

How Did This All Get Started?

Pamela Ulicny, science teacher at Tri-Valley Jr/Sr High School, was accepted in 2011 to the Toyota International Teacher Program's first inaugural trip to South Africa (see the TITP web site at <http://www.iie.org/Programs/Toyota-International-Teacher-Program>). It was the trip of a lifetime. Pam discovered the rich cultural and biological diversity there, but she also saw discrepancies in educational quality, vocational skills, and job opportunities. Since then, Pam has partnered with Mark Gamble of Aspire Youth (<http://www.aspireyouth.co.za/>) and Ed Bender of Sundance Solar (<http://store.sundancesolar.com/>) to develop a way to educate and empower youth both in the U.S. and abroad with the ability to harness renewable energy.

It started with the development of a kit which could turn a simple glass jar in to a solar lantern. Mark provided the original idea, Ed engineered and designed the components, and Pam developed the STEM-based curriculum and assessments. Since the fall of 2013, the Sunbender Do-it-Yourself Solar LED Jar Light Kit (<http://store.sundancesolar.com/sunbender-do-it-yourself-solar-led-jar-light-kit/>) has been on the market for educational and personal use, and has been utilized in the U.S. and abroad. A portion of the proceeds of the product's sale has been set aside to fund projects for Aspire Youth, who serves at-risk South African youth in poverty. Currently, this educational kit is available in nationally recognized vendors such as Wards, Sargent Welch, Edmund Scientific, and Amazon. Sales of the DIY Solar LED Jar Light Kit have funded the shipment of 20 lantern kits to the Aspire Youth headquarters for pilot use.

We are very pleased with the success of our DIY Solar LED Jar Light Kits, but Pam and Ed have an even grander dream of putting education and technology to work in solving the real-world problem of alleviating energy poverty lesser developed countries. While the solar lantern kits have been successful in the U.S., impoverished youth in South Africa are existing off the grid, using kerosene lanterns for light at night. All the while, safer and cleaner photovoltaic light could be made available to those living in energy poverty at a cost less than the long-term price of kerosene.

What is Our Plan?

From the beginning, Pam's ultimate vision and mission was to provide education and empowerment to disadvantaged youth in the Aspire Youth program in South Africa. Together with Mark's innate knowledge of the demographics, politics, economics, and culture of South Africa and with Ed's entrepreneurial, technological, and business skills, our team has developed a "best fit" plan for jumpstarting youth-driven business in the Cape Town area of South Africa. In late July 2015, Pam, Ed, and Natalie Macke (another 2011 TITP attendant) will be going back to Cape Town South Africa in order to train and educate the youth involved and personally launch the programs. Pam's return to South Africa is sponsored by the Fund for Teachers (<http://www.fundforteachers.org/>), which supports educators' efforts to develop skills, knowledge and confidence that impact student achievement.

Our plan to educate and empower impoverished youth in Aspire Youth involves two small business models:

1. The "Peace Lantern" Project – Youth in Aspire Youth will be educated and trained in the technology, manufacturing, and sales of a customized version of the Sunbender Do-it-Yourself

Solar LED Jar Light Kit marketed as a South African “Peace Lantern.” Peace Lanterns will be targeted for sale as a novelty, corporate gift, or souvenir targeting the tourist industry.

2. The “Pay As You Go (PAYG) Solar Lighting Project” – Youth in Aspire Youth will be educated and trained in our customized Pay-As-You-Go Photovoltaic module rental and purchase system which uses mobile phone technology and mobile banking infrastructure to electronically pre-pay for their photovoltaic use. A variety of payment and photovoltaic module options will eventually become accessible, depending on the needs of the household and community.

How Do We Plan to Do It?

Part 1: Launching the Peace Lantern Project

The purpose of the Peace Lanterns was to create a marketable customized novelty which ties together the power of solar energy with South African art and culture. The lanterns are meant to convey the spirit of peace, harmony, and unity emerging within a formerly divided nation. Last spring, art students at Pam’s high school had a contest to design a logo for the lanterns. The guidelines encouraged the use of matabele art (a South African art style) with a symbolic interpretation of peace and unity, along with the inclusion of the 11 South African indigenous languages. The final logo design was chosen by the leaders of Aspire Youth in the spring of 2015 and has already been printed onto a label which will adhere to the jars.

Now that the jars and the logos are set, the next step is to acquire the components necessary to create the photovoltaic/LED array. This includes a printed circuit board (pcb), a 3 volt solar panel, 2 AAA rechargeable batteries, a battery holder, 2 LEDs, and coated wires for each lantern. In addition, soldering irons, solder, solder sucker, wire cutters, a drill, electrical tape, and silicon sealant are also required.

