Business Plan

DRAFT

ENPRO 354

4/30/2010

ENPRO 354

Brian Wolber
Paul Adamczyk
Bonnie Au
Brent Bijonowski
Dan Fanelli
Edlira Hoxha
Monika Krauszowska
Nga Pham
Aamir Rauf
Hannah Schlessinger

Faculty Advisor: David J Mogul, PhD.

The following business plan is the final report of ENPRO 354 for the creation of a non-profit organization named *FreshSea*.

Contents

I. EXECUTIVE SUMMARY

The world is beginning to enter into a global water crisis. The demand for water is increasing with population growth, urbanization, and the emergence of the new global middle class. Supply is going down by factors other than consumption like increased global temperature, changing rainfall patterns, and industrial and agricultural runoff into fresh water sources. The people most affected by all these factors are the people living in underdeveloped countries.

ENPRO 354's solution to this growing problem is the establishment of a non-profit organization, named *FreshSea that* delivers the means of providing water for these communities by means of desalination by reverse osmosis. Our target market would be communities living in underdeveloped countries that live in close proximity or right on a coast line, giving them access to the ocean. The communities would have to be off-grid. Therefore, the reverse osmosis unit would be powered by wind, solar, or a combination of both, in conjunction with a battery used to store the power. Areas of interest to *FreshSea* include Haiti, parts of Central America, and sub-Saharan Africa.

What sets *FreshSea* apart from most other NPO's is that it doesn't create a humanitarian dependence and focuses on coastal communities. Rather than handing out water bottles or drilling wells for inland communities, *FreshSea* would be providing the means for these communities to provide for themselves. A major goal of *FreshSea* is the establishment of strategic partnerships with local governments and other aid and humanitarian organizations that have a presence in the area—someone who better understands the people and the culture. Ultimately, the desired impact here is to improve the standard of living for these communities, encourage economic growth, and ensure social and political stability.

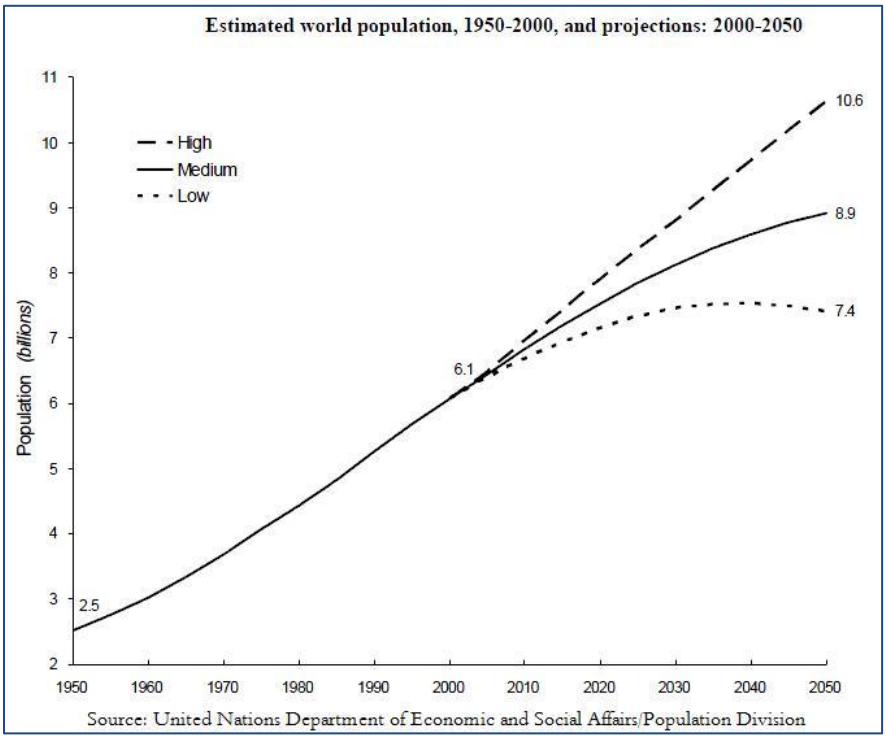
As a non-profit, the organization revenues come from outside sources rather than operations. The organization would be dependent upon foundations, trusts, government grants, and individual donations. Expenses in the first year include the costs to build and field test a prototype and staff pay—even with minimal staffing and lean operations, payroll is the largest expense, accounting for roughly seventy-five percent of expenditures in the first fiscal year.

II. Background Research

According to UNICEF, over one billion people go without access to clean drinking water—that's roughly one in six—and the situation is getting worse. Freshwater is one of Earth's most precious—and finite—resources and is now increasing in scarcity. Global demand for water is expected to increase by over 40% over the next twenty years and is driven by increased populations and urbanization, along with the rise of the new middle class throughout the developing world. Meanwhile the world's supply of freshwater is diminishing from factors other than consumption. Climate change has affected rainfall and induced droughts creating stressed living conditions and increased pollution and agricultural runoff has tainted many freshwater supplies.

Population

As the world's population rises, so does consumption. Roughly 98% of world's population growth is occurring in developing nations, especially China, India, and all throughout the African continent. Even though the world's population growth rate is merely 1.1%, estimates show that by 2050, the population is expected to reach 8.9 billion people.



Many nations already can't meet the demand for water in their country and have resorted to desalination—a method of acquiring fresh drinking water from the ocean—that was always been seen as the last option. Algeria for example is expected to double its population over the next twenty-five years and is currently building utility-grade desalination plants. The quickly industrializing Kingdom of Jordan has experienced a high population growth rate along with a massive influx of refugees from neighboring countries in recent years and is already consuming much more water than can be replenished. Its primary

source of water comes from a body of water that is shared with several other nations. Syria is already home to over 800,000 water refugees.

Urbanization and the New Middle Class

Humanity has spent most of its history as more of a rural species, as opposed to living in cities. There is however a rising trend in the opposite direction—that is, towards urbanization. By 2025 it is estimated that 60% of the world's population will be living in urban areas, compared to 1950 when less than 30% of the world's population lived in cities. The rise of urbanization is due to the increasing world population combined with the migration of individuals from rural areas to urban areas—a problem considering that, according to NASA research on the subject, those in urban areas consume 300 times more than what the ecosystem can provide or replenish.

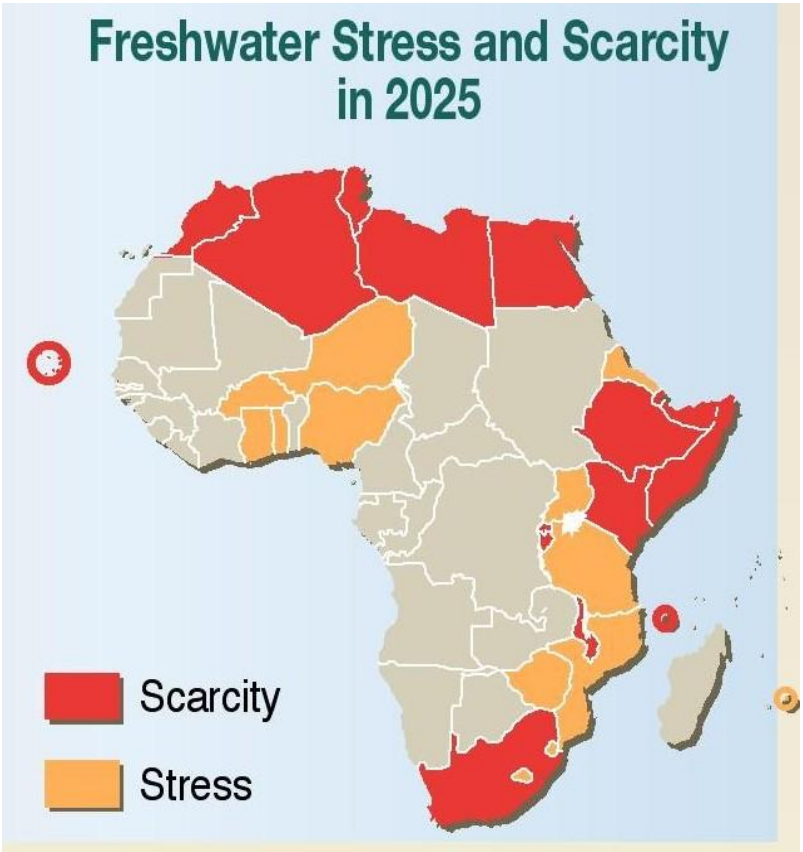
The problem with the rise of urbanization is that it strains a city's ability to provide a wide variety of resources to its citizens while also becoming havens for urban sprawl, environmental problems, and poverty as a result. In the US in particular urbanization is the cause of a wide variety of problems such as increased air and water pollution and destruction of land, while in poor countries cities see problems such as pollution and a lack of availability of basic services.

