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# SYSTEM TO TAKE ADVANTAGE OF THE HUMIDITY GENERATED BY AIR CONDITIONERS IN NORTHERN MEXICO

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## INTRODUCTION

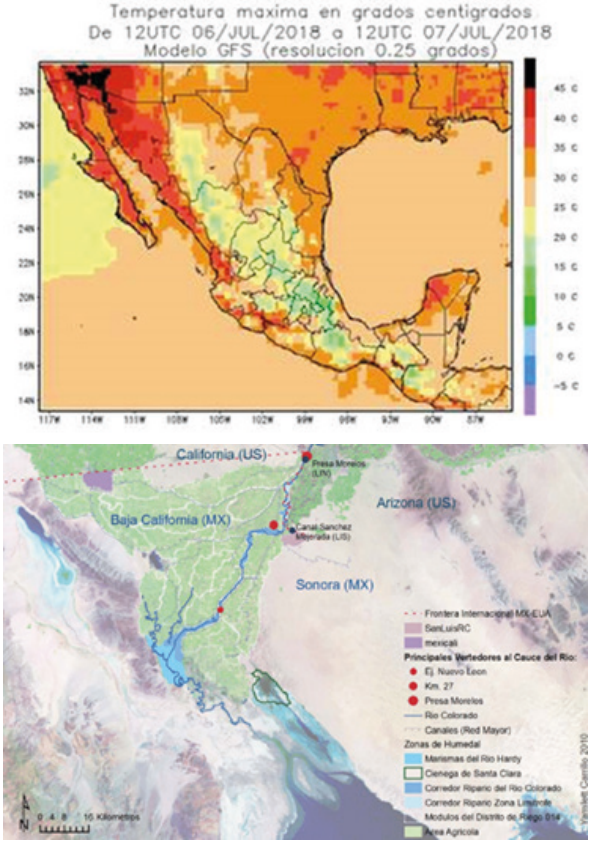
The waste of water is a serious problem since we are consuming more than necessary and it is wasted without any fear as if it were unlimited, but it is not so we must take into account that in several countries there are already water shortages even in several cities in Mexico the water supply is being cut even during the whole day as is the case of Tijuana, Baja California Mexico already have fixed hours as in areas of the state of Sonora that, although being a megadiverse country, it is incredible to see that the rivers are drying up, water pollution is very serious and we are still wasting it ... Worldwide, it is estimated that 80% of the wastewater that is generated is discharged into the natural environment without any prior treatment, which has serious repercussions on the environment and on people's health.

This is just the starting point to give water, an indispensable resource for everyone, the importance it deserves.

It is known that a domestic air conditioner can produce up to 25 liters per day of condensed water, both in cooling and when used for heating. However, the water produced is often discarded.

A single 2 ton mini split wastes in an average summer day 19 liters of water (1 gallon) minimum and if there is humidity up to 57 liters of water approx (3 gallons). These data are from the residence in the city of Mexicali (where the climate is usually with temperatures above 39 ° very dry and the summer season is long) that a year wastes 7,000 liters of water minimum this is equivalent to 1,750 discharges of the toilet (New ones need 4 liters x discharge).

## NORTHERN MEXICO




Based on information from Servicio meteorológico Nacional (SMN) July 07, 2018.

## IMPORTANCE OF WATER RESOURCES IN MEXICALI

Water resource management in arid areas is one of the greatest challenges facing societies in the 21st century. Mexicali is a city with almost one million inhabitants located in the state of Baja California (B.C.), Mexico on the northwestern border with the United States of America. The surface water resources that reach Mexicali are only through the last stretch of the Colorado River, which is one of the largest rivers in the world, but also one of the most controlled, since 100% of its annual availability is allocated between Mexico (9%) and the USA (91%). The Mexicali region is one of the hottest on the planet with summer temperatures reaching 45 to 50 °C. Local demonstrations have put up a resistance that has been noted in the international news to de-