Pam intends to use funds acquired from the Fund for Teachers grant along with funds gathered from her local community to bring along as much of the above materials as possible when she travels back to South Africa in July. In addition, Pam will be implementing the curriculum she developed for the Sunbender Do-it-Yourself Solar LED Jar Light Kits to educate and train Aspire Youth during a launching seminar she will be hosting there. Pam not only intends to train leaders of Aspire Youth, but also plans to train South African educators in a series of teacher workshops which Mark will arrange. In these educator workshops, South African teachers will be introduced to the STEM concepts needed to understand the inner workings of the Peace Lanterns.

Part 2: Launching the Pay As You Go (PAYG) Solar Lighting Project

The purpose of the Pay As You Go (PAYG) Solar Lighting Project is to serve the humanitarian goal of providing light and electronics charging capability to households which have no access to electricity. To Pam, Ed, and Mark, helping to alleviate energy poverty has always been the ultimate aspiration. Ed and his team at Sundance Solar have been working diligently with Mark to develop a low-cost and viable

solution that ties education, training, and 21st century technology and job skills to Aspire Youth while providing a service that is in great demand.

To do this, we have teamed up with Angaza (<http://www.angazadesign.com/>) and adopted their PAYG-Ready platform which is ultimately designed to use mobile technology to 'virtually' pay for their photovoltaic usage while virtually controlling the photovoltaic system's ownership and accessibility. The Angaza platform allows for the flexibility of starting with a cash based system, working up towards a mobile money payment option. Angaza utilizes the already established and most successful mobile phone based financial service in the developing world; M-PESA.

Another contributor and partner in our developing PAYG Solar Lighting Project is One Million Lights (<http://onemillionlights.org/>), whose mission is to improve the daily lives of children and adults by providing clean and healthy lighting. Their mission is to distribute one million solar lights to replace dangerous and polluting kerosene lamps, along with working with U.S. schools to increase awareness of global issues and the utilization of alternate energy.

Through Ed's contact with corporate leaders from Angaza and One Million Lights, it was suggested that we should start with providing a 'best value' basic light. As the business evolves and grows, we could offer more products to the end user. Thus said, the lights chosen as our 'baseline' system is the Green Light Planet Eco Easy Buy system offered by Angaza (<http://www.angazadesign.com/products/#-eco-easy-buy>). Angaza's software is already imbedded into the Eco Easy Buy making it easy for the Aspire Youth sales agents to monitor, activate and deactivate the lights.

Sundance Solar and Aspire Youth can monitor the sales, payments, and usage of the photovoltaic lanterns and even troubleshoot possible problems in real-time on the Angaza Hub online. Sales agents trained within the Aspire Youth program would have the Angaza app on an Android based smartphone. The Aspire Youth sales agent uses the app to enter new customers, receive payments and activate lights via a custom cable linking the phone to the lights.

Customers would make a down payment and the light would be activated for a specific period of time. At the project's commencement, sales agents will accept cash payments, eventually progressing to mobile payment systems if demand permits. When the next payment comes due, the Angaza software imbedded into the photovoltaic unit causes the light to dim, letting the customer know they need to make another payment. The customer then meets the sales agent in a local kiosk open weekly/biweekly for service, makes a cash payment, and then sales agent activates the light for another period of time. The sales agent connects their smart phone to the photovoltaic unit by a cable, which activates the unit while also scanning diagnostics such as the battery charge level and reading system usage rates.

Angaza's software allows for the sales agent's smart phone to send a *bidirectional* signal; one which activates and runs diagnostics on the photovoltaic unit, while the other signal updates the hub which synchronizes the customer's account status, monitors power usage, and calculates the sales agent's commission. Virtual payments will be managed through the Angaza app which connects with M-PESA and deducts the money from their account. The process of payments and virtual account transfers repeats itself until light is paid off. When the unit is paid for in full, the sales agent then unlocks the light permanently. Thus, Angaza's Android app allows for the Aspire Youth sales agent to permit energy activations while monitoring payment status, tracking commission, and diagnosing the unit 'in-field.'

The PAYG Solar Lighting system will be set up according to the economic conditions, demands, and constraints in the communities we target. Different areas could have different plans. Different customers could have different plans. As demand increases, the payment options and the diversity and complexity of the photovoltaic systems with imbedded Angaza technology likewise increases. For example, the next generation of photovoltaic units will likely contain a USB charger for charging electronics. We will rely on Aspire Youth to pull together the data for determining where and how to best roll out the project.

