REWATER

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SBC COMPETITION

ROUND 1 - SOCIAL INNOVATION GENERATION

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“Shift over your home, change our world, start today with rewater system”

The ReWater project is an innovative water purification system that collects, treats and efficiently uses the wastewater generated by washing machines, sinks and showers. Our goal is to revolutionize the future of water consumption by establishing a new model for the efficient and sustainable reuse of greywater in homes and commercial establishments. With ReWater, we seek to drive a fundamental change in the way we value and use water, creating an act of awareness about the importance of conserving this vital resource, as well as ensuring a prosperous future for generations to come. By incorporating cutting-edge technologies and innovative solutions, our project strives to set a precedent in responsible water management, overcoming current limitations as well as opening new possibilities in the fight against water scarcity and natural resource degradation.

How does the Rewater System work?

Pre-Filters: Remove relatively large-sized elements, which, among other issues, can quickly clog or damage the filters. For example, chain filters, grates, and stone catchers are typically placed upstream of the pumping station or at specific points within the irrigation network if they serve a specific function, such as protecting risk elements like valves or hydrants.

Filters: Classified according to the filtering element (part of the filter that actually performs the filtration).

Chlorination: When chlorine is added, it is expected to reduce the impurities contained in the water.

Materials

The materials used to manufacture filters are usually plastics (PVC-U or HD-PE) or metal (carbon steel with a protective treatment). However, despite each type of filter being more suited to certain conditions than others, any filter can function reasonably well under various types of contamination.

The 17 Sustainable Development Goals are a crucial part of the 2030 agenda, as they offer a comprehensive, indivisible view and renewed international collaboration. These goals construct a vision of the future that is collectively sought and have three characteristics: they are universal, transformative, and civilizational.

These 17 SDGs include 169 targets and 21 indicators, approved by the United Nations Member States, who firmly believe that the agenda is both universal and deeply transformative. This new approach moves away from old paradigms where some countries donate while others receive conditional aid. It also aims to embody the principle of common but differentiated responsibilities and to forge a development alliance involving all countries.

To develop an efficient water recirculation system tailored to the specific needs of a house under renovation, it is essential to consider several key aspects:

1. "Service Identification": Clearly define the type of intervention needed, whether it involves installing new systems, maintaining existing structures, or specific repairs to meet the project's needs accurately.

2. "Human Resources Evaluation": Establish a recommendation on the number of specialists required, considering the project's complexity. This analysis will ensure efficient and timely execution.

3. "Adaptive Quotations": Implement a system of flexible quotations that adjusts in real-time to project requirement changes. This approach will allow users to get an immediate and accurate cost estimate.

Important Data

Three out of ten people lack access to safe drinking water services, and six out of ten lack access to safely managed sanitation facilities.

From 1990 to 2015, the proportion of the global population using an improved drinking water source increased from 76% to 90%.

Water scarcity affects more than 40% of the global population and is expected to increase. Over 1.7 billion people currently live in river basins where water consumption exceeds recharge.

More than 80% of wastewater from human activities is discharged into rivers or the sea without any treatment, leading to pollution.

Goal 6 Targets

One of the targets under SDG 6 is as follows:

By 2030, expand international cooperation and support provided to developing countries in building capacity in water and sanitation-related activities and programs, such as water harvesting, desalination, efficient resource use, wastewater treatment, recycling, and reuse technologies.

Responsible Production and Consumption

Important Data

Less than 3% of the world's water is fresh (drinkable), of which 2.5% is frozen in Antarctica, the Arctic, and glaciers. Therefore, humanity must rely on just 0.5% for all ecosystem, human, and freshwater needs.

Over a billion people still do not have access to drinking water.

Excessive water use contributes to global water scarcity.

Water is a gift from nature, but the infrastructure needed to manage it is costly.

Goal 12 Targets

One of the targets under SDG 12 is as follows:

By 2030, achieve sustainable management and efficient use of natural resources.

