

# Affordable and Sustainable Water Solution for Under-Privileged Communities in India



*“Making a difference, each drop at a time”*

**Faculty Advisor: Atul Wad**

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Xufeng Miao

Dias Diego

Shah Pranay

Choi Tae

Rojo Beitia David

Swingler Mark

Mbaegbu Amaka

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## I. ABSTRACT

India's huge and growing population is putting severe strain on all of the country's natural resources. Most water sources are used on a domestic, industrial and agricultural basis. The quality of the water used is presumed to be the major problem that the people face, but the real problem is the quantity of water supplied. Quite a few organizations have been engaged with supplying drinking water to the community, but still not enough to address the needs of all the different sectors of the community, especially irrigation. In order to increase the availability of water to the people, it is necessary that the people have alternative means of supply of water, and a strong sense of the value of water.

The whole project is about creating a business plan that could serve as an affordable and sustainable solution for the water problem to the underprivileged. The team H<sub>2</sub>OPE strives to bring about change. A change where we could provide a solution which benefits the affected community as well as it can allure investors for the betterment of living standards for the people.

The team, we have been working with are students from Indian Institute of Technology, Roorkee, and would address the issues

concerned with the village of Chharba, Uttaranchal. With resources obtained through research protocols sent to IITR, and through investigation of the village, we identified user needs, and came up with two feasible ideas to tackle the water quantity crisis affecting the village. Our proposals are a portable washing machine that reduces the amount of water and detergent consumed during washes. It also has the added benefit of capturing used water which can be re-used for irrigation either in a small garden or farm after a simple recycling treatment process. We also propose a rain harvesting collector which captures water from the rain, which can be stored.

## **II. Background and Objective**

The primary purpose of IPRO 355 is to develop a socially responsible, economically viable, and environmentally sustainable business plan that provides solutions for the water problem facing the underprivileged communities of India.

Chharba is a small village with a population of approximately 14000 people. The village has a diverse population of people from different castes and religions. It houses around 1500 families. The living standards of people in the village are not very good. More than half of the numbers of families are still below poverty line. Agriculture is the most common occupation, and a few villagers also work in the industries

nearby located at a distance of approximately 10 miles. Our group is also a part of the competition organized by the Acara Institute. Its mission is to develop sustainable business solutions that address the global societal challenges. They are working in developing countries like India, parts of Africa, and parts of Latin America. The objective of the team is to work on a project which deals with affordable and sustainable water supply solutions for the people of Chharba, which can be scaled and used in other developing countries. We are working hand in hand with students from Indian Institute of Technology- Roorkee. The aim of the project is to make a viable business plan that can address the water issues in a village named Chharba near Roorkee.

### **III. ORGANIZATION AND APPROACH**

➤ We have a team of 7 students and 1 professor that worked as one collaborative team during the semester. The following characteristics show the structure of our problem solving process:

- The professor and one team member acted as facilitators and communicators between our group and the team at the Indian Institute of Technology, Roorkee, as well as the Acara Institute.
- Research was conducted by each group member in a team effort based on interests and user needs of Chharba. Special attention was given to the economical, social and environmental

structure of the village.

- The professor supplied guidance and information based on the researched topics by the students and the needs of the Acara Institute in meeting our solution.

- Communication is an important means of collaboration within the group. Email, class time, skype calls, phone calls, meetings outside class and iGroups were the main forms of information transfer among the students and the professor. Team members kept all information transparent by uploading data to iGroups and emailing other team members with pertinent information about topics being discussed.

- A weekly class meeting for approximately 3 hours was the base camp for the group in making major decisions and discussing important matters.

- Problems were solved based on an overall group decision.

- Phone numbers were provided by all students on iGroups for any major conflicts or issues that arose during the semester.

➤ We set out over the course of the semester to develop a sustainable business solution that addresses global societal challenges, with our focus on a sustainable water solution for the people of Chharba, India.

- The team communicated with the Indian Institute of

Technology, Roorkee students to learn about the area, site conditions, culture, and quality of water of the area through well revised research protocols focusing on user needs.

