Solar-powered Water Purification and Community Development in Haiti's Artibonite Valley

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ABSTRACT:
In May 2017, the Project Haiti team of two faculty and eleven students from Embry-Riddle Aeronautical University, Daytona Beach, Florida designed and installed a solar-powered water purification system in the village of Drouin, Artibonite Department, Haiti. This region has been at the epicenter of the post-2010 cholera epidemic that has infected hundreds of thousands and killed many thousands. There has been no reliably safe drinking water in the region. The Haitian operators were empowered with ongoing maintenance and operation of the system, and micro-business operations. Partnership with Haitians and the long-term partnering NGO (non-governmental organization) is a critical enabling aspect that improves sustainability of this community development effort.

HYDRAULIC SYSTEM DESIGN
As specified by the partner organization, the hydraulic system was designed to purify at least 1,500 gallons per day while limiting the amount of consumables needed to run the system. Figure 3 shows the three stages of filtration in the Drouin purifier.

1. The first two stage consist of Helix Sediment Filters that remove particles like sand and dirt that are larger than 0.0001 microns (Stage 1) and 5 microns (Stage 2). These filters are ideal as field-serviceable and require no replacement cartridges.
2. The third stage is a reverse osmosis membrane that removes particles larger than 0.00001 microns. As shown in Figure 4, this includes all remaining contaminants (viruses, spores, protozoa, bacteria, and salt).

WATER QUALITY TESTING
Microbiological tests were performed on water samples from three locations: Owazis packaged drinking water sold locally, the main community water source (Artibonite River), and Project Haiti’s Cool Blue Water. These sources are shown in Figure 5. Each sample was subjected to three tests indicating the presence or absence of bacteria. Results are shown in Table 1, it was determined that only the Cool Blue Water was safe.

COMMUNITY HEALTH TRAINING
Those in Drouin and most in the Artibonite region are fully aware of their low water quality but have no other choice. Having access to clean water is vital, but understanding its appropriate use and centrality to basic health is life changing.

MICRO-BUSINESS IMPLEMENTATION
One of the most important elements to the success and sustainability of the project is the launch of a micro-business [shown in Figure 6]. The purified water produced is sold at no cost to the school, and additional water produced bottled in culturally appropriate bottles and sold at a minimal cost. Proceeds from sales support:
- System maintenance costs
- Operator salaries
- Teacher salaries
- School costs

CONCLUSION
The Embry-Riddle Project Haiti team provided:
- Sustainable Technology and Training for improved health and quality of life
- Micro-business framework supporting education and local economy
The Embry-Riddle Project Haiti team gained:
- Hands-on engineering experience solving real issues, with real people, within real constraints
- Global perspective and greater appreciation for how critical education is to improving quality of life