What are the Anticipated Costs?

Part 1: Financing the Peace Lantern Project

Based on market research findings through Mark, the ideal price range for the Peace Lanterns has been estimated to be a retail price of R90 (90 rand or approximately \$8.50 U.S.). However, this retail price is too low to allow for a sustainable business model for both Aspire Youth and Sundance Solar. The starting price for the pcb (printed circuit board) when purchased in bulk is \$2.00 US, and the rest of the items (solar panel, LEDs, rechargeable batteries, battery holder, wire) amount to approximately \$2.51 more. Shipping and taxes also need to be factored out of the profit margin.

This would allow for only a narrow profit margin for Aspire Youth if Sundance Solar agrees to supply the lantern materials 'at cost'. Sundance Solar is considering offering materials 'at cost' to jump start the enterprise, but could not sustain this agreement long term. In an effort to reduce costs and boost domestic revenue, Mark is looking into South African markets which could supply the stock components other than the pcb. In addition, we are looking into corporate sponsorships for the Peace Lanterns, along with promoting the use of the lanterns in South African schools, similar to the successful implementation of the lanterns to teach STEM skills in classrooms across the U.S.

Part 2: Financing the Pay As You Go (PAYG) Solar Lighting Project

The Green Light Planet Eco Easy Buy (<http://www.angazadesign.com/products/#-eco-easy-buy>) will cost Sundance Solar approximately \$8.50 each with a minimum starting order of 200 lights (plus freight, duty, and brokerage fees). If the lights are subject to an 18% import duty, then the cost increases by an additional \$2.25. Sundance will need to sell the lights to Aspire Youth for approx. \$12.50. Aspire Youth, in turn, will sell lights for approximately \$20 to \$25.

According to the contract signed between Sundance Solar, Angaza collects 3%-8% of gross sales. Angaza's profit margin starts at 8% and the percentage decreases as the sales of the lights increases. At \$20 per light, Angaza gets \$1.60 each. Angaza's fees are billed at the end of every month. Without duty and freight and broker fees, Aspire Youth's cost per light is \$14.10.

To launch the PAYG Solar Lighting Project, the minimal startup costs have been estimated to be approximately \$10,000. This could purchase 500 lights plus other initial costs including smartphones for new sales agents and travel costs. With a more robust \$25,000 of seed funding, 1,500 solar lights could be purchased along with covering the anticipated start-up costs.

To help to generate the necessary seed funding, we launched an indiegogo campaign last spring (<https://www.indiegogo.com/>). Through crowdsourcing, we collected a total of \$2165.00 after fees from the credit card companies and the indiegogo site are taken out. With this money, a sample pack of Angaza compatible lights was purchased for \$150.00 for delivery to Sundance Solar. Most of the remaining funds were used to purchase 200 Eco Easy Buy lights @ \$8.50 each. Freight to South Africa increases the light's price to about \$9.65 each, totaling \$1,930. Thus, the remaining \$85.00 from the campaign will not go far to cover any other duties or start-up costs in South Africa. Some funds have been collected through Pam's local churches and service organizations, which can be donated towards freight charges. But we're still in desperate need of further financial support.

What are the Anticipated Benefits?

Part 1: Anticipated Impacts of the Peace Lantern Project

- Spreading STEM to international classrooms (with the intent of targeting underserved schools) as we present curriculum to South African teachers addressing how solar panels work, how rechargeable batteries work, how LEDs work, series and parallel circuits, and how calculate charge and discharge times in a do-it-yourself solar lantern kit.
- Forges international collaborations between educators and students
- Provides job and business skills for unemployed and disadvantaged South African Youth
- Diversion from poverty-driven issues, such as drugs, crime, and gangsterism
- Emphasis on clean energy, sustainability, and domestic resources while embracing South African art and culture
- Promoting peace in South Africa in the wake of conflict and issues such as xenophobia
- Promoting a viable market in novelty and corporate gifting while also creating a souvenir for the tourist trade, which makes up a huge portion of South Africa's economy

Part 1: Anticipated Impacts of the Pay As You Go (PAYG) Solar Lighting Project

- Less of a fire hazard than kerosene lanterns, less fatalities due to dangerous and illegal hookups to the power grid
- Less air pollution and eye damage which comes from kerosene use indoors
- Less money spent on lighting compared to the long-term cost of kerosene
- More productive hours/more reading and study time
- Job creation for the unemployed and underserved
- Teaches impoverished youth about STEM topics, employment and business skills
- Innovation in emerging technology: Right now, no one is doing exactly what we propose to do with virtual payments for photovoltaics, so the market is wide open and the possibilities and impact are endless.