- We researched various methods of product delivery, existing business models, and business applications to help create our business plan.

- Sustainability is an essential part of our solution, so research in sustainability, both in material resources and business, was a large part of our research.

- The team developed multiple solutions that we narrowed down to our current proposals through collective brainstorming, research conducted in Chharba focusing on user needs and demand, and created a cost/benefit analysis.

- We ensured that our business plan fit the balance between social, economic, and environmental profit and benefit.

- We ensure that our proposals are scalable, and can be applied to other parts of the developing world.

## IV. ANALYSIS AND FINDINGS

After constructing a detailed research protocol, and identifying user needs through our connections with IITR students in Chharba, we understood the needs and desires of the people in Chharba, we identified the scope of our project in order to solve the problem of water shortage. We came out with two proposals to address the crisis, which are the portable washing machine and the rain harvesting collector. Refer to water system diagram in Appendix A.

### ● PORTABLE WASHING MACHINE

- Our proposal is based on a product made by The Laundry-Alternative Inc, whose patent expired at the beginning of this year (See Appendix B). We will simplify the design and reduce the manufacturing costs in order to make it more affordable to the people of Chharba. This is a compact container, pressure sealed lid, which is controlled through agitation by hand or by foot (pedal) for 2-3 minutes with hot water and 3-5 minutes with cold water. Our proposal is based on a product made by The Laundry-Alternative Inc, whose patent expired at the beginning of this year. The way the machine works is that when you put warm or hot water into the drum, fit the lid in place and seal the



machine, the air inside the drum absorbs the heat of the water and expand. When the air expands it creates pressure inside the drum. The pressure forces the detergent (which is diluted into the water) into and through the fabric (which is porous) much faster than you could by hand or machine. There are two ways you can rinse the clothes:

1. After draining the grey water with the detachable drain spout, leave the clothes in the washer and fill with clean cold water. Replace the pressure lid, tighten and turn the machine for about 30 seconds. Drain and wring dry.

2. Fill the sink or basin with clean water. Empty wash into sink and agitate by hand.

Our main idea is to re-design a more efficient portable washing machine and sell it to the families in Chharba. We have constructed a cost/benefit analysis that advocates this endeavor.

## **V. MARKET**

The potential market for washer is the large middle class in India. First of all it will be applied to Chharba and after that, because of its scalability, the market could be expanded to the rest of India. Our market basically consists of rural and urban households, traditional Dhobis (traditional clothes-washers in India who pick up, wash and deliver

clothes to the homes). Dhobis could also use these machines to be able to wash clothes at the home, rather than take them to rivers or wells, as they do now. Rural low income homes could get subsidized rates. Additional markets could include institutions (schools, hospitals, hotels etc.)

According to McKinsey, there were 50 million people that belonged to middle class in 2005 in India. The World Bank stated that there were 264 million people of middle class in 2005. In accordance with CNN-IBN, there were 200 million people of middle class in 2007. In addition to this, McKinsey data estimates 30% population growth over 20 years.

Though the middle class is an important market, they have the purchasing power to afford more expensive machines currently in the market (LG, Samsung etc). We plan to target this market initially in Chharba and the surrounding region as a means of market entry, demonstration and to establish visibility and credibility. Research shows that lower income consumers in India aspire to own products that are being used by the upper and middle classes-though they do not have the income to afford them.

Our goal is to offer them a solution that works well, and that they can afford within their incomes.

This is our strategy, and is based upon the very large potential market for this product in India, and other emerging markets. In India alone, the rural population is approximately 700,000, most of whom are

poor. If we can achieve a 5% market share of the low income people (490,000 people) our gross revenues could be massive.

## **VI. Marketing Strategy**

Our Marketing Strategy consists of 4 parts which are the following: Characteristics of the product, Distribution, Sustainability and Advertising.

### **1. Characteristics of the product,**

First of all, our Product is a low priced non-powered, light weight product. It operates in a really simple manner. The maintenance costs are minimal and its functionality it is really valuable, especially for the middle class.

