educators would thrive off funding initiatives as such. With fewer students exposed to the threats of generators and night-time social vices, they could subsidise our products by $10 so that they become affordable to these students. We do acknowledge that this may prove to be a difficult task, however, it is not one we are willing to rule out just yet. Another alternative is to market the product in a way which concludes it is an investment for the families of such students, to decrease the danger associated with other forms of electricity access. This would require us to market and relay the quality of our product to, not only the students but to their families also.

### 4.2 Target Consumer

The target consumer of our product is going to be a student, male or female, between the ages of 17 to 23. For this specific analysis, she will be a 20-year-old female student. Female is chosen here because they are more likely to be harassed and susceptible to dangerous situations on their way to university at night to charge their devices for their university work (Journal of Studies in Education, 2012). She will go to the Federal University of Technology located in Minna and live within a radius of 3 to 5 km away. She is likely to come from a family with low disposable income, largely due to the investment required by them to send their child to university. Generators are not new to her, in fact, for the last ten years, they have been adopted by the family to generate electricity. Although she finds them reliable, she is aware of the fact that her brother was hospitalised due to the fumes he inhaled when maintaining their generator. Solar power technology is a new concept to her, therefore, she is excited to try it in her home and for her school work because it will decrease the likelihood of another one of her family members falling ill and decrease the likelihood of being involved in a dangerous situation.

### 4.3 Advertising

Before we have generated any profit, we will employ a few marketing techniques to advertise our product to our target market. These techniques will largely be online-advertising, posters and word-of-mouth. Helios has chosen these methods because out of the 83.4 million people in Nigeria with access to the internet, a large proportion of those will be students in tertiary education. We are assuming this because the internet is generally a required resource for those in education to conduct their research. We are willing to, once again, partner with these four universities in order to increase student knowledge about solar panel technology. This will allow us to market our product through the institutions' website/domain, market through poster advertising within the university and create a discussion around the alternative sources of electricity. Poster advertising will also be done in places such as malls, libraries and local hang out spots, essentially wherever our targeted students are mostly present.
After profit has been generated, our avenues of advertising will expand, reaching more students from other universities all over Nigeria. We aim to source contractual agreements with computer retail outlets (or sales websites) to sell our device as part of a package deal when a student (or even an individual from an older cohort) buys a new laptop. Generally, Nigerians tend to watch series and movies on their mobile phones so we intend to exploit this by purchasing airtime with these companies. This can get costly, however, so we will need to be making substantial profits to include this aspect.

4.4 Current Competitors

Solar panel technology is not a new concept to those in Nigeria. There are approximately 128 companies who work exclusively on solar technology, however, this tends to only be rooftop solar technology, not specific to any individual or family (Business List, n.d.). Narrowing this group down to those that specialise in providing portable solar technologies, there are approximately eight companies (VConnect, n.d). The price of their products is relatively similar, being between US$35 to US$45 (VConnect, n.d). Nigerians also have the opportunity to import solar panel chargers if they wish to do so, however, the cost of the product and price of the shipping alone tends to be very expensive. In saying this, these companies are not specialising in one product and their products are not made with quality materials such as ours at Helios. Most of these companies use a battery with less mAh or a solar panel with a lower wattage output (VConnect, n.d). We are able to gain a competitive advantage over these companies as we differentiate ourselves by providing durable and exceptional quality products. Due to this, our products will last significantly longer than those of our competitors.

5. Financials

5.1 Initial Investment

In our first year of production, we are aiming to produce 1,000 units. This will ensure we are reaching the quality we desire and that our small number of consumers are beyond satisfied with our product. The initial investment required for 1,000 units is US$51,480. Costs associated includes salaries for two employees, marketing costs, contract manufacturer costs, raw material costs ($25.48 per unit) and transportation costs. As the founders of Helios, each member of the core management team will need to invest US$6,435. This may require a small bank loan or family investments.

