PROJECT SUMMARY

Clean Water for the World is a non-profit organization that began based on work that Prof. Bill Larsen (RIT Civ. Eng. Tech, retired) and Sarah Brownell did in 2000-2001 to modify a manufactured UV system that was originally made for the US boat and cabin market for use as a community water system run by solar panels in rural Haiti. Clean Water for the World was started to improve the design of the system, fitting most of the components into a wooden box that doubles as a shipping container, and increase distribution to Haiti and other countries. Their design costs about $700 and can be built with simple parts and tools. Their systems have already been given away to numerous communities in Haiti and Nicaragua with the requirement that treated water be given away for free. The current system is set up for community use as it is intended to provide for 50-100 people.

ADMINISTRATIVE INFORMATION:

Project Name:	Improving the Clean Water for the World UV Treatment System	Faculty:	Brian Thorn, Andres Carrano, Benjamin Varela
Project Number:	*(Leave this field blank, so that a number can be assigned when the project is launched)*	Industry Guide:	Sarah Brownell
		Project Customer:	Clean Water for the World
		Project Sponsor:	Clean Water for the World
Project Track:	Sustainable Water Systems	Project Budget:	
Project Family:	UV Water Systems		
Parent Roadmap:	Sustainable Water Systems		
Planning Term:	Fall 2010		
Start Term:	Winter 2010		
End Term:	Spring 2010		

PROJECT CONTEXT:

Following areas of improvement that would be tackled by the Multidisciplinary Design Team:

- Generally reducing manufacturing costs, possibly incorporating Design for Manufacture.
- Redesign of the shipping container and UV housing, using lighter/cheaper/more compact materials
- Design for reducing insect sabotage (cockroaches took down one of the UV units by eating off the wires insulation and causing a short)
- Improving the current power system to be more cost efficient as the batteries are golf cart batteries which cost up to $220 and often only last 3 years.
- Improving the user interface and ease of completing cleaning and maintenance steps, including a modular design to solar panel maintenance and hook-up.
- Designing in incentives for the operator to keep the unit running. Clean Water for the World requires that the water be given away for free, which means the operator must volunteer to provide their community with water, do maintenance, and replace parts for free. Some people are willing to do this, but over time may let the system fall into disrepair or use the solar panels and batteries for other things. Adding more solar power to the system to provide a combined water treatment and cell phone charging station in one box could provide a cell phone charging micro business which gives the operator incentive to keep the UV working well.

Design ideas can come from previous senior design team, P07402, which created a UV water cleaning device that runs off of the power grid or a solar power option. The project is part of the roadmap for sustainable water systems, R11007, and in particular the path of bacterial cleaning. The roadmap and senior design project information can be found on the edge.rit.edu website.

PROJECT HOUSE OF QUALITY:

Sustainable Water

	Cleaning					
Number of different harmful contaminants filtered						
Number of environments it can work in (ex. Desert, ocean, jungle, tundra, etc.)	+ +					
Turbidity of the water (ex. Appearance, clarity, palatability)		+				
Amount of harmful biological contaminants	+ +	+ +				
Amount of harmful chemical contaminants	+ +	+ +				
Amount of harmful mineral contaminants	+ +	+ +				
Amount of water which can be stored		+				
Shelf life before contamination		+		+ +	+ +	
Input flow rate		+				
Output flow rate		+				
Flow rate (internal to distribution system)						
# of customers						
Distance covered						
Indication of working vs. not working, including early warning				+	+	+
Measures the amount of flow through system						
Budgeting or Rationing of Supply						
Number of sources which can be collected from (ex. Flowing, Standing, Water Vapor , Rainwater, Animal Waste)						
Input flow rate						
Output flow rate						
Spec	a.1	a.2	a.3	a.4	a.5	a.6

Our mission is to provide compelling solutions to the problem of sufficient, accesible, economical, and sustainable potable water supplies for the world's population.

VOC - Affinity Groups	CO #	VOC - Customer Objectives	Customer Weights / Preferred Direction	Number of different harmful contaminants filtered	Number of environments it can work in (ex. Desert, ocean, jungle, tundra, etc.)	Turbidity of the water (ex. Appearance, clarity, palatability)	Amount of harmful biological contaminants	Amount of harmful chemical contaminants	Amount of harmful mineral contaminants
				Up	Up	Down	Down	Down	Down
Economical	1.1	Supply water that will not exceed 15% of gross income and considered completed once below 5% of gross income.	20.0%						
Sustainable	2.1	Use a device that is compatible with multiple water sources.	20.0%	1	9	1			
	2.2	Minimized educational requirement for safe operation and environmental responsibilities.	20.0%						
	2.3	Incorporate a concise and well organized structured action plan.	20.0%						
	2.4	Utilize environment specific sustainable power source.	20.0%		9				
	2.5	Have products readily available where required and needed.	20.0%		3				
	2.6	Ensure processed water is maintained at its cleaned condition.	20.0%			1	1	1	1
Sufficient	3.1	Own a device to meet consumption demands (2 liters/person/day).	60.0%						
	3.2	Own a device to provide safe and clean drinking water (palatability (taste, smell, clarity)).	60.0%	3	3	3	3	3	3
	3.3	Available testing methods to substantiate cleanliness.	60.0%				3	3	3
	3.4	Device desingned for storage and water cleaning that is robust to damage.	60.0%	3	3	3	3	3	3
Accessible	4.1	Strong societal support to assist with producing clean sustainable water.	0.0%	3	3	3	3	3	3
	4.2	Operate a device that has simple usage.	0.0%						
	4.3	Operate a device that requires time efficient maintenance.	0.0%						
	4.4	Limit collection time to fit within the range of 50% to 5% of current collection time.	0.0%						
	4.5	Modified water transportation that requires less human effort.	0.0%						
			Measure of Performance	#	#	NTU	ppm	ppm	ppm
			Nominal Value	0	0	0	0	0	0
			Marginal Value	1	1	0	0	0	0