### **2. Distribution**

The second part corresponds to distribution which will involve employing the services of middlemen to assist in door-to-door sales and advertising. This is also a major advantage for us because there are several sources of middlemen in the village of Chharba. We would also create partnerships with local biodegradable detergent companies that will help advertise our product to the masses.

### **3. Sustainability**

Sustainability is the third part of our strategy. The portable washer is a 'green' product. It will enable water collection and recycling for rural

household use. OUR PITCH: “we can make a direct and significant impact to improve rural water system” by saving the water from laundry and reuse it for other household purposes. With regards to the quality, we aim to reduce the impact of chemicals (laundry effluents) on underground water which would improve health quality because fewer chemicals would be used in water saved for irrigation. Macro environmental impact (water table, deforestation etc), education and user awareness of water issues is also essential. We might have periodic replacement of the mobile parts available locally (1 year guarantee). The washer can be scalable for other parts of the developing world.

#### **4. Advertising**

The last part of our marketing strategy is low cost advertising through newspapers and billboards as well as mail promotion. In addition to this, we will be publicizing the savings and benefits. As discussed before, middlemen will help heavily with door to door advertising. It is also our goal to educate people about the environmental benefits

#### **Key factors for competitive success for the washing machine**

##### **1. Industry factors**

As a whole new business in India we have no competitors since one

of the main techniques is washing stone, with negative consequences for the environment and the other technique is electric washing machines focused on up-market. Considering the last one, there are four different types of electrical devices offered in India: Fully automatic machines, semi-automatic machines, front loading washer and top loading washer. The mayor players for these electrical washing machines in India are LG with 27% of the market share, Whirlpool with a 17% share market and Samsung with a market share of 14%.

Our competitive advantage is the low price, the simplicity of the device, as well as the fact that it does not use electricity; it is a portable device and saves water. See Appendix C.

## **2. Environmental factors**

As we presented above, the high increasing rate of the population of our target customers is forming a better situation for our products. The demands of household products are also increasing proportionally with the population.

The economy of India is the fourth largest by purchasing power parity (PPP); the market is in a high spirit. Moreover, the cheap labor force will highly decrease the cost of our products.

See Appendix C for comparison with other current means of

washing in Chharba and the rest of India. See also Appendix C for five-year projected cash flow for wonder wash.

### **Obstacles and Risks**

Our first obstacle for the washing machine will be achieving the price point for low income residents over time. Another obstacle that we could be facing it is the fact that it is not easy to implement a new technique due to cultural resistance to changing traditional washing methods (the possible resistance from the dhobis could be a risk to take into consideration). Also, the simplicity of the device makes it easy to copy.

### **● RAIN HARVESTING COLLECTOR**

The rain harvesting collector is a simple system that collects rain water and is a low cost, low maintenance solution aimed at households. It consists of gutters that will be retro fit to the perimeter of each roof in order to direct the rainwater into a collection barrel and cistern on the ground. The gutters can be constructed of local materials such as bamboo or PVC. See Appendix F.

Our customers will be the villagers of Chharba and beyond.

In order to implement the rain harvesting collector a Rainfall study about the region of the village is required. Appendix shows that June, July, August and September (Monsoon season) are the months that

provide the most amount of water, around 80% of the total rainfall in the year. The data shows that it rains approximately 90 inches per year. See Appendix E.

The fact that not much work has been done on rain water harvesting in the village, give us an advantage to implement our proposal.