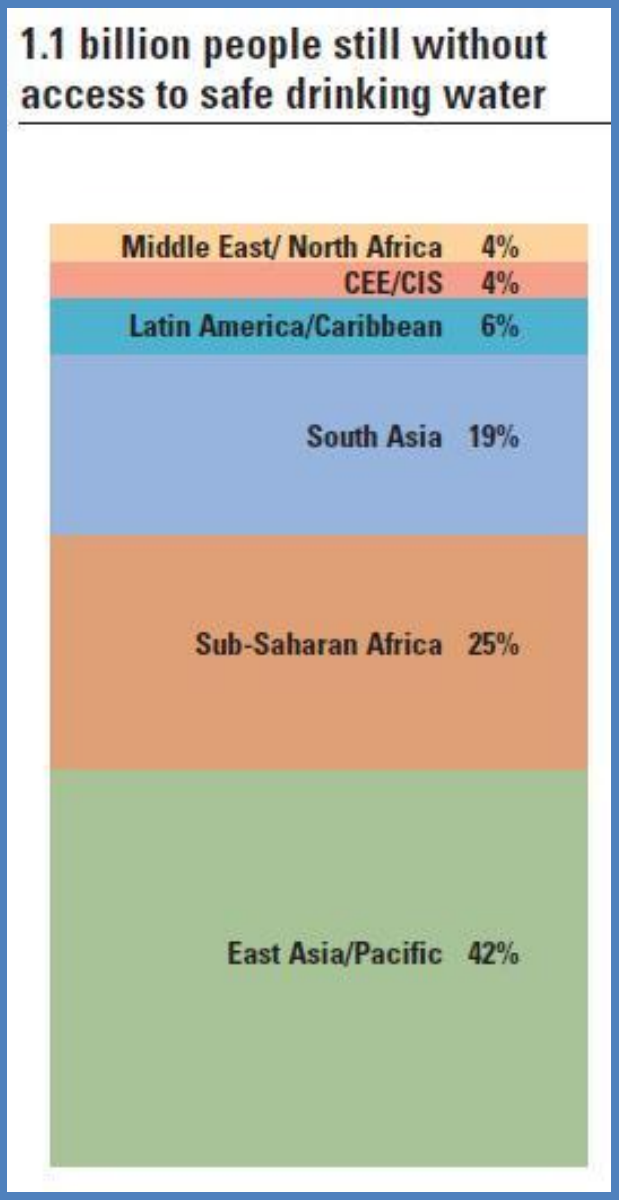
Part of what is driving this increased urbanization is the emergence of a new global middle class, especially in China and India. In fact in a recent article in McKinsey Quarterly, the percentage of the population in India that makes up the middle class is expected to rise from 5% to over 40% over the next two decades.

Climate Change

The changing weather patterns of the world have been substantially affecting the world's quantity of readily available fresh water in the form of melting glaciers, shrinking rivers and lakes, and drought.

The glaciers of the Himalayas play a vital role in providing much of the water for India, China, and the rest of central Asia. Many of the rivers in India and China get their start in the mountains. However with increased greenhouse gas emissions and temperatures, the glaciers of the Himalayas are rapidly melting, leading to flooding conditions in India and southern China. If the glaciers melt completely and are not replenished, the water supply for over two billion people would be threatened—that's practically a third of the world.

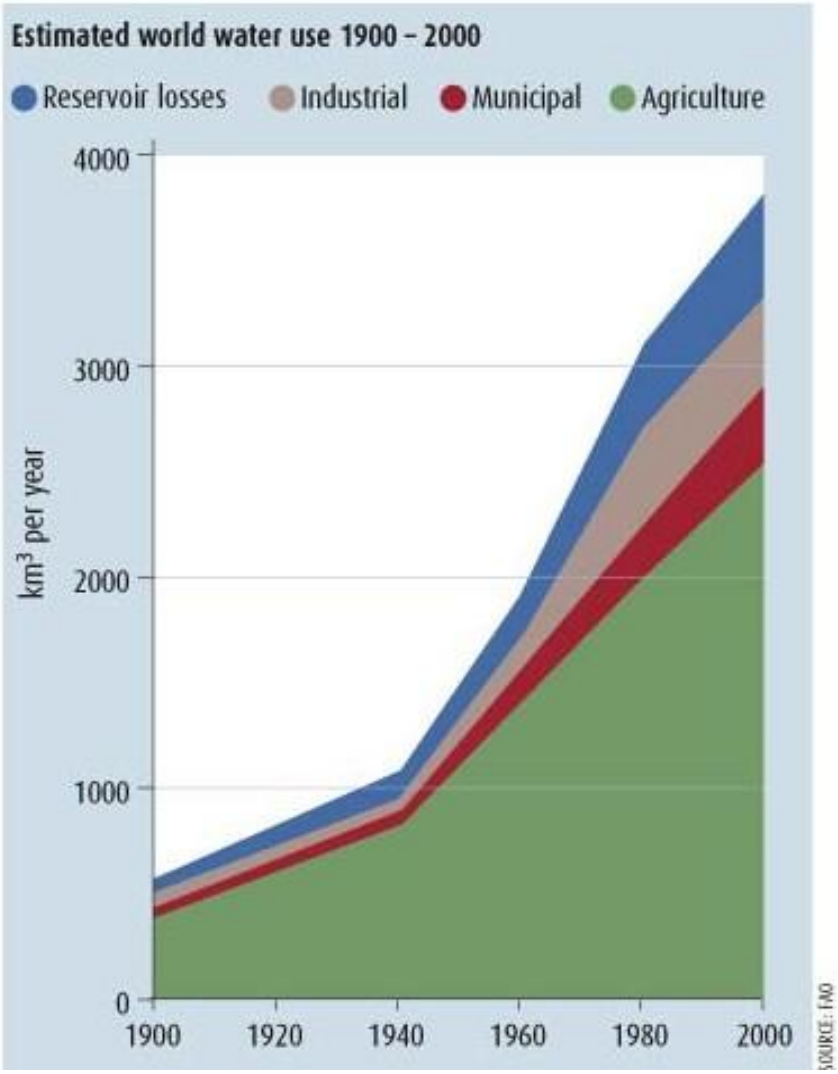




Rainfall

With climate change comes alterations in rainfall patterns. In China, five provinces have been dealing with their worst drought in over century, affecting millions (see appendix D). In India, northern and eastern states have received roughly 23% of the normal rainfall expected during the rainy season. Since last December, over twenty Philippine provinces have been in drought conditions, threatening its export dependent agriculture economy. In Thailand, water reservoirs are down by 40%. In the western hemisphere, Honduras announced on March 23rd of this year

that they are in a state of emergency against drought and famine. At the moment, only half the citizens of Honduras have access to water. Back in Africa, expected rainfall in the west and east never came. This has left over 10 million people living in the Sahel region (between the savannahs and Sahara) with very little food and water. In Niger alone, 8 million out of the 15 million people living there are at risk.