mand better water management in the region, which is currently in a state of water stress. The groundwater source is declared in deficit by Mexico's water management authority, on which a large agricultural valley south of the city called "El valle de Mexicali" depends. In addition to the Colorado River water allocated to Mexicali, other cities in Baja California, such as Tijuana and Ensenada, which do not have large water supplies, are also allocated water from the Colorado River. Irrigation technologies in the region are of low efficiency, with agricultural water use representing about 80% of consumptive use. On the other hand, U.S. cities that also depend entirely on runoff from the Colorado River are also in a water availability crisis and have initiated modifications in their internal management that could increase the conflict in the situation of the agreed amounts that the U.S. must deliver to Mexico established in an international treaty in 1944. This water crisis has revealed the poor planning and preparedness of the state government to face a water management problem that is likely to worsen due to climate predictions in the climate change scenarios in the region. The most important points of a SWOT analysis are presented here to identify the most critical points in the administration that can serve as a guide to focus efforts to find possible technical-administrative solutions.

The present case of B.C. is an example of what the world's societies may face according to climate change forecasts (Diamond, 2005), warning that great societies of the past disappeared due to the lack of adequate and effective management of their natural resources. As cities use more water for their rapidly growing populations, agriculture must significantly improve the efficiency and productivity of its water use. Investing in irrigation improvement provides a guarantee against rainfall variations and stabilizes agricultural production, boosting crop productivity and allowing farmers to diversify their activities.

Investment in water development enhances the value of land. Small-scale works for water harvesting, irrigation and drainage using local labor are economically viable. The next 30 years will pose new challenges. With population growth - about 8.3 billion people by 2030 - agriculture will have to adapt to changing patterns of food demand, combat food insecurity and poverty in rural areas, and compete for scarce water resources with other users (FAO, 2005).

100 to 110 million hectares of irrigated land in arid and semi-arid areas of the world have serious drainage problems. Currently, 20 to 30 million hectares of irrigated land have been severely damaged by salt accumulation, and an estimated 0.25 to 0.5 million hectares of agricultural land are lost annually to salt accumulation. However, effective drainage also causes problems: the drained liquid often contains salts, mineral residues, sediments and residues of agricultural inputs, the disposal of which should be safe (FAO, 2003).

## CURRENT SITUATION MEXICALI WASTE, SQUANDERING AND CONTAMINATION OF THIS RESOURCE

Photographs by Andrea Gonzalez 2022 Drenes de la ciudad de Mexicali B.C México

## THE PROBLEM

Today, water security in Mexico faces five main challenges: scarcity, contamination, water conflicts, environmental deterioration of basins and aquifers. By 2030 there will be shortages in Mexican watersheds if the population continues to concentrate in the country's main urban centers, because aquifers will be even more overexploited, warned Polioptro Martínez Austria, during his online conference offered for the Ministry of the Environment.

## SYSTEM OBJECTIVES

General objective: Improve water resource conditions.

### SPECIFIC OBJECTIVES

- Water preservation through a piped water collection system and a water storage container.
- Reduce consumption by reusing, storing and saving the water released from the A/C for internal consumption.
- Implement it at the local level in those areas with dry hours and hot weather, as an indispensable measure for water service.

The Tecnológico Nacional de México campus Mexicali was used as a model but it is not yet viable in the city of Mexicali due to its extreme dry climate and the fact that the price of water is very low compared to the rest of Mexico (this city is privileged to have this resource 24/7, although we no longer have the guarantee that this will continue to be the case). However, the research and analysis of this institution and the conditions in which it is located can be very useful to be used from a house to buildings, whether departmental, educational institutions and even hotels among other places.


Photography Andrea Gonzalez 2023

## PROTOTIPO TECNOLÓGICO DE MEXICALI

Efficient maintenance

### CONSTANT FAILURES IN A/C AND OTHER (IN RELATION TO TEC)

At the Technological Institute of Mexicali I saw an opportunity in the air conditioning system which was that its water waste could be used for the implementation of a water collection system and its use for irrigation in green areas with this we can prevent water shortages and waste of it in the air conditioners.