### **Success Factors & Considerations (socio-economic)**

- Self sustaining business
- Profits for the village community through materials and installation
- Focus on local construction materials, local knowledge and techniques, local labor
- Recognize local customs, social structures and habits.
- Consider existing institutional settings (develop institutional support)
- Ensure political commitment
- Involve local stakeholders in design and planning (developing ownership and skills)
- Organize operation and maintenance: simple, local, affordable, low frequency, accessible services
- Ensure proper local training, capacity building
- Secure property laws / ownership; own benefits, motivation, financing mechanisms

- Evaluate capital resources, loans, micro-credits
- Recover costs; make choices based on affordability and willingness to pay
- Respond to actual needs
- Build on co-operation successes in communities

A simple cost/benefit analysis that advocates our proposals is shown in Appendix G

## **VII. Conclusion**

After constructing a detailed research protocol, and identifying user needs through our connections with IITR students in Chharba, we understood the needs and desires of the people in Chharba, we identified the scope of our project in order to solve the problem of water shortage. We came out with 2 proposals to address the crisis, which are the portable washing machine, rain harvesting collector.

Learning from our approach this semester, one major recommendation for a future IPRO team will be to establish a strong line of communication from the beginning with the partner team in India. Next would be to develop a good breakdown and sub-team relationship of the work very early on. Create a research protocol as soon as possible in order to define the user needs. Then proceed to solving the



engineering and design aspect of the project through tests and iterations. A good idea would be to send the prototype to the village in order to get user feedback and expand the team research and design. The next step would be to create a solid business plan to provide services and formulate a supply chain as well as manufacturing, marketing, and sales.