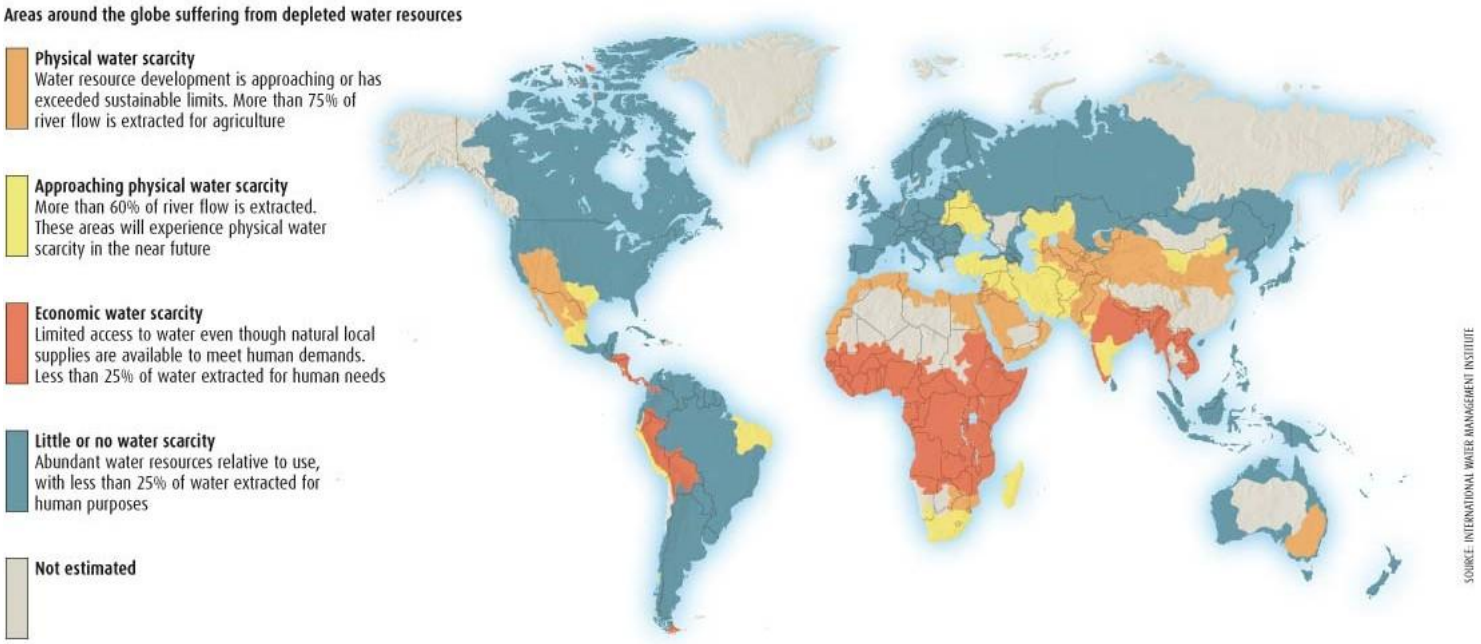


Agriculture and Industry

As stated earlier, we're witnessing the emergence of a new global middle class. As people raise themselves out of poverty, the consumption per person also increases, i.e. a middle class person consumes more food, water, and energy than someone living in poverty. Additionally, many people are now embracing a new type of American dream—rather than moving to America and being successful, they are remaining in their own country and achieving the goal of an American standard of living. People are eating fuller meals and are consuming more food—most notably people are eating more meat. To keep up with demand, farmers have to grow more crops to feed livestock in addition to what is directly consumed by humans. Also, the livestock being bred have their own hefty water intake. In fact, a 1,000 pound cow will consume over 14 gallons of water a day! This trend is largely responsible for what has caused the enormous spike in water demand in recent decades. In fact over 70% of the demand of water now is attributable to agriculture. A major contributor in water scarcity is the polluting of freshwater sources by industrial and agricultural runoff. In many developing nations like China, India, Thailand, and Nigeria, industrial waste flows freely into the local rivers which used to be major sources of local drinking water.

Focus

The people who are most affected my all these conditions and variables are those living in underdeveloped countries. Despite whatever technology or solutions are implemented in the developed and developing world to address their water scarcity, the people living in poor underdeveloped nations lack the resources are means to acquire water. These people and the water scarcity they face will be the focus of this business plan.



III. Organization Description and Summary

To address the dire prospects for the world's water situation, *FreshSea* would be created to help those most affected—people living in underdeveloped nations. *FreshSea* would be a non-profit organization whose purpose is to deliver a means of providing freshwater to coastal communities in underdeveloped countries by desalination.

As a non-profit, our return-on-investment (ROI) does not come in the form of money, but rather is the form of social value—the positive impact that we make on a person's life. Our goal is that someday the poorest people of the world do not go without clean drinking water.

Goals for the first fiscal year of operations:

- Raise $400,000
- Field test a prototype

Our goal for the first fiscal year of operation would be to raise $400,000 in capital and to have a prototype ready for field testing.

Company Logo

As a small start-up, staffing will be kept to a minimum of seven people. In time as funds grow and operations expand, more staff can be hired. The following is a list of the initial position descriptions and responsibilities, along with an organizational chart.

<u>Executive Director:</u>

- Responsible for administrating the organization and reports to the board of directors. Manages firm's day-to-day operations relating to providing the *FreshSea* service of delivering sustainable cost effective desalination units to coastal communities.

Accountant:

- Keeps track of all company funds.

Fundraising Officer:

- Tasked with raising funds and applying for grants; establishing relations with philanthropists, foundations, and trusts; organization and executing fundraising events.

Marketing—Strategic Relations Officer:

- Responsible for establishing and maintaining positive relationships with partner organizations and governments, promoting the firm, and building brand awareness.

Development Officer:

- Finds opportunities for the firm in underdeveloped countries.

IV. Product-Service Design

Our solution to the water crisis in the underdeveloped world is the implementation of a reverse osmosis (RO) desalination unit, powered by renewable energy. It will utilize already existing technologies that have proven themselves in the market place to be reliable and of utmost the quality.

Originally, *FreshSea* had hoped to develop a new, innovative, novel approach to desalination. Further research however showed us implementing a new experimental approach was too expensive, time intensive, and risky.

Since the world's oceans hold most of our water, they shall be the source from which fresh water will be made. The only problem is that ocean water contains large amounts of salt, rendering it not suitable for human consumption due to the deleterious effects of large amounts of salt intake can have on the human body. So, the proposed solution will involve a desalination process that can effectively remove salt and other unwanted contaminants down to concentrations acceptable for human consumption.

The Solution

The best RO unit on the market to meet our goals at this time is produced by an American company called *Rain Dance Water Systems*. The power sources utilized will be wind, solar, or a

RainDance Water System: RDWS-WH-SWRO-2000

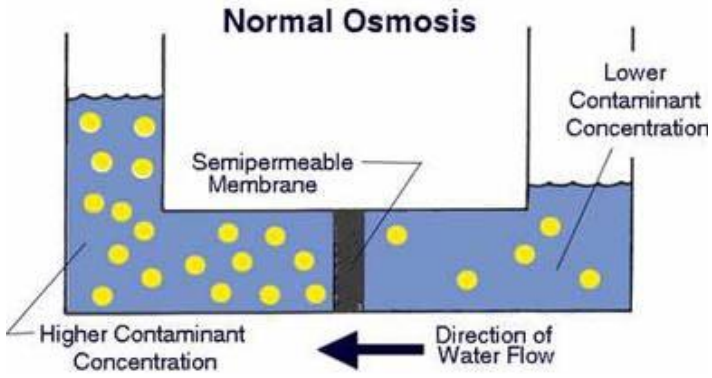
combination of both.

First we will go over the science of reverse osmosis to explain it to the reader and then go into detail on the technical aspects of the RO Unit.

Science of Reverse Osmosis

A detailed description of the reverse osmosis desalination process will follow herein, along with reasoning for its selection. Before reverse osmosis can be explained though, the general principles behind regular osmosis must be briefly described.

Figure 1 Simplified Schematic of Osmosis



If two solutions, one heavily concentrated with salt and the other one consisting of pure water, are separated via a semi-permeable membrane that only allows the passage of water molecules and nothing else, then a natural phenomena, called osmosis, will immediately occur. Osmosis is the passage of water from the pure side through the membrane to the concentrated side of the semi-permeable membrane in an attempt to reduce the difference in concentrations between the two solutions. It must be noted that this process is completely natural and requires no energy input whatsoever. The process is given by the simplified schematic in Figure 1.

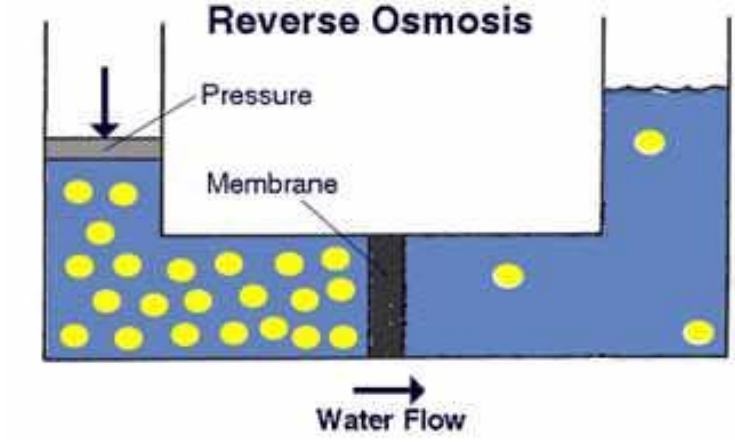


Figure 2: Schematic describing reverse osmosis

Once normal osmosis is understood, reverse osmosis can be explained rather easily. It is a process, as the name suggests, that does the opposite of what normal osmosis wants to do. Instead of water flowing from a lower concentration side to a higher concentration side, the opposite is done: water from the

concentrated side is forced through the semi-permeable membrane to the lower concentration side. The key word here is forced because this process is not natural, pressure must be applied in order to force the water through the membrane to the purer side. This is the scientific basis on how seawater reverse osmosis desalination works. Figure 2 is a visual describing reverse osmosis.