Climate Action

Filter:

Gravel is a commonly used material in water filtration systems. In filtration systems, gravel is layered along with other filtering media such as sand and activated carbon to remove solid particles, sediments, and other contaminants from water. Gravel acts as a support medium for the sand and helps provide a uniform distribution of water flow through the filter. Additionally, its porous structure allows water to flow through while retaining undesirable particles. This process is fundamental in many drinking water treatment plants and domestic and commercial filtration systems.

The sand is commonly used in water filtration systems, such as sand filters, as it is an effective medium for removing particles and sediments from water. The process typically involves the passage of water through a bed of sand, where suspended particles become trapped in the spaces between the sand grains. Here is a basic description of how sand is used to filter water:

Filter Preparation: The sand filter is set up with a layer of gravel at the bottom to provide support and allow proper drainage. On top of the gravel, a layer of sand is placed, which is the main filtration medium.

Water Flow: The water to be filtered is passed through the sand filter. Depending on the system's design, the water can flow by gravity or be pumped through the filter.

Filtration: As water passes through the sand layer, particles and sediments suspended in the water become trapped between the sand grains. The sand acts as a porous medium that retains the particles while allowing clean water to pass through.

Cleaning: Over time, the sand becomes clogged with retained particles, reducing its effectiveness. To maintain the filter's efficiency, a cleaning process known as "backwashing" is necessary. During backwashing, the flow of water through the filter is reversed, agitating the sand and releasing trapped particles. The backwash water, along with the liberated particles, is discharged from the system.

Sand Replacement: Over time, the filter sand may wear out or become compacted, affecting its filtration capacity. It's important to periodically replace the filter sand to maintain its efficiency.

This sand filtration process is widely used in large-scale water treatment systems, such as in drinking water treatment plants, as well as in residential and commercial filtration systems.

Important Data

The oceans have warmed, the amount of snow and ice has decreased, and sea levels have risen. Between 1901 and 2010, the average sea level rose by 19 cm as the oceans expanded due to warming and melting. The extent of Arctic sea ice has reduced in recent decades since 1979, with a loss of 1.07 million km2 per decade.

Goal 13 Targets

One of the targets under SDG 13 is as follows:

Improve education, awareness, and human and institutional capacity on climate change mitigation, adaptation, reduction of its impacts, and early warning.

NOM-127-SSA1-1994.

This standard defines the parameters set for the acceptable use and human consumption of potable water,

According to the latest census by INEGI in 2020, Mexico consumes an average of 48 billion liters of water per month. What's even more concerning is that 94% (Mexico City Water System) of this water is wasted in our households, primarily through unused greywater. We understand that water is a vital resource that we cannot afford to waste. That's why we've developed an efficient and, above all, urgent solution to tackle this water crisis from our homes: greywater recirculation.

According to the Mexico City Water System, an individual consumes an average of 307 liters of water per day, which is about 200% more than the recommended amount of 96 liters.

On average, a family of four in Mexico City uses 1,920 liters of water daily. In Mexico, domestic use accounts for 10% of fresh water, and globally the average is 8%.

Without including garden irrigation, the typical water usage percentages for a household in Mexico are:

- Toilet flushing: 40%

- Shower: 32%

- Washing machine: 14%

- Kitchen: 5%

- Bathroom sink: 3%

Greywater Outlets	Use	Consumption (L/min)	Usage Time per Person (min)	Total consumption (L)	Weekly Consumption (L)
Bathroom sink	Daily	6	7	42	294
Kitchen sink	Daily	15	15	225	1575
Shower	Daily	9	10	90	630
Washing Machine	Weekly	5	10	50	50
Total					2549

Greywater Outlets	Use	Consumption (L/min)	Usage Time per Person (min)	Total consumption (L)	Weekly Consumption (L)
Bathroom sink	Diario	10	5	50	350
Kitchen sink	Diario	8	10	80	560
Shower	Semana	50	10	500	500
Washing Machine	Semana	8	10	80	80
Total					1490

Table1: greywater outlets consumption

In Mexico, every four seconds approximately one million liters of wastewater are generated, including drainage water, gray water, and soapy water. The entire society participates in this. This becomes critical because there is little capacity to treat it. It is estimated that only between 20% and 30% of the water is treated at the national level.