**APPENDIX SUMMARY:**

**A. Water System Diagram**

**B. Washing Machine Proposal**

**C. -Table 1: Comparison of different washing techniques**

**-Table 2: User demographic of various techniques**

**D. Washing Machine - Five years projected cash flow**

**E. Rainfall in Dehradun District**

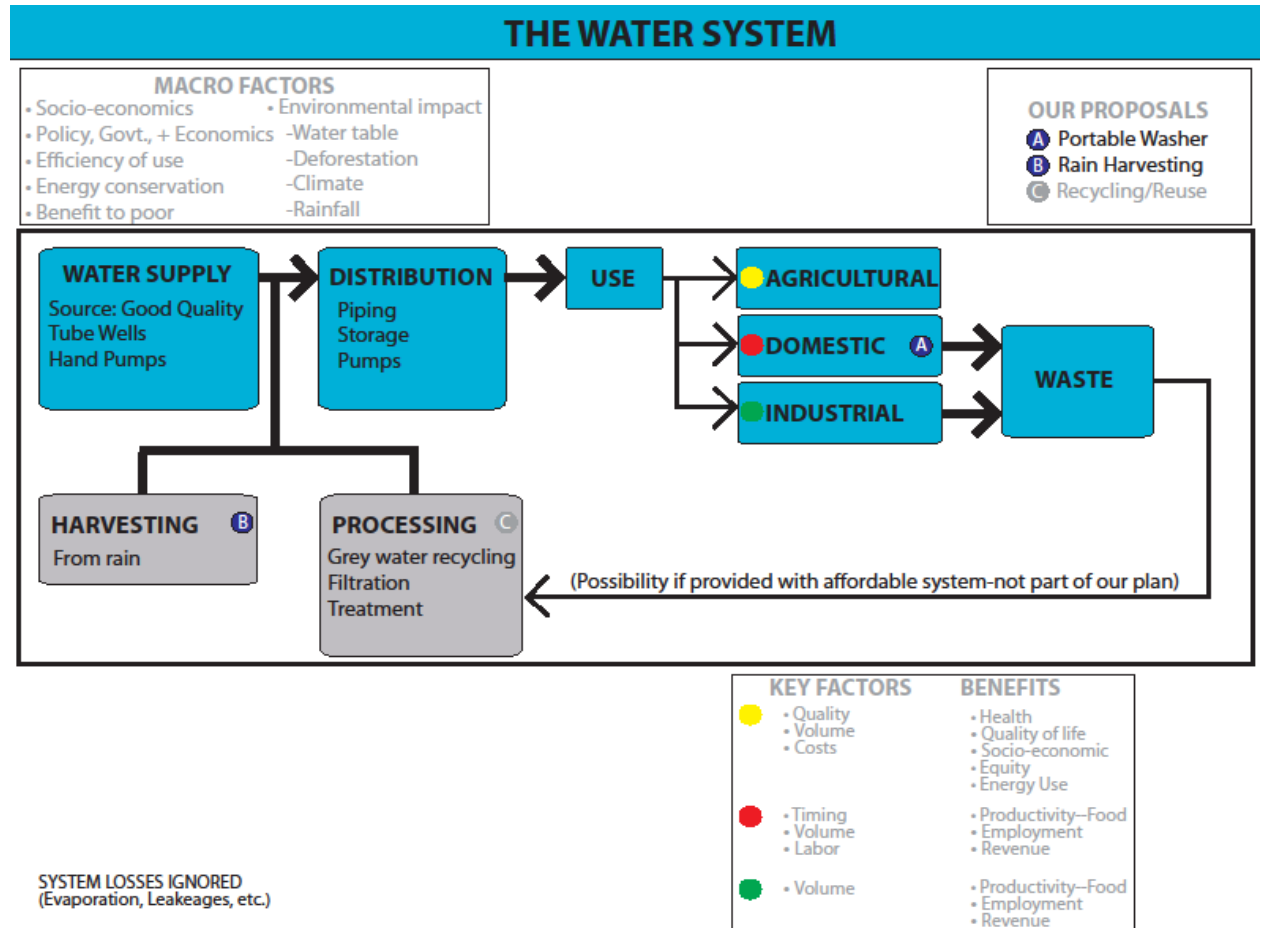
**F. Rain Harvesting Diagram**

**G. Proposed Budget**

**H. Class Roster**

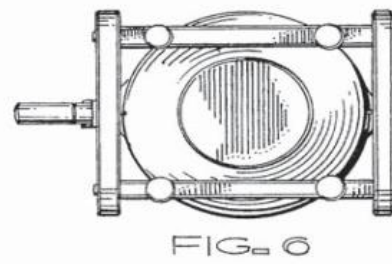
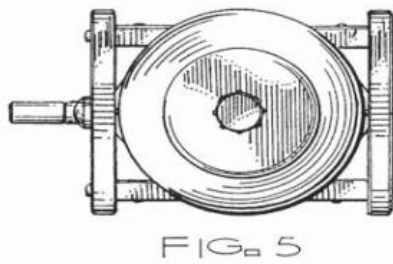
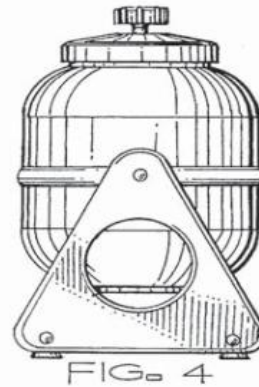
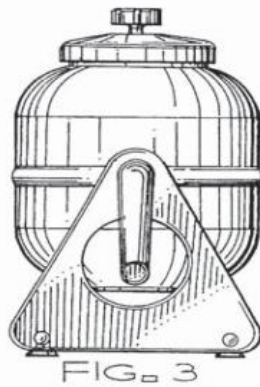
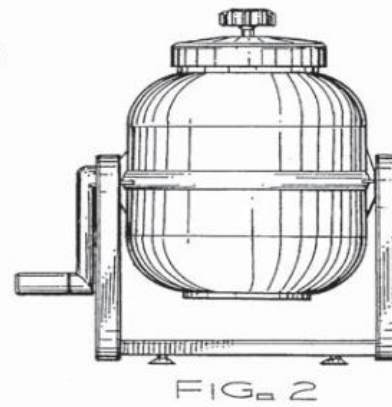
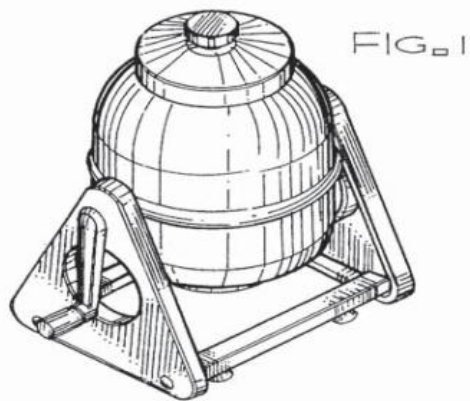
**APPENDIX A**