More specifically, reverse osmosis desalination incorporates this concept as its basis for extracting salt from seawater, but the overall desalination process is made up of several steps or stages. The first step is to pump in seawater from some source along a coastline either via surface intake or via a sub-surface intake such as a beach well drilled on site. Next, before the seawater can actually reach the reverse osmosis system, the raw seawater must undergo a pretreatment stage. The purpose of this pretreatment stage is to filter out sand, sediment, volatile organic compounds and to add anti-scalant chemicals to the raw seawater, all with the purpose of preventing fouling of the reverse osmosis membranes and to improve quality of the filtered water. Once this pretreatment stage is complete, the seawater then flows to the actual reverse osmosis process. Here, a high pressure pump, powered by an electric motor, begins to apply immense pressure to the seawater in order to force it through the membrane pores, in the process leaving behind a salty brine concentrate and also producing near pure water, with very low TDS (total dissolved solids) concentration. A look at Figure 3 shows a generalized, magnified image of an example reverse osmosis membrane.

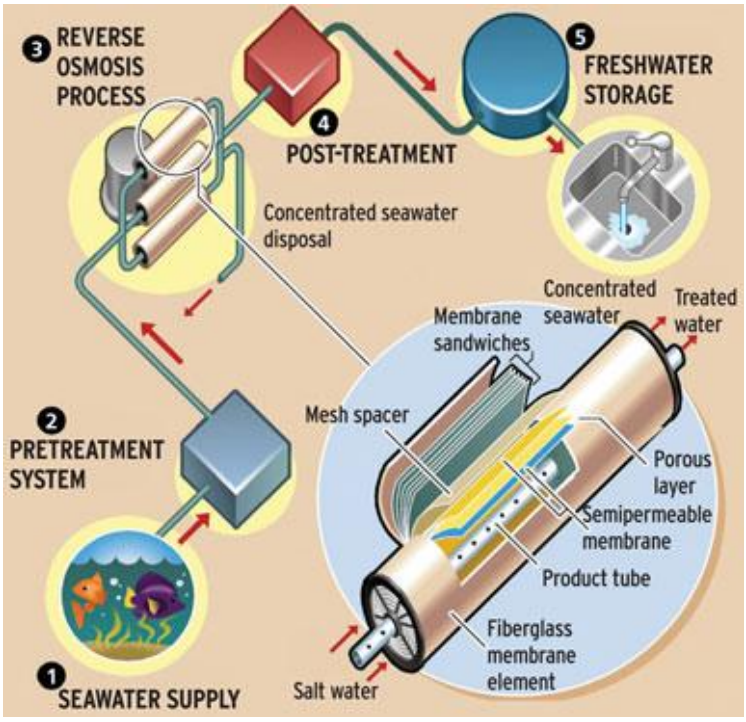


Figure 3

As one can see, the seawater is forced through the outside layers of membrane wrapping until it reaches the core, where it is a hollow pipe that carries the purified or treated water out. Seawater that is not able to be forced through the membranes completely is rejected as concentrated seawater that can be fed back to the source from whence it came. Depending on the type of membrane used and concentration of seawater coming in, recovery ratios, defined as the flow rate of permeate or pure water retrieved divided

by the total or incoming flow rate of seawater going into the reverse osmosis unit, can range from about 10% to 50%. Following the reverse osmosis stage, the water that does make it through the membrane wrapping must now enter a post-treatment stage. A typical post treatment usually involves an ultra-violet light dose that is used to kill off any microorganisms that might have passed through the membrane's small pores. Finally, after passing post-treatment, the purified water is now ready for human consumption and is stored in a convenient storage tank for future use. A generalized flow diagram for a reverse osmosis desalination plant is given below in Figure 3.

Considerations for Design

Before designing a product that can do the aforementioned, the amount of people intended to be serviced with this desalination process and their water consumption needs must be estimated to a relatively good degree of accuracy. This proposed desalination process will be a small-scale system that can put out 2,000 gallon of fresh water in a 24 hour period; however the unit would not be operated for such long durations. Our logic however in choosing this capacity was that if it were operated for such duration, could provide 1 gallon of water to 2,000 people—that's roughly 400 to 500 families. This amount of water should suffice drinking needs and some other minor amenities water might provide them.

The target market's population and the amount of fresh water needed are established, now a design of an appropriate desalination process or desalination unit can commence. Research into what available technologies exist reveals that a plethora of technologies are available to accomplish small-scale desalination. Some technologies are better than others because of many factors that have to be taken into consideration. But the main idea to grasp is that the technologies exist and therefore there is no need to invent or design a new technology; rather, all that has to be done is to choose the most suitable technology for small-scale desalination—one that is mass produced by a company, make slight modifications to it, and then finally implement the finished product upon a willing community in need of fresh, potable water. One more aspect of this product or solution has to be noted. Since this product is a small-scale, global solution, once the product is chosen, tweaked, and finalized, it will be applicable anywhere in the globe because the only factor that has to be considered from location to location is the concentration of salt in the seawater. If the chosen product is built to withstand the harshest seawater conditions, it is safe to say that the product will be applicable globally.

The aforementioned applies to the part of the product that actually desalinates the water and does not apply to the energy technology that is needed to power the product. So, depending on where this product is implemented, there will be a single desalination technology, that is applicable globally, and an accompanying energy technology that is most suitable to the specific

location, because one energy source cannot serve as a global solution to power the desalination product.

Technical Data

For all the in-depth technical data, please refer to Appendix C

Power Source

The communities that meet our target market criteria would be located off-grid. Therefore, the desalination units would require a self-sustainable approach to power generation via renewable energy. The specific power source employed however is dependent upon the conditions, environment, and geographic location of the community being targeted. The *Rainmaker* desalination units would use either wind, solar, or a combination of both.

Solar

FreshSea would use photovoltaic solar panels for areas that have optimal solar conditions and few cloudy days. No particular brand or model has been determined. It will depend upon what deals can be acquired at the time of purchasing. The system acquired however will need to produce at least 3 kilowatts. Financial research thus far has shown that costs will be in the vicinity of $17,000.

Wind

Wind energy will be used in areas that do not receive adequate sun exposure and show optimal wind conditions. The Chinese-made “Everlite” brand has been selected due to its 3km optimal output and affordability. This turbine is estimated to cost roughly $3,000.

The Battery

Key to the enterprise is the implementation of an intermediary battery. The power sources would charge a battery and when people activate the desalination unit, it would draw its power from the battery. For the wind turbine we have examined, a 12 volt rechargeable sealed lead-acid battery is highly recommended.

Considerations for Power Source

We began the search for a power source with the idea that it would be a sustainable, eco-friendly generator. We wanted to use natural resources because, in the long run, this is a cheaper option and it utilizes existing resources (wind and the sun) in the area. While wind power is not a feasible option in some areas, it seems that the places where we want to provide

our service all have good sunlight. We also looked at hydroelectric power. It does not seem to be a good primary energy source because it requires a gradient (hilly or mountainous terrain) to generate the hydrostatic head needed to turn the turbines in the hydroelectric generator. Since we want a versatile system we have decided that hydropower should be used only as an intermediate power source and not to power the pumps that bring water to our reverse osmosis desalinator.

Questions that we addressed in the decision making process are:

- Is it a widely used and well-tested technology?
- Is it easy to maintain and does it have a long expected lifetime
- Will it provide a consistent power supply?
- Can it be installed in a small area and with limited installation costs?
- Is it minimally invasive to the people and their culture?
- Is it cheap?
- Would it be adaptable to the reverse osmosis system?

We decided to rule out a hydroelectric generator, even though it is a very efficient, non-polluting and reliable energy provider. The reason hydroelectric power does not fit with our system is that we want a desalination unit that can be used anywhere and hydroelectric power requires a large hydrostatic head to run the turbine. This head can be found naturally in rivers and streams (areas where water is running down a slope) or made by putting water into a deep tank. Since we are not guaranteed to find a sloped or hilly area and we do not want to add to the cost of our unit by making a giant tank, we will not be using hydroelectric power. Perhaps this will be a viable source for future units.

V. Marketing Plan

Value

What sets *FreshSea* apart from other aid organizations is the product-service combo we provide. Unlike other organizations, we do not create a humanitarian dependence. Our value proposition is that we provide the means for these people to provide for themselves. We're creating a liberation from economic and environmental constraints, in addition to a liberation from outside dependence.