90% of industrial wastewater is treated, and we see a correspondence on the part of the industry to return water with the qualities indicated by the Mexican official standards.

The problem lies in municipal waters, because although there are about 2,300 wastewater treatment plants in municipalities, only about 40% are functional. The treatments require a large amount of energy for pumping and the cost of keeping the plants running can be up to 70,000 pesos per month ($3,770). Municipalities with a weak economy turn off the pumps. The untreated waters eventually reach rivers, bodies of water, and oceans, with all the consequences that implies. They carry phosphates, have a high amount of nitrogen, and there is also a discharge of nutrients into water bodies with algae growths that end up decreasing the dissolved oxygen in the water.

Prices:

Prices vary depending on the type of home. Taking into account the differences between them, we have calculated a price per square meter. It is important to note that the prices shown are for homes already built; in the case of new construction, the costs decrease. In the same way, if the home already has a cistern or other similar elements, there will be a notable reduction in costs.

“In the following prototype, we present an average social interest home, which includes 1 sink, 1 toilet, 1 washing machine, and 1 shower, for which we estimate a cost of $70 Mexican pesos per square meter for design and calculation. Adding up to a total of $8025 eight thousand twenty five Mexican pesos if the house requires a cistern, filter, piping, and valves.”

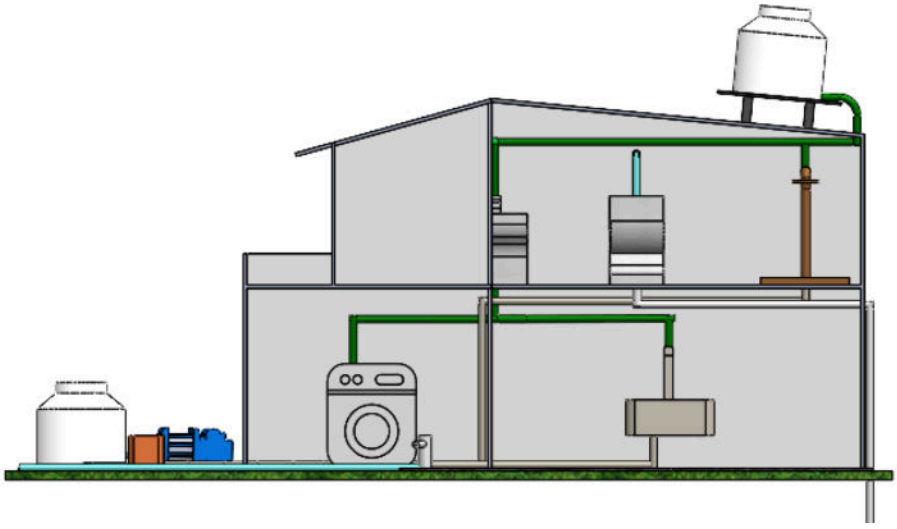
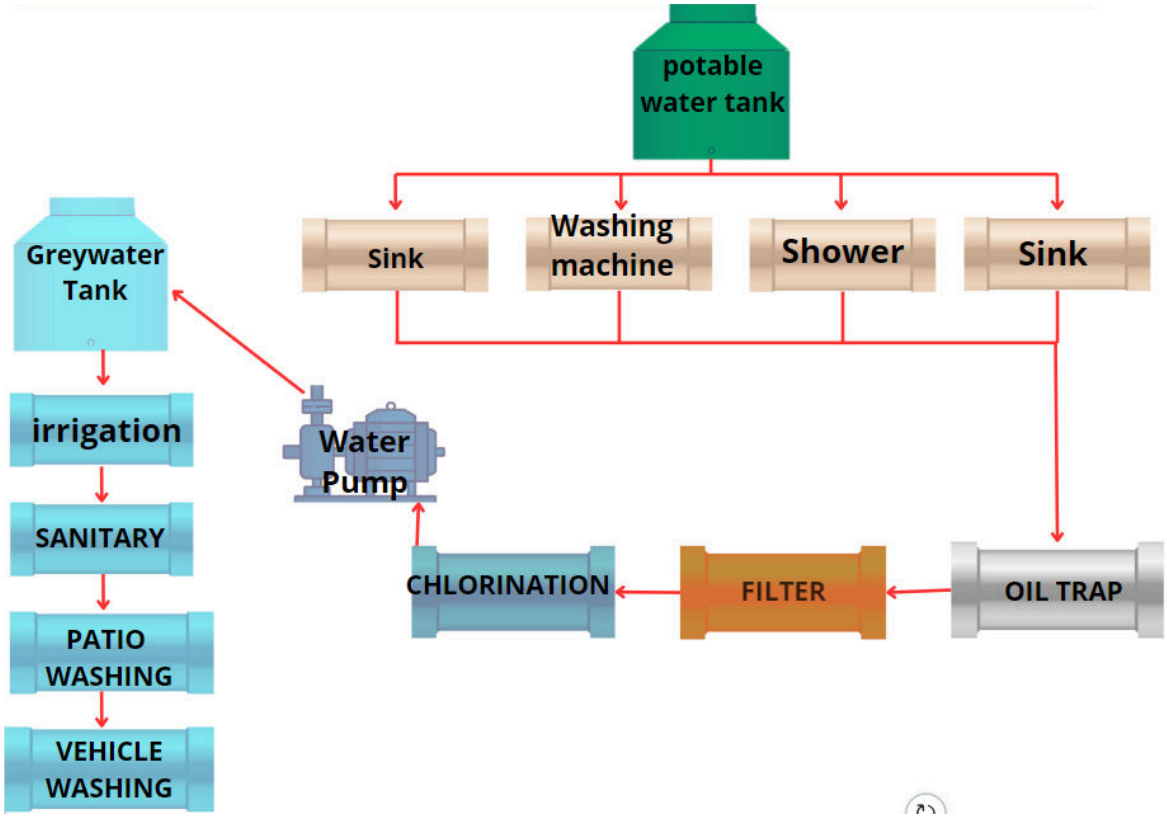


illustration 1:social interest home commonly in mexico; Blue pipe: Recirculated water; White pipe: Black water; Beige pipe: Gray water; Green pipe: Drinking water



All the following prices are calculated in Mexican pesos:

REWATER SYSTEM BUDGET FOR HOME - ROOM				
CODE	CONCEPT	UNIT	AMOUNT	PRICE
SANITARY				
SAN01	1 1/2" SANITARY PVC PIPE UNIVERSAL PLUMBING BRAND	ML	2,7	$ 17,00
SAN02	1 1/2" SANITARY PVC ELBOW TYPE CONNECTION UNIVERSAL PLUMBING BRAND	PZA	6	$ 4,06
SAN03	PLACEMENT OF SANITARY CONNECTIONS AND PIPING	JOR	1	$ 250,00
				SUBTOTAL