**WATER SYSTEM DIAGRAM**



**APPENDIX B****Washing Machine Proposal****U.S. Patent**

Mar. 5, 1996

**Des. 367,742**

**APPENDIX C**

Table 1: Comparison of different washing techniques

	Washing Stone	Electrical Washer	Proposed Washer
<b>Price</b>	Outdoors (n/a)	Expensive (+ installation cost) Considered a luxury item.	Affordable (no installation cost). 1/6 <sup>th</sup> cost of local brands
<b>Accessories</b>	Soap bars, bucket	Detergent (high quantity)	Detergent (low quantity)
<b>Size</b>	Large washing stone/surface requires travelling outdoors.	High indoors space requirement	Portable and compact (easy storage after use)
<b>Environmental impact</b>	Chemical effluents flow directly into rivers/ponds. Mixing with water table.	Requires hot water, Huge water consumption, disposal is a burden on municipal facilities.	Cuts down water use by 1/2, detergent by 1/3, and enables easier collection, reuse, and disposal of water.
<b>Convenience</b>	Intensive back breaking labor. Involves exposure to unclean polluted ponds.	Very convenient. Fully automated	Convenient. Requires minimal effort.
<b>Time</b>	Time consuming (inefficient + travelling time)	Average 30-45 mins (10-20 lb load)	3 minutes for 5 lb load
<b>Power</b>	No power	High power requirement. Dependent on gov't for electricity provision.	No power requirement.

Maintenance	n/a	Expensive repair (labor and materials)	Few moving parts. Easily replaced locally.
Macro Factors	Adverse health effect. Low status /undesirable work.	Recurrent expenses, Noisy. Requires instruction manual.	More frequent use required. Easily adaptable as part of daily lifestyle. No learning curve.

Table 2: User demographic of various techniques

	Rural	Urban
Washing Stone/outdoors	Extensive	Majority use (also includes 'under the tap/in bathtub' washing.)
Electrical washer	Not used	Mostly a luxury item. A status symbol. Families with the machine also employ maids or 'dhobis' as it is cheaper.
Proposed 'manual' washers	New product	New product

**Note: We need statistics to back up statements**



<b>Position</b>	<b>-6,041.00</b>	<b>1,589.00</b>	<b>3,178.00</b>	<b>9,011.60</b>	<b>21,077.92</b>	<b>46,241.77</b>	<b>46,241.77</b>
Cost of production per unit		11	10	9	9	8	9

**Washing Machine - FIVE YEARS DETAILED SALES**

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Total
<b>SALES</b>							
Price of Product*		\$	\$	\$	\$	\$	\$
		15.00	15.00	15.75	16.54	17.36	79.65
Sales Volume**		400	560	896	1523	2742	6121
Total Income		\$	\$	\$	\$	\$	
		6,000.00	8,400.00	14,112.00	25,189.92	47,608.95	\$101,310.87

<b>Target market share after 5 years</b>	
Rural Population	700,000
Low Income	490,000
Our Target Share (%)	5
Total Population Target	24,500
Average members per household	4
Total households	6,125