Target Market – Our Niche

There are over a billion people on this planet that lack access to clean drinking water and that number is going to increase as we progress into the 21st century unless the global community changes its water consumption habits. But how many of them actually fit into *FreshSea*'s target market? It is highly improbably that an accurate estimate can be obtained. The conditions that define *FreshSea*'s target market however can be easily defined

Unlike the other aid organizations that provide water by drilling wells or bottled water, FreshSea will target communities that live in coastal areas and provide water by desalination. These communities would have to live in underdeveloped countries and live within a reasonable walking distance of a salt water body.

Barriers

To help address this global concern, *FreshSea* will face barriers. The high capital costs and inexperience of the organization, in addition to being a name that the public or potential sources of funding have never heard of, all stand in our way of making progress.

If however cheaper, experimental forms of desalination that can be implemented on a small-scale come to market, our capital costs could be lowered. By hiring experienced staff that are willing to accept a low salary in exchange for the potential social impact, along with projected growth of the firm, would be a great asset. The formation of strategic partnerships with organizations already involved in these target markets would make entry much easier and would be beneficial to both parties.

Strategic Partnerships

A major goal of *FreshSea* would be to establish strategic partnerships with other aid organizations currently involved in the underdeveloped world. By establishing a working relationship with organizations that have an established presence, brand and manpower, in

addition to having the trust of the local population, *FreshSea* could work through these organizations.

A possible scenario is that *FreshSea* does its part by acquiring the parts of the combined desalination unit/power source and then sends the complete unit to the partner. The partner would then establish the unit and train the local population how to use and maintain the unit. *FreshSea* upholds its financial end and the partner organization does the work for less than it would require *FreshSea* to do on its own. The following is a list of potential strategic partners:

List of Potential Strategic Partners

Title	Description
Charity: Water	NPO bringing clean, safe, drinking water to people in developing nations
UN-Water	UN Humanitarian aid org
Oxfam	Dedicated to solving poverty and injustice
Africare	NPO specialized in development in Africa
Engineers without Borders	
Solar Electric Light Fund	Brings solar power to world's poorest regions
MercyCorp	Aid agency focused on distaster relief
Global Water Foundation	NPO dedicated to delivering clean water to world's neediest communities
US State Department	
US Peacecorps	Promotes world peace and friendship by assisting underdeveloped communities
UNICEF	Dedicated to providing food, water, and healthcare to children

VI. Desired Social Impact

Water is key to life and constitutes seventy percent of our body mass, and is the medium for all metabolic reactions. A healthy person could go on living without food for 3 weeks, but without water, only 3 days.

As the global population grows, the demand for fresh water will continue to rise, in parallel with the decrease of fresh water supplies by shrinking lakes and rivers, climate change, decreased rainfall, and pollution. According to UN-Water, a humanitarian branch of the United Nations, by 2025 the water scarcity around the world would cause two-thirds of the global population to live under stress conditions; and one in every six people will not have access to safe freshwater.

The intention of *FreshSea* is to provide a sustainable method by which coastal communities in underdeveloped countries can access fresh drinking water by means of reverse osmosis desalination. By doing this, we hope to accomplish the following impacts on the society:

- Improving the quality of life
- Encourage economic growth
- Ensure stability and prevent conflict

1. Improving Quality of Life

The desalination unit uses reverse osmosis, which not only removes salt, but also the microorganisms and other small particles in the original water supply. Essentially, the device doubles as a filter.

2. Encourage Economic Growth

The new water supply would help lower the burden on the economy by cutting or eliminating the costs of importing or transporting water. By removing or diminishing the stress of little to no access to freshwater, productivity can increase and provide economic opportunities to the community.

3. Stability and Peace

It is said that water will be the new oil and that the wars of the future will be fought over this precious and finite resource. By providing a method of extracting fresh water from the sea, *FreshSea* would be contributing to global peace efforts and help stabilize communities.

VII. Fundraising

List of Potential Sources of Funding

- US Government grants
- William J Clinton Foundation
- Bill & Melinda Gates Foundation
- Robert Wood Johnson Foundation
- William & Flora Hewlett Foundation
-

As a non-profit, *FreshSea* would be dependent upon outside funding and financing to maintain its operations—an issue encountered by most NPO's.

To ensure a steady flow of funding and capital, *FreshSea* will utilize every option available. Prominent sources of funding include but are not limited to government grants, foundations, charitable donations, and philanthropists. Strategic partners might also aid in funding.

A key aspect in fundraising will be for *FreshSea* to establish and maintain excellent relations with the public and the media, along with other organizations that could be strategic partners.

Government Grants

The United States government offers many federal grants that can be used for desalination, water resources, and social development

Foundations, Trusts

There is a large number of foundations and trusts within the United States that are committed to funding projects and non-profits that work in social development and delivering resources like water.

Corporate Donations and Sponsorship

Corporations often seek out non-profit to donate money to. Their donations allow them tax deductions and helps fulfill their social responsibility obligations.

A future goal of *FreshSea* is to seek corporate sponsorship, thereby assuring a steady flow of funds and continued operation.

Individual Donations and Philanthropists

Individual donations and philanthropists can supplement our fundraising efforts.

Investment Income

Leftover funds can be placed in a bank and gain interest over time.

VIII. Financial Plan

Unlike a for-profit venture, *FreshSea* will be an NPO. As such, our return on investment comes not in the form of money but rather in the form of social value—our positive impact on peoples' lives.

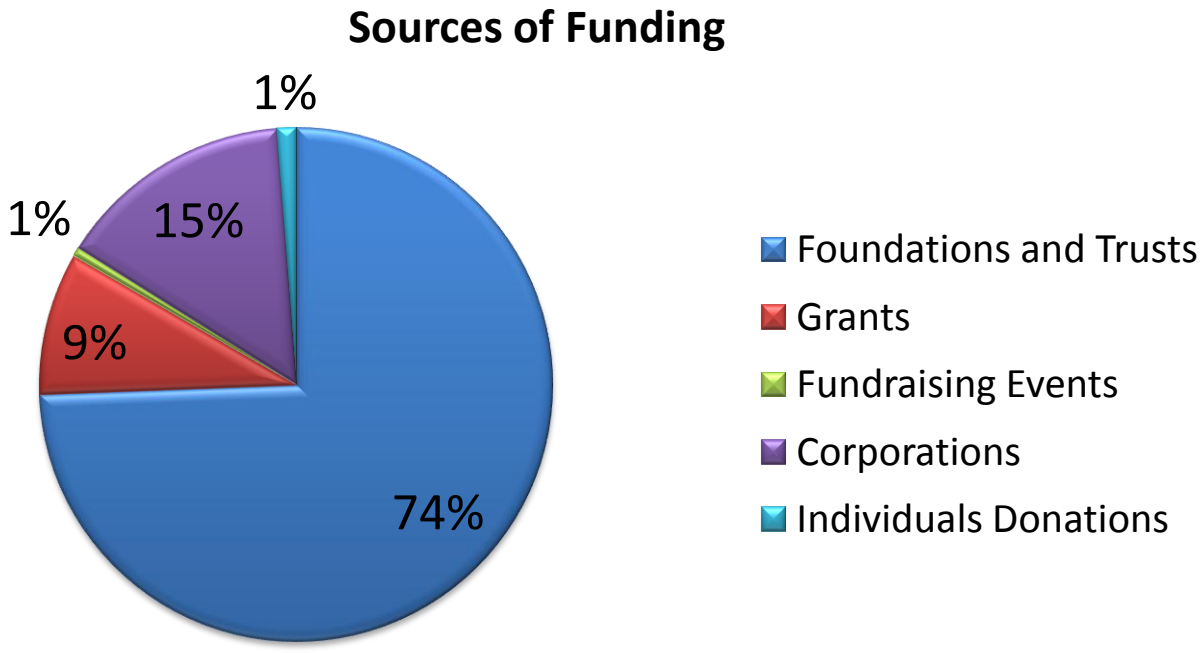
Our goal for the first fiscal year of operation is to raise $400,000. This will allow us to pay all staff, to purchase one desalination unit, one complete solar panel array, one small-wind turbine, and cover all shipping costs. We would then be able to proceed with the creation of a working prototype and field testing.

