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Water Scarcity

Utilizing Saltwater and Solar Stills for a Better Uganda

It is not an unknown fact that water scarcity is a global issue. Here's the truth: 2.1 billion - yes, that's right, 2.1 billion - around the world lack access to safe water ("Progress on Drinking Water, Sanitation and Hygiene"). Yet 71 percent of the earth is composed of water ("How Much Water Is There on Earth?"). Clearly the saltwater is not being fully utilized. There are several countries, especially in the continent of Africa, that are in dire need of safe drinking water. In fact, by the year 2030, 75 million to 250 million could be living with severe water stress ("Water Shortage in Africa: A 2019 Update). For a more precise area, let's zoom in on the country of Uganda.

Uganda is a country of 241,550 kilometers bordered by South Sudan, Kenya, the United Republic of Tanzania, Rwanda, and the Democratic Republic of Congo ("Country Profile - Uganda"). With that being said, all of the countries in this part of Eastern Africa are suffering from water shortage. This can be a major problem, especially considering that crops must have water to survive. Approximately 37.8 percent of the land in Uganda is cultivated, and this is mostly used for the main exports of cereal crops, root crops, bananas, pulses, oilseeds, coffee, vegetables, fruits, cut flowers, and cocoa ("Country Profile - Uganda"). The average farm size in Uganda is 1.4 hectares or approximately 3.45 acres, comparable to the size of 2.6 football fields ("Smallholders Dataportrait").

The ever-growing population of Uganda is considered a contributing issue to the lack of resources. Today, the population is around 45,217,783, with a vast 74.3 percent living rurally. This leaves 25.7 percent urban, living in cities such as Kampala ("Uganda Population (LIVE)"). I've found that it is very difficult for the rural population, nearly three-fourths of Ugandans, to access water. In fact, women and children in Uganda have to make a trek of 3.7 miles (on average) each day just to get water ("Clean Water Program").

The government type in Uganda is a presidential republic, with three branches that allow for equal representation from several different groups of people, which include women, military, youth, and persons with disabilities. Clearly the Ugandan people are considerate enough that they consider equality for all, so I believe that they would greatly appreciate a solution to the water shortage that would allow for women to work and the youth to be educated.

Narrower research led to the living conditions of a typical Ugandan family, which is, on average, composed of four to five members. Sadly, it is most likely that the typical family would live in substandard housing ("Uganda" *Habitat for Humanity*). Poor housing conditions are usually the

equivalent of poor living conditions. Habitat for Humanity is currently working on bettering the Ugandan housing.

The food families survive on is typically from their own farms and gardens due to the largely rural-based living style and is often cooked over an open fire (“Cuisine and Etiquette in Uganda”). The diet mostly consists of plantains, starchy roots, and cereals, though pulses, nuts, and leafy greens are often served on the side (“Uganda” *Nutrition Country Profiles: Uganda Summary*). Nearly three-fourths of Ugandans work in agricultural careers (“The World Factbook: Uganda”). The average gross salary of Ugandan careers is 18,167 US dollars (“Uganda: 2019/20 Average Salary Survey”). There is available education for Ugandan children; however, it is overcrowded due to a large population and a small number of schools (“Education in Uganda”). Health care is better in Uganda than in most African countries due to the availability of education, but it still could be improved (“The State of Healthcare in Uganda”). The main human concern in Uganda is the lack of available water and toilets. With that being said, I’ve come to the conclusion that the problem that is in most dire need of being solved in Uganda is unavailable water.

Currently, fifty-one percent of Ugandans have limited or no access to sanitary water (“Uganda’s Water Crisis - Water in Uganda 2019”). The water that these people can access is often filled with harmful bacteria that threaten to keep children out of school or adults from work. Organizations such as WaterAid and Beyond Uganda are attempting to change that for the better by adding wells or raising money for water filters, but as they work, the population of Uganda grows, worsening the problem. Another factor that contributes to the lack of water is that the springs, which are a major water source for the rural population, are contaminated with pathogenic bacteria (Haruna, Rukia, et al).

Uganda’s people as a whole are suffering from the water shortage. Of course, there are different levels of this. Out of the nearly ninety percent of Ugandans who live in small towns and rural areas, approximately two-thirds have no access to sanitary water (“Clean Water for Rural Uganda”). That’s roughly 27,130,670 people. Of course, there are also those who live in urban areas, such as the major city of Kampala. They aren’t much better off than those who live rurally unless you consider the factor that they are slightly closer to the water pumps. Finally, there’s the wealthy group of Ugandans, and they only experience this hardship through their fellow citizens. If we look beyond the location factor, there are also the subgroups of women, men, children, and the elderly. Let’s begin with children. They are often kept from school for one of two options; those are that they’ve fallen ill from water-borne diseases or that they are helping their mother out collecting water (this is especially true for those with large families). Speaking of mothers, women are often the parent that stays at home keeping the household running. They are the subgroup that is mainly affected by the lack of convenient water, as they will take their children and collect water. Men may not be the ones collecting the water in a typical household, but they are still affected, as they may be kept from work, the family’s only income, for days or weeks at a time because of the unsafe drinking water. The elderly can’t do anything about this, as they’re too old to work or walk so very far for water collection. However, they are still impacted because their weaker immune systems can easily catch viruses from any contaminated water.