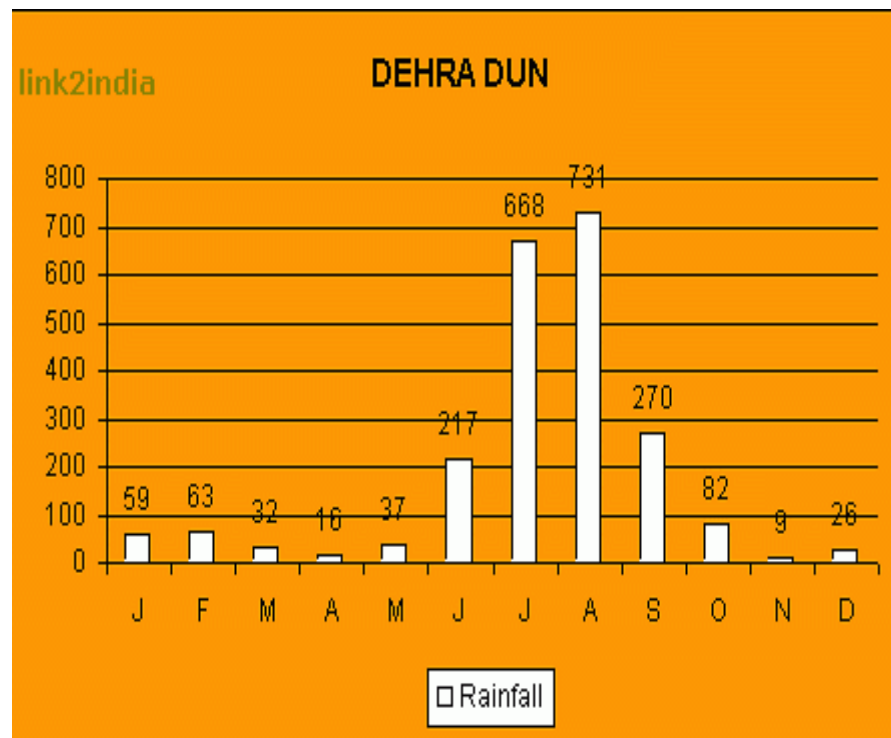
\* Our plan is to have a mixed pricing strategy - higher for urban and upper/middle income consumers, and lower (subsidized) for poorer customers  
 The price shown here is the average weighted price of the product

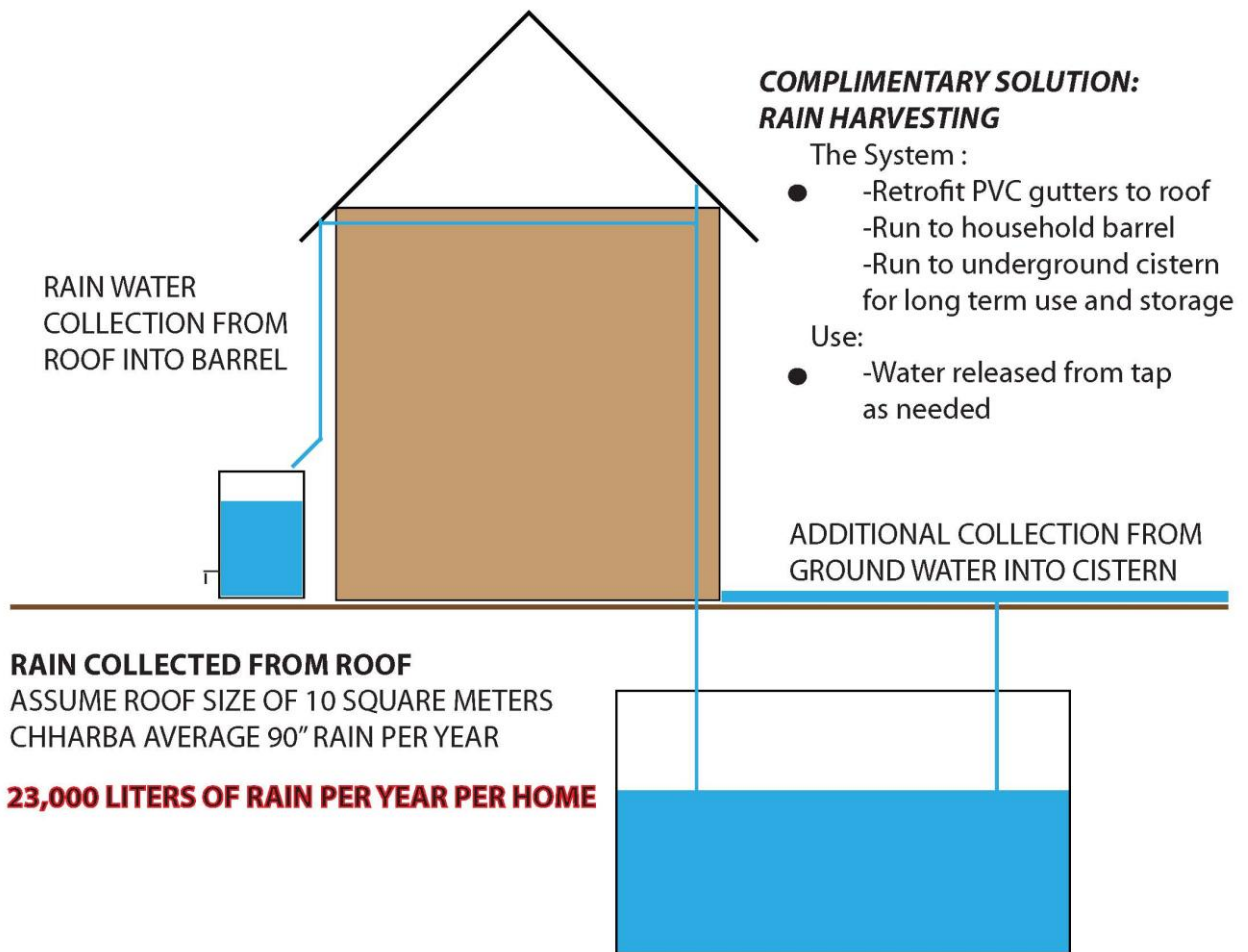
\*\*Sales volume is based on marketing focus on the Chharba region. From year 3 onwards we will expand nationally and expect high growth rates.