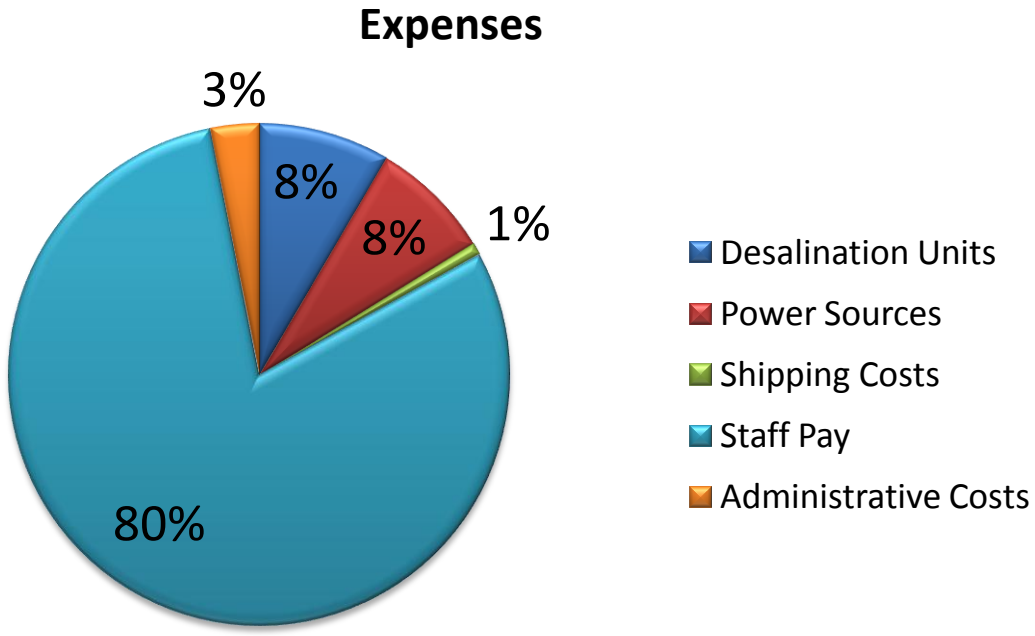
The following are our revenue/expense projections:

First Fiscal Year Projections

REVENUE AND SUPPORT			
Foundations and Trusts	$250,000		
Grants	$30,000		
Fundraising Events	$2,000		
Corporations	$50,000		
Individuals Donations	$4,000		
Investment Income	$0		
TOTAL REVENUE AND SUPPORT		$336,000	(Goal is $400,000)
OPERATING EXPENSES			
Desalination Units	($27,000)		
Power Sources	($25,000)		
Shipping Costs	($2,500)		
SUPPORT EXPENSES			
Staff Pay	($255,000)		
Administrative Costs	($10,000)		
TOTAL EXPENSES		($319,500)	
NET ASSETS		$16,500	

Left over funds (net assets) would be reinvested into the firm or placed in a bank to gain interest.


Sources of Funding
1%
1%
15%
9%
74%
Foundations and Trusts
Grants
Fundraising Events
Corporations
Individuals Donations


Expenses
3%
8%
8%
1%
80%
Desalination Units
Power Sources
Shipping Costs
Staff Pay
Administrative Costs

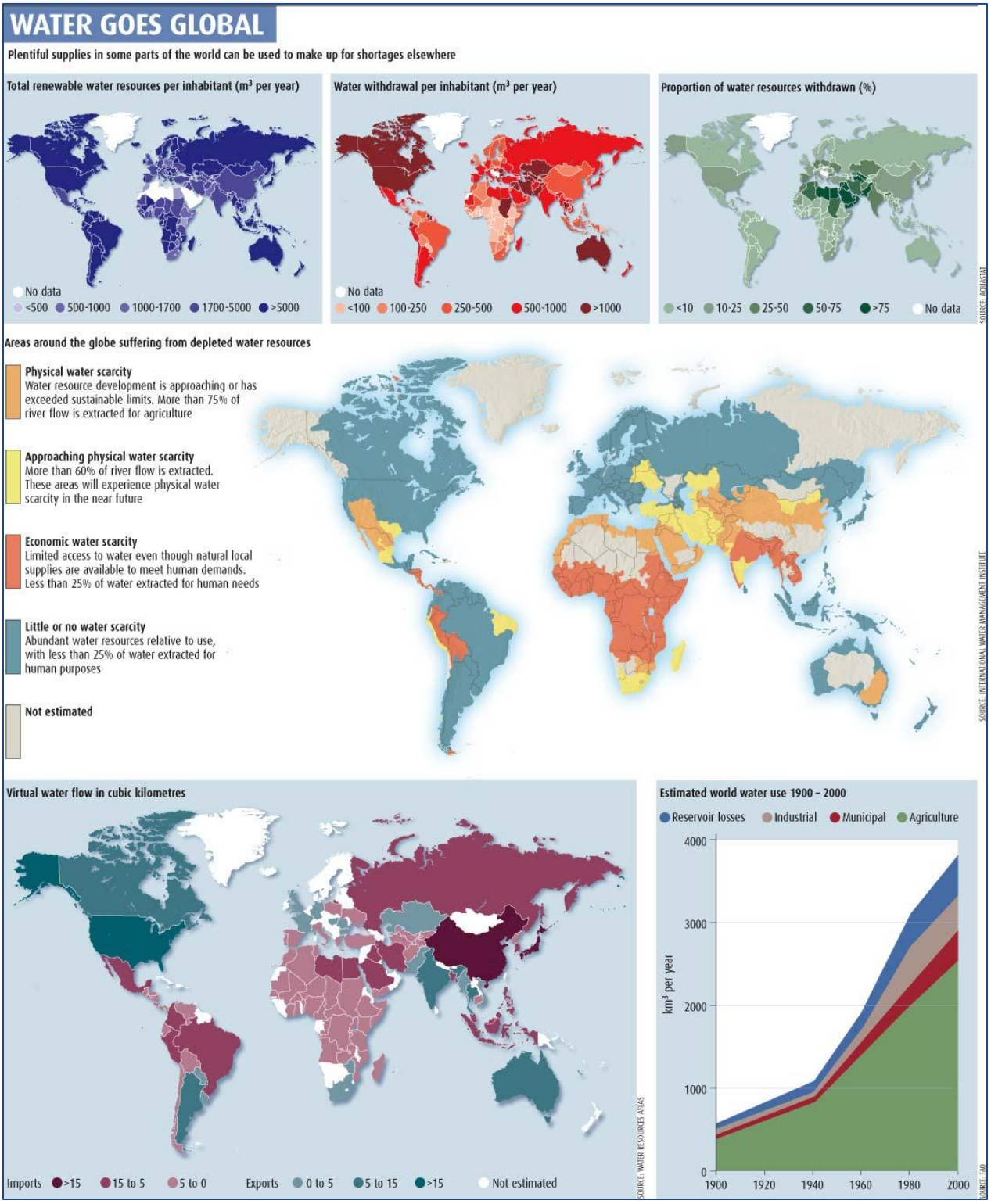
IX. Critical Risk Factors

The success of *FreshSea* can be affected by several critical risk factors that we have identified below, along with possible responses to meet those risks or assumptions.