Marginalized populations are defined as “groups and communities that experience discrimination and

exclusion (social, political and economic) because of unequal power relationships across economic, political, social and cultural dimensions” (“Glossary”). Marginalized populations rarely get a chance to express themselves and stand up for their views, and this would be even more so if their time was taken

up by water-borne illnesses and water collection, which is, of course, the case in Uganda. In fact, women globally have walked 200 million hours just for water collection (“Collecting Water Is Often a Colossal Waste of Time for Women and Girls”). The youth rarely has a chance to express themselves or often even make it to school because of water collection or diarrhoeal diseases. The environment is also somewhat affected, as there is a large area of wetlands in Uganda that will disappear in time if Uganda goes to that water as a last attempt at gaining water. That wetland environment is home to many animals, including mammals, invertebrates, birds, fish, and the babies and eggs of many of these animals (“Water Scarcity”).

In my research, I found a possible solution that is currently being used: biosand filters. However, as this is a feasible solution and less expensive than more complex technology, it still is not the best for the Ugandan people. Water filters do not remove dissolved contaminants or chemicals, including salt (“Biosand Filter/More Information”). Another less costly water filtration system I researched was the bamboo charcoal filter. However, this system will not filter pathogens and families would need to continue purchasing the bamboo charcoal often. I researched many different filtration systems, but most had similar problems, including not filtering enough daily for a family’s hydration or not removing all of the dangerous substances found in water sources.

I propose that the fundraising sites for water wells and biosand filters continue running, but I believe there’s a better solution to clean water, and this solution is powered by the sun. Materials scientist Guihua Yu and his team have recently made developments to huge, tank-like objects called solar stills. The only previous problem with this technology is that it could not produce enough water in a day for even one person. However, the advancements made by Guihua Yu will solve this problem in a cheap and efficient manner. He used a mixture of three polymers - polyvinyl alcohol, polypyrrole, and chitosan - to make a hydrogel (Service, Robert F). All of these polymers are on the less expensive end of the spectrum, and solar stills can cost less than 240 USD. Solar stills work by condensing saline water into drinking water, and this process works much more efficiently when used with Yu’s hydrogel.

The project would start with Uganda’s rural poor citizens. One of the policies would be that recipients of the solar stills would have to send in a written request. This must be in place for a few reasons. First, they must vouch for themselves and why they should receive the solar stills. It is important that the money raised is going toward those who really need it. This policy is also a necessary one because of the reason that some will not accept charity and would be offended at a gift such as this. Therefore, only those who write a written request would receive solar stills.

Of course, not all families would have the resources or education to be able to write these applications. Assistance from local professors or scholars would be offered. A sense of community is necessary for this to work, as I believe that the assistance should be voluntary as to not take away from funding going

toward the solar stills. I also think that this would be a benefit as assistance from Ugandans who can relate to others from their country would be a comfort for those in need of the solar stills. But before citizens can fill out these applications, they must know about the program and how it could benefit them. Fliers would be hung in areas with large crowds of those who would be in need of the solar stills. These would advertise the program and where to learn more about it. Word of mouth would also be important here to allow the news of the program to further spread. Funding would go toward a willing professor at one of the universities in Kampala so they can educate the public about the solar still project. I think this would be an extra draw for many Ugandans because a free class would be the extra education that many across the globe are searching for.

One of the United Nation's seventeen goals is to provide clean water ("Water and Sanitation - United Nations Sustainable Development"). Another goal of theirs is education for all, and if children in Uganda are kept at home due to water-borne diseases, they would be better able to focus on their schooling. Their final goal is to have global partnerships, including those with civil societies. Because of this, I believe that the UN would proudly manage a project that makes use of saltwater for those who need it most. But, as I mentioned, they have sixteen other goals to focus on as well. All that this project requires from the United Nations is their management in the early stages as well as approval and some help with funding, as this project is sustainable and will not need much further effort once started. Solar stills are long-lasting, as they are powered by renewable solar energy. The funds for the project itself will also be sustainable as when the families are financially stable once again, they will return the money from the solar stills. In that way, it is a loan of sorts.

I also understand that in the account for the solar still project, there must be money toward the installation and maintenance of such large and complex technology. To raise this money, the website organized by the United Nations will have a page for donations. Of course, many websites such as these are ignored, so it will need advertisements. This could be done online, but I believe the best way to begin to advertise is through methods such as posters and visiting schools, as online advertising is a highly overused and common method, and if this project is to raise money, the advertising must stand out. From there, willing individual donors could potentially help with peer-to-peer fundraising. This is a common method where individual donors set up their own sites for peers to donate to rather than all the funding going to one site. Of course, possible donors must be cooperative and willing to give money for a greater cause. To convince potential donors, marketing could include that once this project helps those in countries lacking clean water at the moment, solar stills could also benefit those in the United States. By 2025, two-thirds of the earth's people could face a global water shortage ("Water Scarcity"). 96.5 percent of the earth's water is saltwater, and 71 percent of the earth is water. If we make use of this water through solar stills, water would be available for much longer, so our world could continue running, all through the use of simple, solar-power technology.

In summary, Uganda is a landlocked country with roughly 27,130,670 people that lack access to safe drinking water. This is not just a number - a lack of safe drinking water minimizes successful education, representation for marginalized populations such as women, and the economy of Uganda as a whole. But

this is only a small portion of the global water crisis.

It's time we start utilizing saline water and the sun to improve living conditions in Uganda... and our world as a whole.

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