The figures do not include inflation

Population growth could affect these projections in terms of total potential market



**APPENDIX E****Rainfall in Dehradun District**

**APPENDIX F****Rain Water Harvesting**

**APPENDIX G**

**Typical domestic water consumption in Chharba and Basic Economics for Rain Harvesting**

Type	Liters / person / day
Cooking	4
Drinking	3
Bathing	15
Laundry	8
Ablution (toilet use)	9
Miscellaneous (cattle)	10

1	Average collector per household per year	23000 (liters / year)
2	Average consumption of water per household (4 people)	5880 (L/month)
3	Rain Harvesting water collected / Water consumption per month	3.91 (month)
4	Cost of water per month	2.25 \$/month
5	Total savings per year	\$ 8.80
6	Cost of Rain Harvesting collector and setup	\$ 10.00

7. The cost of the setup is covered by the 1st quarter of the second year

8. Business can be taken up by local social entrepreneurs or NGO's

**APPENDIX H**

## Proposed Budget

<b>Activity</b>	<b>Cost</b>	<b>Description</b>
<b>Prototype</b>	\$42.95	We purchased a Wonder Wash Machine
<b>Food</b>	\$200	Meals will be provided to speakers and the group.
<b>Printing Supplies</b>	\$70	Finishing costs for Brochures, Posters and other IPRO Deliverables.
<b>Shipping Prototype</b>	\$115	We will shipping a Wonder Wash to IIT Roorkee
<b>Total</b>	<b>\$427.95</b>	

**APENDIX I**

## Class Roster

<b>IPRO 355-Roster</b>		
<b>Team Member</b>	<b>Major</b>	<b>Contact Info</b>
<b>Choi Tae</b>	Architecture	tchoi@iit.edu [REDACTED]
<b>Dias Diego</b>	Business	ddias1@iit.edu [REDACTED]
<b>Mbaegbu Amaka</b>	CHBE	ambaegbu@iit.edu [REDACTED]
<b>Miao Xufeng</b>	Business	xmiao1@iit.edu [REDACTED]
<b>Rojo Beitia David</b>	Mechanical Engineering	drojobe@iit.edu [REDACTED]
<b>Shah Pranay</b>	Biology	pshah95@iit.edu [REDACTED]
<b>Swingler Mark</b>	Architecture	mswikngl@iit.edu [REDACTED]