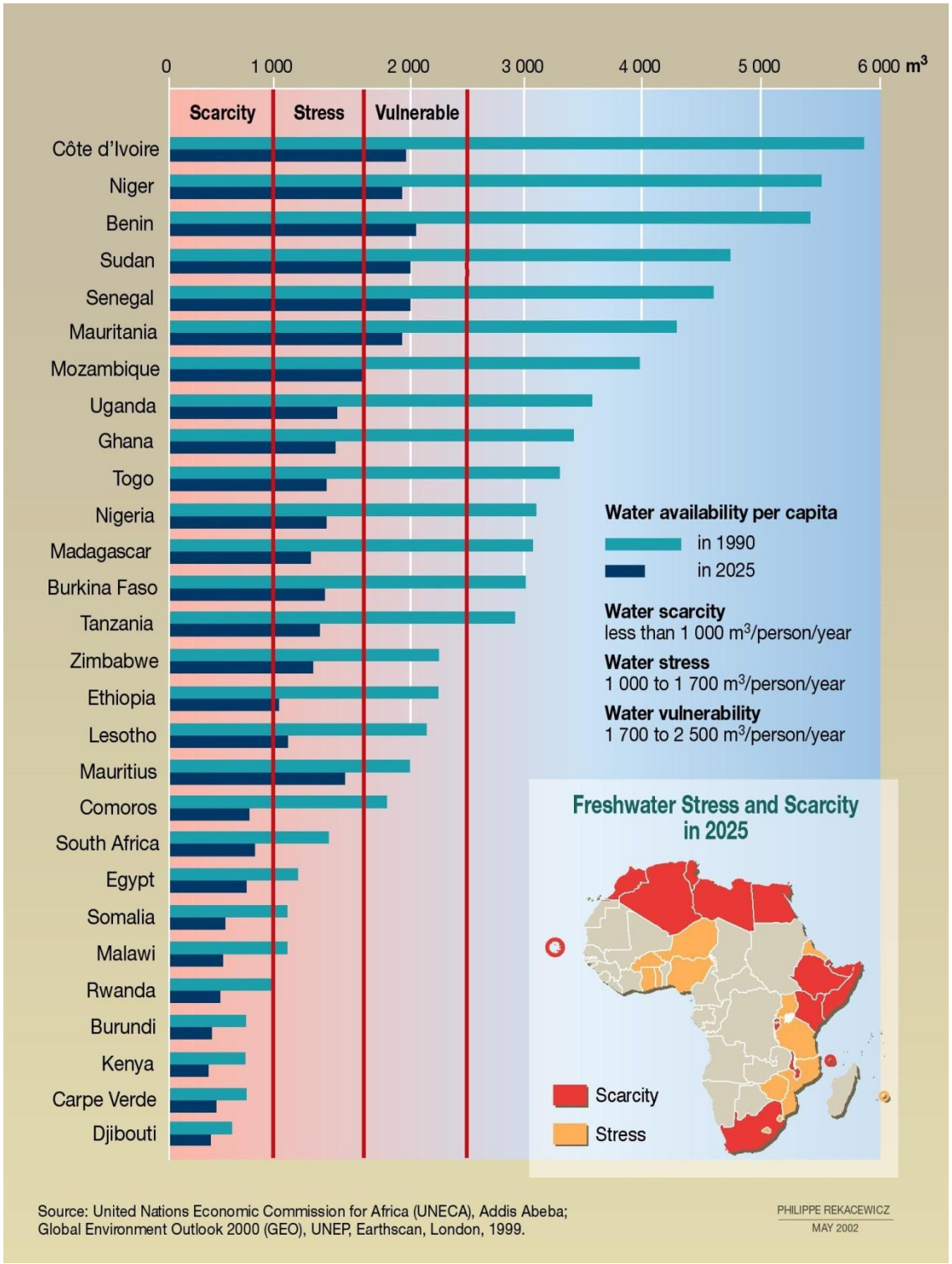
Risks/Assumptions	**Project Management Responses**
Political or Social Instability	A nation's instability can present a myriad of security risks. To address the threat of danger, we have researched potential nations and flagged them as SAFE, CAUTION NEEDED, and DANGEROUS/HIGH RISK.
Funding Shortfall	As an NPO, all revenues are generated donations from philanthropists, foundations, and other organizations, along with the receiving of government grants. Without proper funding to purchase the materials from suppliers or pay staff, operations would cease.
Quality	Quality desalination devices and power sources are of a highest priority for *FreshSea*. We cannot risk sending a unit overseas and installing it, only to find it nonfunctional. To mitigate this risk, we would preassemble the unit and perform rigorous testing before dismantling the unit and then sending it to its destination.
Power Source Reliability	The desalination device being employed *FreshSea* is suitable for the sea water of any location in our target markets. However the power sources that will be employed vary, depending on the geographic location and weather patterns. If the power source's operation is intermittent or limited due to a sort of environmental incompatibility, we risk compromising the feasibility of the desalination unit.
Theft	A potential risk in the employment of technology in the underdeveloped world like this is the theft or vandalism of the unit.

X. Appendix

A.


WATER GOES GLOBAL
Plentiful supplies in some parts of the world can be used to make up for shortages elsewhere
Total renewable water resources per inhabitant (m³ per year)
No data
<500
500-1000
1000-1700
1700-5000
>5000
Water withdrawal per inhabitant (m³ per year)
No data
<100
100-250
250-500
500-1000
>1000
Proportion of water resources withdrawn (%)
<10
10-25
25-50
50-75
>75
No data
SOURCE: AQUASTAT
Areas around the globe suffering from depleted water resources
Physical water scarcity
Water resource development is approaching or has exceeded sustainable limits. More than 75% of river flow is extracted for agriculture
Approaching physical water scarcity
More than 60% of river flow is extracted. These areas will experience physical water scarcity in the near future
Economic water scarcity
Limited access to water even though natural local supplies are available to meet human demands. Less than 25% of water extracted for human needs
Little or no water scarcity
Abundant water resources relative to use, with less than 25% of water extracted for human purposes
Not estimated
SOURCE: INTERNATIONAL WATER MANAGEMENT INSTITUTE
Virtual water flow in cubic kilometres
Imports
>15
15 to 5
5 to 0
Exports
0 to 5
5 to 15
>15
Not estimated
SOURCE: WATER RESOURCES ATLAS
Estimated world water use 1900 – 2000
Reservoir losses
Industrial
Municipal
Agriculture
km³ per year
4000
3000
2000
1000
0
1900
1920
1940
1960
1980
2000
SOURCE: FAO

B.


0
1 000
2 000
3 000
4 000
5 000
6 000 m³
Scarcity
Stress
Vulnerable
Côte d'Ivoire
Niger
Benin
Sudan
Senegal
Mauritania
Mozambique
Uganda
Ghana
Togo
Nigeria
Madagascar
Burkina Faso
Tanzania
Zimbabwe
Ethiopia
Lesotho
Mauritius
Comoros
South Africa
Egypt
Somalia
Malawi
Rwanda
Burundi
Kenya
Carpe Verde
Djibouti
Water availability per capita
in 1990
in 2025
Water scarcity
less than 1 000 m³/person/year
Water stress
1 000 to 1 700 m³/person/year
Water vulnerability
1 700 to 2 500 m³/person/year
Freshwater Stress and Scarcity in 2025
Scarcity
Stress
Source: United Nations Economic Commission for Africa (UNECA), Addis Abeba; Global Environment Outlook 2000 (GEO), UNEP, Earthscan, London, 1999.
PHILIPPE REKACEWICZ
MAY 2002

C. Technical Data

Company	Rain Dance Water Systems		
Product Model	RDWS-WH-SWRO-2000		
Dimensions	34" W	96" L	75" H
Price	$21,975		

Stage 1 Seawater Intake

Components	Description	Power Requirements	Cost	Maintenance Requirements	Additional Costs
Submersible Pump	Gathers seawater to be processed by pretreatment stage.	745 Watts, 1 Phase, 230 Volts, 8 Amps	$650	Check frequently for functionality, pump seals,	
PVC Piping	To serve as piping between pump and water source		<$200		

Stage 2 Pretreatment

Components	Description	Power Requirements	Cost	Maintenance Requirements	Additional Costs
Hard Water Treatment	Pretreates/protects membrane from hard water scale and silica		Included	Need steady supply of chemicals	$1,300/year
Sediment and Carbon Filters	Removes dirt, sediment, and organic compounds		Included	Replacement filters	$150/year

Stage 3 Reverse Osmosis

Components	Description	Power Requirements	Cost	Maintenance Requirements	Additional Costs
High Pressure Pump	1,000 PSI pump forces seawater through membranes	1600 Watts, 3 Phase, 220 Volts, 7 Amps	Included	Replacement seals and valves if necessary	$350/year
Sem-Permeable Membranes	Separate contaminents from fresh water		Included	Needs to be replace every one to three years	$800 for 2 membranes
PVC Piping	For sending excess or waste seawater back to ocean		<$200		

