Solar Distillation: A Sustainable Solution to Climate Change's Effects on an Impoverished Community

Clean drinking water is essential for human life. Human civilization has based its needs around its diversity and importance to life for millennia. However, in coastal Southwestern Bangladesh, saltwater has begun to intrude into the freshwater delta, turning the rivers' water brackish and salinizing a majority of the fresh water in the area. The brackish water soaks through soil and into underground aquifers that the people use as tube wells to supply clean drinking water.

This problem is caused by sea level rise, one of the products of Global Warming and Climate Change. CO_2 traps sunlight in the atmosphere, retaining heat that melts ice caps around the world and slowly raises the sea level ("Sea Level | NASA Global Climate Change."). It is also caused by that same trapped sunlight warming up the oceans, and because of thermal expansion, the water expands and raises the water level (US Department of Commerce, and National Oceanic and Atmospheric Administration). The rising layer of water in the Bay of Bengal slowly creeps up the delta and into the rivers, turning their freshwater brackish. It also enters the soil and seeps through the limestone layer into the groundwater. As a result, it leaves people in rural parts of the area, especially where there is no pipe system or treatment facility, with minimal fresh drinking water.

While conducting my research, I saw that the main problem is not that people are lacking drinking water, but that they are still drinking the salinized water from the tube wells. This is because most people in the region live in rural parts of Bangladesh, and since saltwater intrusion is most common there, their only options are to either go hundreds of miles inland to urban cities to collect drinking water or to drink the water they have in their villages and ignore the health

problems. Their poverty prevents them from being able to afford a vehicle and go comfortably to the large cities for water, so they choose to drink the salinized well water.

Entry of saltwater into the wells salinizes the water, causing excess dehydration, hypertension or high blood pressure, and pregnancy complications for over 20 million people in rural areas who drink the water (Shetty). It raised the salt to water ratio 20 parts salt per 1000, and the human body can only tolerate 5 parts to thousand ("Syful Islam in Dhaka"). In addition, saltwater has also begun to travel up the rivers, which most people in the area use for farming. This combined with saltwater infiltration into the soil has caused major agricultural damage in the region. It created malnutrition problems for many villages in that region, especially for smaller islands slightly off the coast of Bangladesh (Alam, et al).

The most common and rewarding way to get rid of salt in water is to use desalination methods. There are different ways to desalinate water, though not all of them are sustainable or efficient. A common solution to overly salinized water that is also used a lot by bottled water companies is using reverse osmosis plants, which involves running the salt water through a partially permeable membrane, expelling the salty brine and purifying the leftover water (Tularam). This method is effective, but it has many drawbacks. Negative effects of the treatment of the semipermeable membrane with harmful chemicals and the expulsion of the saline brine into nearby oceans highly outweigh the benefit, and there are other ways to desalinize water more sustainably. While researching other methods for desalinization, I found that a more sustainable and thorough method is to use the process of distillation, namely solar distillation, which would use solar power. It involves boiling the saline water, catching the steam from it, and allowing it to condense into water that is almost void of impurities. This process is effective, sustainable, and does not require much maintenance or many people to run it.

To solve this problem, I would establish moderately sized desalination plants that would use regular and solar distillation as their primary method for desalination. I would have one placed every 100 kilometers, each being slightly inland from the 580-kilometer coast. That way, the plant can desalinate enough water for a smaller community and keep it running daily without much problem. It would also be faster and more efficient for the people if they have a problem, as it is a few days' journey on foot, a few hours by driving, and a few minutes on the phone. Water delivery would be much more efficient, with cars being able to dispatch from the desalination facility and distribute thousands of gallons of water to the rural villages each week. I will also spread the word about these treatment plants, so people will stop drinking contaminated well water and being further harmed by it.

I plan to acquire the money for this project by sending a grant of around $20,000,000 to BRAC, a non-government organization based in Bangladesh. About $3,000,000 would go towards the construction of the pipes throughout Southwestern Bangladesh, which require intensive labor and material. About $10,000,000 would go towards the construction of the treatment plants because my plan is to build several smaller plants, which cost around $2,000,000 each to build. It also requires laborers to construct the buildings. Around $4,000,000 would be used to pay all the laborers, as well as the maintenance workers for the pipes and treatment plants. The final $1,000,000 would go towards spreading the word about the health problems with drinking overly salinized water, raising awareness and decreasing the negative effect on people.

Saltwater intrusion is a smaller issue affecting people in patches across the world. However, ignoring it for too long will cause its damages to double in size and lead it to becoming a leading problem for the world's coastal peoples. Many people in Bangladesh suffer

from the loss of their clean water, and with implementation of proper water treatment facilities, I believe solar distillation can apprehend it and set a baseline solution before it becomes a major concern.

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