<table>
<thead>
<tr>
<th></th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPERATING REVENUE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL REVENUE (with Sales at $42)</td>
<td>42,000</td>
<td>105,000</td>
<td>147,000</td>
<td>210,000</td>
<td>315,000</td>
<td>420,000</td>
</tr>
<tr>
<td><strong>OPERATING COSTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salaries</td>
<td>15,000</td>
<td>15,000</td>
<td>15,500</td>
<td>15,500</td>
<td>30,500</td>
<td>30,500</td>
</tr>
<tr>
<td>Marketing</td>
<td>3,000</td>
<td>2,500</td>
<td>2,500</td>
<td>3,500</td>
<td>4,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>5,000</td>
<td>12,500</td>
<td>17,500</td>
<td>25,000</td>
<td>37,500</td>
<td>50,000</td>
</tr>
<tr>
<td>Total Fixed Costs (per year)</td>
<td>23,000</td>
<td>30,000</td>
<td>35,500</td>
<td>44,000</td>
<td>72,000</td>
<td>84,500</td>
</tr>
<tr>
<td>Variable Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw Materials ($25.48)</td>
<td>25,480</td>
<td>63,700</td>
<td>89,180</td>
<td>127,400</td>
<td>191,100</td>
<td>254,800</td>
</tr>
<tr>
<td>Transportation</td>
<td>3,000</td>
<td>7,500</td>
<td>10,500</td>
<td>12,500</td>
<td>15,000</td>
<td>20,000</td>
</tr>
<tr>
<td>Total Variable Costs (per unit)</td>
<td>28.48</td>
<td>28.48</td>
<td>28.48</td>
<td>27.98</td>
<td>27.48</td>
<td>27.48</td>
</tr>
<tr>
<td><strong>TOTAL OPERATING COSTS</strong> (per year)</td>
<td>51,480</td>
<td>101,200</td>
<td>135,180</td>
<td>183,900</td>
<td>278,100</td>
<td>359,300</td>
</tr>
<tr>
<td><strong>TOTAL PROFIT (LOSS)</strong></td>
<td>(9,480)</td>
<td>3,800</td>
<td>11,820</td>
<td>26,100</td>
<td>36,900</td>
<td>60,700</td>
</tr>
<tr>
<td><strong>TOTAL MARGINAL PROFIT (LOSS)</strong></td>
<td>(9,480)</td>
<td>(5,680)</td>
<td>6,140</td>
<td>32,240</td>
<td>69,140</td>
<td>129,840</td>
</tr>
</tbody>
</table>

| Initial investment for 1,000 units | 1000 |
| Employee Salary | 15,000 |
| Marketing | 3,000 |
| Manufacturing | 5,000 |
| Raw Materials | 25,480 |
| Transportation | 3,000 |
| **Total Investment Required** | 51,480 |
| Contribution from each team member | 6,435 |
Starting production in 2019 and with an initial investment of US$51,480, by 2024 we can expect to have a profit increase of 252 percent (before tax), with a sales price of US$42. In our first year of production, we are projecting to incur a loss, this is so we do not overstate our forecasted sales. Within two years, however, Helios will start to incur profits which will incrementally increase as production each year increases. These profits will be reinvested into the future success of our company. To break even in our first year we are required to produce and sell 1,702 units, however, we are only forecasting to produce and sell 1,000 units. To counteract this, however, in our second year we only need to produce and distribute 2,219 units to break even but we are estimating to sell 2,500 units. We then have a margin of safety equal to 281 units and US$11,802 in revenue.

Substantial business changes will be reassessed and conducted every two to three years, resulting in a change of fixed costs. Based on the above financial analysis, in our third year of production, we will reward our employees with a pay rise. Graduate salaries figures have been estimated via research conducted on the average alumni salary in Nigeria (Ikeke, 2017). The allocated cost of the partnerships with manufacturers in Nigeria is estimated based on how much employees tend to make in factories as such. The first three years will compromise of just one contractual agreement with a manufacturer, however, in our fourth year we will broaden our market by introducing a second manufacturer and hiring a further two technical engineers.

5.1 Taxation

| TAXED PROFIT   | - | 1,140 | 3,546 | 7,830 | 11,070 | 18,210 |
| TOTAL PROFIT (LOSS) AFTER TAX | (9,480) | 2,669 | 8,274 | 18,270 | 25,830 | 42,490 |
| TOTAL MARGINAL PROFIT (LOSS AFTER TAX) | (9,480) | (6,820) | 1,454 | 19,724 | 45,554 | 88,044 |

Nigeria has a corporate tax of 30%. Total profit after tax is the amount of income we will generate and put towards future production. In the first two years of production, we will not exhibit a large return on investment. After the third year, however, we will have an increasing return on investment, allowing for our loans to be paid back and for profit to be generated.

6. Future Outlook

Our product will be introduced to the market in Nigeria as a means of decreasing the harm associated with accessing electricity currently. Knowledge of this impact is going to and has already positively influenced Nigerian citizens perceptions of solar power technology, therefore, the introduction of our product in 2019 is likely to be welcomed. Once we have established the market and have succeeded our predicted growth, a future objective of ours will be to engage in business extended towards all people who require portable solar energy and will create a variety of products to serve all types of devices. This business objective rests on the assumption that we meet our targets. Once profit has substantially incrementally increased, we aim to decrease the price of our product (and subsequent products) to engage with target markets of lower disposable income. We will reassess our current product and introduce new products with five to seven years of decent growth. Solar power technology exponentially increases in quality, size and abilities every few years so it will be necessary for us to improve our existing technology as this occurs. Adaption of our current product to offer solar solutions to all types of requirements, perhaps even whole house solar electricity systems will not be a hard task. Although we have focused our efforts on students in Nigeria, this product also has the ability to be introduced almost everywhere. With the switch to solar power becoming increasingly popular, we have the ability to broaden our business on a global scale. Our opportunities are simply limitless once we have entered this industry and Helios is incredibly excited to embark on this journey.
7. References


Ikeke, N. (2017). This is how much most graduates earn in Nigeria as starting salary. Retrieved from https://www.naija.ng/1103088-this-graduates-earn-nigeria-starting-salary.html#1103088