Stage 4 Post-Treatment

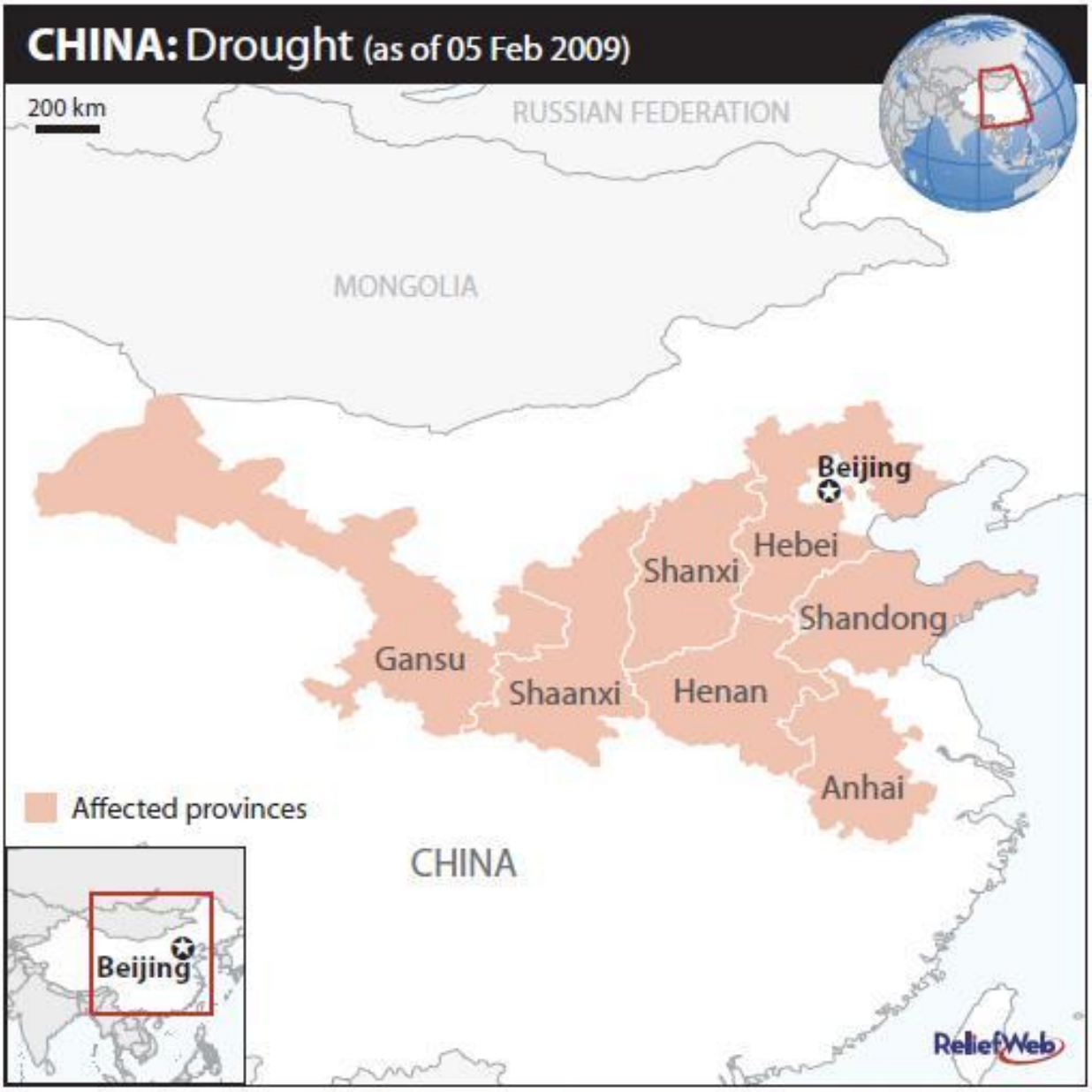
Components	Description	Power Requirements	Cost	Maintenance Requirements	Additional Costs
UV Sterilizer	Eliminates microorganisms in freshwater	60 Watts, 1 Phase, 220 Volts, 0.3 Amps	Included	Needs new lamp every 12 months	$45/lamp

Stage 5 Water Storage

Components	Description	Power Requirements	Cost	Maintenance Requirements	Additional Costs
PVC Piping			<$200		
Storage Pump 1	Pumps water into storage tank	375 Watts, 1 Phase, 115/230 Volts	$600	Check frequently for functionality, seals	
Storage Pump 2	Pumps water out of tank	375 Watts, 1 Phase, 115/230 Volts	Included	Check frequently for functionality, seals	New Pump, $500
Storage Tank	Holds 300 gallons of purified water		Included		

Total Power Consumption	**3,200 Watts**
Total Cost of RO Unit	**$26, 400**

D. Areas of drought in China, 2009



Lower precipitation affected 9.5 million hectares of winter wheat in Northern and Western China.

Map Sources: UNCS, GAUL.
Reference: FAO. 44 percent of winter wheat areas in China under extreme drought conditions. 04 Feb 2009. The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Map created on 05 Feb 2009 – *www.reliefweb.int*.

XI. Bibliography

A. Authored Sources

- Morrison, Jason with Mari Morikawa, Michael Murphy, Peter Schulte (February 2009). "Water Scarcity & Climate Change: Growing Risks for Business & Investors." *Ceres Report*, with the Pacific Institute.
- Bessenasse, Mohamed, with Ahmed Kettab, Adnane Souffi Moula (12 October 2009). "Seawater Desalination: Study of Three Coastal Stations in Algiers Region." *Elsevier – Desalination*, 250, 423-427.
- Fohoohar, Rana, and Mac Margolis (15 March 2010). "The Scary New Rich. The Global Middle Class is More Unstable and Less Liberal Then We Thought." *Newsweek*
- McNamara, Carter. "Overview of Nonprofit Fundraising Sources and Approaches." The Free Management Library, *Authenticity Consulting, LLC*.
- Jowitt, Juliette (30 March 2010). "Global Water Crisis and Cheaper Technology Sparks Surge in Desalination." *The Guardian*.
- Summers, Leslie J. (June 1995). "Desalination Processes and Performance." *Lawrence Livermore National Laboratory*.
- Jowitt, Juliette (2 November 2009). "Is Water the New Oil?" *The Guardian*.
- Hadadin, Nidal, et al (17 January 2009). "Water Shortage in Jordan—Sustainable Solutions." Desalination Journal, pages 197-202, ELSEVIER.
- Barnett, T.P., et al (17 November 2005). "Potential impacts of a warming climate on water availability in snow-dominated regions." *Nature Magazine, issue 438 pages 303-309*.
- Rowling, Megan (22 March 2006). "Climate change to create African water refugees." *AlertNet, Reuters Foundation*.
- No author (7 July 2009). "Mumbai faces acute water shortage." *BBC News*.
- Connor, Steve (23 March 2001). "Global thirst 'will turn millions into water refugees.'" *The Independent*.
- Kirby, Alex (22 March 2001). "World warned on water refugees." *BBC News Online*.
- Amos, Deborah (7 January 2010). "Mideast Water Crisis Brings Misery, Uncertainty." *NPR News*.
- Shanahan, Mike (17 November 2005). "Millions face water shortages due to climate change." *SciDev*.
- Roberts, Dexter (15 April 2009). "China faces a water crisis." *Business Week*
- DOE/Lawrence Berkley National Laboratory (4 February 2010). "Black Carbon a Significant Factor in Melting of Himalayan Glaciers." *Science Daily*.

- Ramanujan, Krishna (25 June 2004). "NASA Scientists Get Fix on Food, Water, and Fiber Use." *National Aeronautics and Space Administration*.
- Beinhocker, Eric D. et al (August 2007). "Tracking the Growth of India's Middle Class." *McKinsey Quarterly, McKinsey Global Institute*.
- Chao, Ling (8 April 2010). "Drought Relief Efforts Underway." *China Daily*.
- Goswami, Rahul (16 August 2009). "Drought Stalks India." *Energy Bulletin – Post Carbon Institute*.
- Red Cross Society of China (23 March 2010). "China: RCSC Offers Relief to Drought-Hit Areas." *ReliefWeb*.
- Xinping, Wang, et al. (26 March 2010). "Worsening Drought Ravages Countries in Asia and Latin America." *People's Daily Online*.
- Oxfam International Press Releases (17 March 2010). "Failed Rains Put 10 Million People at Risk of a Food Crisis Across West Africa." *Oxfam International*.
- UNESCO (2006). "World Water Development Report 2." *United Nations, UN-Water, UNESCO*
- United Nations (August 2008). "Millennium Development Goals Report 2008." *United Nations Department of Economic and Social Affairs*.
- United Nations (2004). "World Population to 2300." *United Nations Department of Economics and Social Affairs, Population Division*.
- Gadberry, Shane (2010). "Water for Beef Cattle." *University of Arkansas – Division of Agriculture*.
- Beiser, Vince (7 November 2007). "Worldwide Water Worries—Too Many People, Not Enough Water." *Wired Science*.
- Shiru, Niu (2010). "Industrial Pollution in Developing Countries." *International Labor Organization*.
- Shwarz, Joshua (1 November 2003). "Beach Well Intakes Improve Feed-Water Quality: a Comprehensive Study for the Middle East Desalination Research Centre (MEDRC)…." *Water and Waste Water International*.
- Bergeron, Ryan (11 September 2009). "Segway Inventor Takes Aim at Thirst with Slingshot." *CNN*.
- Kranhold, Kathryn (17 January 2008). "Water, Water, Everywhere." *The Wall Street Journal*.
- Krishna, Hari J. (2010). "Introduction to Desalination Technologies." *Texas A&M AgriLIFE*.

XII. Refining the Plan—Thoughts for the Future

One thing that *FreshSea* would like to do in time is return to researching new or experimental approaches to desalination. If the cost drivers could be lowered or eliminated, a new opportunity may arise. Additionally, different power sources may be researched too. In areas where agriculture is key to the local economy, a biomass energy approach may be viable.

We would also like to continue to improve upon our business model. If strategic partnerships are established, the way that business is conducted would rapidly change.