Concept Paper

AguaClara Concept Paper

Overview

AguaClara is a Cornell University project that is improving drinking water quality through innovative research, knowledge transfer, and design of sustainable and replicable water treatment systems. AguaClara water treatment plants are designed to treat turbid surface waters at the municipal scale. They are built by local labor using local materials, and they are operated without any electricity. AguaClara partners with local institutions, who build, operate, train, transfer, oversee, and monitor the water treatment plants to ensure long term sustainability. AguaClara plants have a one-time construction and capacity-building cost of less than $20 per person served. The annual fee for operation and maintenance is approximately $2 per person.

The Challenge and the AguaClara Niche

Diarrheal diseases, mostly from unclean water, claim the lives of approximately 5000 children throughout the world every day. Drinking untreated water and using it for bathing are major causes of waterborne disease. When coupled with basic sanitation, access to sufficient safe drinking water reduces this toll dramatically (UNICEF, 2005).

Many municipal water treatment plants in the Global South have been inserted by developed nations. They are not sustainable when operated away from their normal supply chains, trained technicians, and capital investments, and it is common to see these plants sitting unused or broken in cities with unsafe water. In the communities that are capable of maintaining the complex machinery and computer systems in these plants, there is often a massive debt between the utility and the electric company.

AguaClara technology is an innovative way to bring economy of scale to water treatment, while maintaining simplicity of design that can be sustained even in impoverished regions. The AguaClara plants require no electricity and all repairs can be completed with local materials and labor. Plant designs are robust and scaled to meet the projected need in each community for years to come. The project also provides sustainable designs to cities and villages with smaller populations that often do not receive municipal treatment in Honduras.

Point of Use Treatment Systems

Point of use (POU) drinking water treatment systems recently have become a favored solution among many development organizations, but the challenges of training every household, the impossible task of monitoring water quality, and the high cost of replacing failed units have led to the renewed realization that appropriate municipal-scale water treatment systems could provide a more sustainable solution. POU systems may be the only viable option in rural communities or areas where water scarcity makes managing a distribution system difficult, but they are not necessarily cost-effective in villages and cities where there is access to a regular water supply.

POU technology is more expensive per liter of water treated, it treats only the water used for special purposes--~~rather than all water entering a home~~--and it is often unobtainable by the poorest members of a community. Many households using POU treatment do not receive intensive training with their systems, and it is not uncommon to see these small systems used inappropriately. Working at the municipal scale provides a solution to nearly all of the concerns raised regarding POU water treatment.

Municipal Scale Treatment Systems

A series of shortcomings has prevented municipal water treatment plants from becoming a widely supported tool for meeting the Millennium Development Goals. Engineers view each municipal-scale installation as a custom design, and the resulting engineering costs often exceed the construction costs for small water treatment plants. The conventional solution to these high design costs has been to rely on imported package plants, which often become unused shortly after their inauguration, as explained above ("The Challenge and the AguaClara Niche"). The lack of empirical experience or a theoretical basis for designing water treatment plants for populations of less than 50,000 has forced a reliance on generic packaged designs that use electric power and imported components. This lack of knowledge about processes for small communities is what has driven the AguaClara team's work.

Our Successes

To make our plants successful, the AguaClara team works hard to address each of the shortcomings with municipal water treatment theory and practice. Our strategy to reduce the engineering design costs is to both publish our design algorithms and create an automated, web-based, design tool that will enable partner organizations to obtain detailed design documentation. These downloadable designs will include 3-D CAD drawings of an AguaClara plant that are customized to the local materials that will be used for constructing key features.

The team has developed designs for municipal plants that are economical to construct at only $20 per person served for construction and start-up, plus $2 per person per year for operations and maintenance. These designs are based on fundamental fluid mechanics and ongoing research. The team has invented a gravity powered chemical dosing system that delivers a precise flow rate of coagulant and chlorine, two chemicals that are necessary for reducing turbidity and disinfecting water. The chemical dosing rate can be easily set by a plant operator based on influent water turbidity, which removes the need for electric pumps used for dosing in most other plants.

AguaClara has already proven to be successful at treating turbid surface water on the municipal scale. Working with Agua Para el Pueblo (APP), a Honduran NGO, AguaClara has designed water treatment plants that are working effectively and providing safe, clean water to 2000 people in Ojojona, and 3500 people in Tamara Honduras (sponsored by Rotary and the Sanjuan fund). Our largest design to date is a 2000 L/min plant for 5500 people in Mar cala (sponsored by IRWA with construction supervision by IRWA and ADEC). The newest plant, for Cuatro Comunidades with a population 2000, is just coming online. This brings the total number of people served by our technology up to 13,000.

Our Goals

Having shown that the AguaClara technology is successful in Honduras, we plan to continue expanding throughout Honduras and to begin extending to other countries in Latin America. Our long-term goal is to secure partner organizations around the world that can oversee construction and fundraising for treatment plants in their regions.

Our first priority is to establish a truly robust and sustainable base with our partnerships in Honduras. Currently our central partner, Agua Para el Pueblo, will need to secure financing of approximately $160,000 over the next two years to meet this goal of stability. Our growth model emphasizes a South-to-South spread with strategic North-to-South collaborations. This model is the most sustainable for AguaClara because it utilizes the capacity of our partners to share their firsthand experiences working with our designs, and it provides new sites with a network of local supporters. Our reliance on local capacity building is the main driver behind fundraising for AguaClara operations in Honduras. When our partners in Honduras are secure and our Cornell laboratory is well funded, then we can begin expanding AguaClara along lines of global partnerships.