Closing Remarks Regarding Project Viability

#1: We're Being Endorsed By National and International Nonprofits and Socially Conscientious Businesses

So far, we have received the greatest support and feedback from the U.S. based nonprofit One Million Lights (<http://onemillionlights.org/>). Their mission is to provide clean, safe, affordable solar lighting to rural communities around the world, made possible by partnerships and donations. One Million Lights also works with local schools to increase awareness of global issues, providing students with the tools and knowledge to bring about change in their environment. OneMillionLights.org is an "Oprah Endorsed" charity with big corporate sponsors such as Energizer and Intel.

Ed has spoken with Jen, director of One Million Lights. Jen is willing to become a liaison for donations to our Solar Lantern and Solar Lighting Project, and would love to collaborate with other socially conscientious corporations, and has assisted other alternate energy projects before, and the donation transfer seems to work well. Likewise, we are starting to talk to the representatives of their One Million Students Program, whose mission is to educate students on the science behind solar technology and its diverse application, and to help students understand the impact of solar lighting on people living without electricity.

Level Up Village (LUV - <http://levelupvillage.com/>) offers unique in-school, after-school, and summer enrichment programs for K-9 that virtually connect students in the U.S. with students in developing countries via video. Through shared STEAM curricula, LUV students are prompted to explore their global partner students' culture while collaborating on a common project for social good. LUV has

already purchased our Sunbender Do-it-Yourself Solar LED Jar Light Kits to teach solar power to students in the U.S. and in the poorest barrios in Nicaragua.

We are still looking more deeply into funding for the Peace Lanterns, and likewise looking for markets in which to sell the novelty lanterns. According to Mark, Pick n Pay, South Africa's second largest supermarket chain store, is interested in becoming a distributor for the Peace Lanterns under their youth enterprise program.

#2: There is a Huge Potential Impact, Growth, and Development

1.3 billion people (or approximately 1 in every 5) worldwide don't have access to safe and reliable lighting after the sun sets. Currently, most off-grid families incur ongoing, expensive kerosene payments. However, consumers in energy poverty rarely have enough cash in hand at one time to purchase a solar home system outright. By offering installment pricing, our PAYG Solar Lighting Project is able to reach a much larger customer base. Our system removes the upfront cost barrier of distributed solar by enabling off-grid customers to pre-pay for clean energy in affordable amounts as they consume it. Pay arrangements can be very flexible; in some places lights are paid off in as little as two payments, while in other places the lights are financed over 6 months or more. With a cloud-based software platform to effectively manage PAYG sales at scale, managing customer accounts or even shutting down the light if it were stolen should not pose an issue.

Although the actual degree of sales in of the Green Light Planet Eco Easy Buy lights depends on the promotional ability of the sales agents, similar projects in other countries have proven success rates. Angaza's experience with selling solar lights in Zambia started at 70 lights at the first month and grew to 3000 lights per month with 15 agents selling. If we make an anticipated \$8 per light and sell 500 a month that is \$4,000 month gross profit. If our project grows at the same scale as the one in Zambia, profits could reach \$24,000 a month.

Finally, there is the idea of technological growth in the future. With the increased standard of living and savings from not purchasing kerosene, families could further invest in larger and more diversified photovoltaic arrays, including ones which supply more power, have USB charging capabilities, and have the capability of adding on additional solar panels. Anganza's technology could also imbed virtual diagnostics and GPS technology, so that permanently mounted photovoltaics systems can make their own 'service calls' so that a technician can receive a virtual message stating where the photovoltaic unit is located and the nature of the problem.

According to an excerpt from the LUMINANet, a social network for the global off-grid lighting community (<http://luminanet.org/>), a full transition of all South Africans off the grid to solar off-grid lighting would net an annual savings of \$90.80 per household per year, would supply 5 million households with better quality light, and would reduce or eliminate fuel-related health issues, fire hazards, and toxic fumes (see attachment). The transition to solar power would also eliminate the use of 561 million liters of kerosene, 305 million candles, and the disposal of 75 million batteries annually. Thus, we hope that our business plans pose a 'win-win' for eliminating health hazards and waste, promoting sustainability, eliminating energy poverty, improving the standard of living for the poor, providing business opportunities, and for enabling a growing South African economy.