CUSTOMER NEEDS ASSESSMENT:

Customer Need Number	Stakeholders	Description	Measure of Effectiveness (How will you demonstrate that you have met the need).
1.1	Users of Water, Water Purification Equipment Manufacturers, Dubai (Desalinization)	Supply water that will not exceed 15% of gross income and considered completed once below 5% of gross income	Documentation: Analytical calculate the percentage of average regional gross income to cost of water, to determine effectiveness
4.2	Users of Water, Water Purification Equipment Manufacturers, Dubai (Desalinization)	Operate a device that has simple usage	Documentation: Experiment with a representative group to observe simplicity.
4.1	Users of Water, Charities/Church Groups, Government	Strong societal support to assist with producing clean sustainable water	Demonstration: Analytically calculate support of resources from government, churches, charities, etc...
2.2	Users of Water, Water Purification Equipment Manufacturers, Dubai (Desalinization)	Minimized educational requirement for safe operation and environmental responsibilities	Demonstration: Experiment with users to see how much time it takes for them to learn the required content.
2.4	Water Purification Equipment Manufacturers, Dubai (Desalinization)	Utilize environment specific sustainable power source	Demonstration: Experiment with compatibility of region specific power sources with designed device.

ENGINEERING SPECIFICATIONS:

Engineering Spec.	Derives from Customer Needs	Relative Importance (-,1,3,9)	Description	Measure of Performance	Engineering Units	Marginal value	Ideal Value	Validation Method
a.1	2.1, 3.2, 3.3		Number of different harmful contaminants filtered	Measure quantity of contaminants removed from highly contaminated water source with minimal time allowance.	(integer)			Experimental
a.2	2.1, 2.4, 3.2,		Number of environments device can work in (ex. Desert, ocean, jungle, tundra, etc.)	Measure the device's effectiveness in extremely diverse environmental conditions.	(integer)			Experimental
a.3	2.6, 3.2, 3.3		Turbidity of the water (ex. Appearance, clarity, palatability)	Compare the water conditions under maximum capacity.	(NTU)			Experimental
a.4	2.1, 3.2, 3.3		Amount of harmful biological contaminants	Measure quantity of contaminant removed from highly contaminated water source with minimal time allowance.	(ppm)			Experimental
a.5	2.1, 3.2, 3.3		Amount of harmful chemical contaminants	Measure quantity of contaminant removed from highly contaminated water source with minimal time allowance.	(ppm)			Experimental
a.6	2.1, 3.2, 3.3		Amount of harmful mineral contaminants	Measure quantity of contaminant removed from highly contaminated water source with minimal time allowance.	(ppm)			Experimental

PROJECT INTERFACES:

Must be able to interface to a distribution, storage, or collection unit on the input or output end. Also, be able to interface with a monitoring device that would be able to check the quality of the water and assess if it is drinkable.

STAFFING REQUIREMENTS:

This project will be handled by a Multidisciplinary Design Team of 5 members. It will include 2 industrial and system engineers, 1 mechanical engineer, and 2 electrical engineers.

Position Title	Position Description
ISE	This individual will be working on design for manufacture of the device. They will make sure that it is easy to assemble so that it can be manufactured in mass quantities. This individual should have a good understanding of manufacturing processes and how to design a device for manufacture.
ISE	This individual will be responsible for making sure the device is economically sustainable and doing life cycle assessments of the device. They will also work on the interface to make sure it is easy use for the customer. They should have a background in sustainability and human factors to make sure that the device is easy to use and does not require a lot of training.
ME	This individual will be responsible for coming up with robust, lighter, cheaper materials for the product. Also, be able to make a new housing for the UV cleaning system. The skills required would be a good understanding of the different material options. Also, they should be able to test those materials and make sure that the device is structurally sound.
EE	This individual will be responsible for working with the current solar power supply, linking it into the UV cleaning and making it more efficient. Also, they will need to work on possible other functions that could run off of the solar power that would be useful for the user. The skills that would be necessary would be work with power supply and generation. Also, they will need experience with circuits and being able to make the power supply cheap to manufacture.
EE	This individual will be assisting in the powering of the device. They need to make the solar panel modularly hook-up to the unit so that it can be easily removed and theft can be reduced. Need to have skills with power supply and generation. Also, some design skills that would be helpful in making the power supply for user friendly.

PROJECT CONSTRAINTS:

There are social constraints so that the operator has incentive to use the device and not keep drinking harmful water. Students are expected to understand the social value of the project, along with its effect on people's lives.

REQUIRED FACULTY / ENVIRONMENT / EQUIPMENT:

Describe resources necessary to support successful Development, Implementation and Utilization of the project. This would include specific faculty expertise for consulting, required laboratory space and equipment, outside services, customer facilities, etc. Indicate if required resources are available.

Category	Source	Description	Resource Available (*mark with X*)
Faculty		ISE faculty who have background in sustainability and designing for manufacture. An ME faculty who has background in materials	X
Environment		Open space to do design work and outside space for work with solar energy	X
Equipment			
Materials		Current UV system created by Clean Water for the World	X
Other			