HYDRAULIC/ RECIRCULATION					
HID01	13 MM OR 1/2" HYDRAULIC PVC PIPE UNIVERSAL PLUMBING BRAND	ML	2,85	$	10,00
HID02	13 MM OR 1/2" HYDRAULIC PVC ELBOW TYPE CONNECTION UNIVERSAL PLUMBING BRAND	PZA	3	$	4,64
HID03	PLACEMENT OF HYDRAULIC CONNECTIONS AND PIPING	JOR	1	$	250,00
HID04	1200 LTS ROTOPLATE TANK WITH EQUIPMENT	PZA	1	$	4.460,08
					SUBTOTAL
PRELIMINARY WORKS					
PRE01	TRENCH FOR UNDERGROUND CISTERN	M3	3,5	$	58,00
PRE02	HAULING OF MATERIAL FROM EXCAVATION	M3	3,5	$	30,00
PRE03	CONCRETE BLOCK WALL 15 X 20 X 40	PZAS	102	$	18,26
PRE04	INSTALLATION OF 15 CM COLUMNS	ML	4,8	$	30,00
PRE05	MORTAR AND WALL INSTALLATION	JOR	2	$	250,00
					SUBTOTAL
					IMPORTE

			SUBTOTAL	$ 2.814,52
			IMPORTE	**$ 7.887,28**
TOOLS AND EQUIPMENT				
SMALL TOOLS	0,69%	$ 54,42	$	54,42
MACHINERY AND EQUIPMENT	1,00%	$ 78,87	$	78,87
SITE MANAGEMENT	4,05%	$ 319,43	$	319,43
CENTRAL ADMINISTRATION	2,18%	$ 171,94	$	171,94
			SUBTOTAL	$ 8.511,95
			30% PROFIT ON THE AMOUNT EXCLUDING INDIRECT COSTS	$ 2.553,59
			TOTAL	**$ 11.065,54**

Table 2: Total price of the ReWater system in Mexican pesos for a social interest house.

We've actively participated in several research forums, such as:

illustration 2 :Innova Ingeniería 2024(innovaingenieria.site)

illustration 3:Anáhuac Mexico Research Poster Competition 2024.

illustration 4:State Contest for Creativity and Technological Innovation 2023.

illustration 5:Research Colloquium 2023.

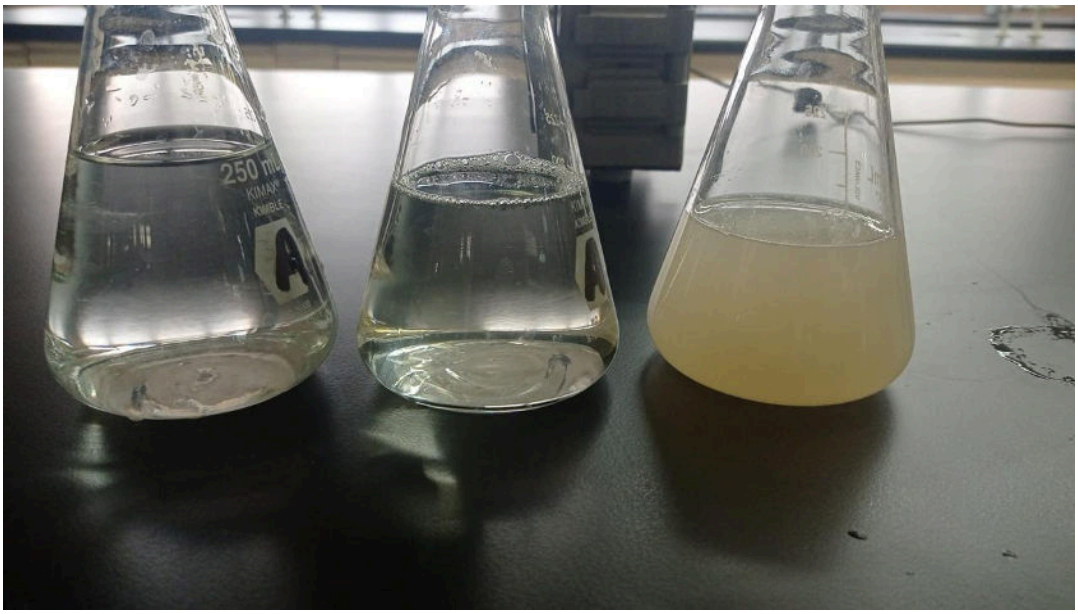


illustration 6: water quality tests carried out after filtration

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