One of the problems to be addressed will be the failures in our system that would require some maintenance to keep the pipes clean of debris and along with them the Rotoplas where the water would be stored plus the water sprinklers need attention to make the most of the water they would throw into a section.

Another thing to take into account is that air conditioners are only used in the months where the heat is higher which would represent only 6-8 months a year and the rest of the system would be unusable.

## IMPROVEMENT PLAN (IN PREVENTIVE MAINTENANCE OF THE TEC)

A point on what you can apply preventive maintenance to air conditioning systems is within the same installation of this, look for the best drainage surface for water over time does not damage the floor / wall / base on which the A / C is installed.

Another important point for tec installations is to clean the filters, it may be a very simple task but tec has several refrigerations per building and all of them have filters, also when a refrigeration does not have enough gas pressure in its system it tends to condense inside its system and expel water together with air into the room.

## DECREASE WATER FAILURES AND WASTAGE

Water is one of the natural resources that are essential for life, this vital liquid is a crucial part of adaptation to climate change, and is the link between society and the environment. That is why all actors in society must pay attention to this important resource, implementing strategies to preserve it more and more. To start with the example, schools or educational centers should be the pioneers and serve as an example on the correct use of water.

### School practices in favor of water

In schools, practices that promote efficient water use should be instilled in students. The Performance Services portal shares seven strategies to reduce consumption in schools:

1. Drinking fountains with aerators: In many occasions, water drinking fountains are a good option for those who carry a reusable container in their belongings. Schools should install drinking fountains with water-saving faucets better known as aerators, as these reduce the amount of water flowing, aerators can reduce water consumption by 30% to 50%.

2. Install efficient flush toilets: Installing this type of toilet helps conserve water considerably, since the average toilet uses 3.5 gallons per flush, while the efficient flush option uses only 1.28 gallons.

3. Detect and repair leaks: Many times water waste is due to improperly installed connections. A leaky faucet can waste 5 gallons per day, adding up to 3,000 gallons per year.

4. Adopt water conservation policies: Schools should be the main places where the efficient use of water should be instilled in students, teachers and administrators, and practice this thinking every day.

5. Promote the use of reusable bottles: In order to reduce plastic waste and encourage everyone to conserve water resources, it is necessary to promote the culture of reusable bottles or thermoses in schools.

6. Install smart water meters: These water meters provide detailed information on usage patterns and can detect leaks and inefficient systems while monitoring usage to cut costs and reduce consumption by up to 27%.

7. Collect and use rainwater: Rainwater can be a good idea to give it a second use. For example, in schools, even in your home you can reuse it for watering gardens, for cleaning some areas and for flushing toilets.

8. Pipeline maintenance: Maintainers should check for faults in inefficient systems that add to heavy water consumption. These fixtures include urinals, showerheads and hose connections.

Benefits of reducing water use in schools Did you know that 6% of total water use in commercial and institutional facilities takes place in schools? When a building of this type knows how to use water; buildings become efficient, costs are also reduced and there is a balance in environmental, social and economic aspects.

## SUSTAINABILITY AT TEC

### GREEN AREAS

The Instituto Tecnológico de Mexicali has several green areas which cover the length and breadth of the campus and there is even an external annexed part which does not mean that it should not be watered. The reused water has this first function that is consumed by our green areas instead of using the garden sprinklers that are usually turned on during peak hours where students come in and out of class passing through these areas where we often get splashed either from clothes, shoes, backpack and even with mud but by using a hose connected to the Rotoplas where this water is stored, you should also make a channel type path for the water to flow within an area and go to each tree without being leaving the water area.

### RECREATIONAL AREAS

The Tecnológico de Mexicali has not only green areas but also recreational areas such as basketball and soccer courts, as well as an area for exercise with some obstacles which must also be maintained, such as cleaning, which can be done with reused water. On TEC's day, the entire university is cleaned and more water is constantly used than necessary due to neglect.

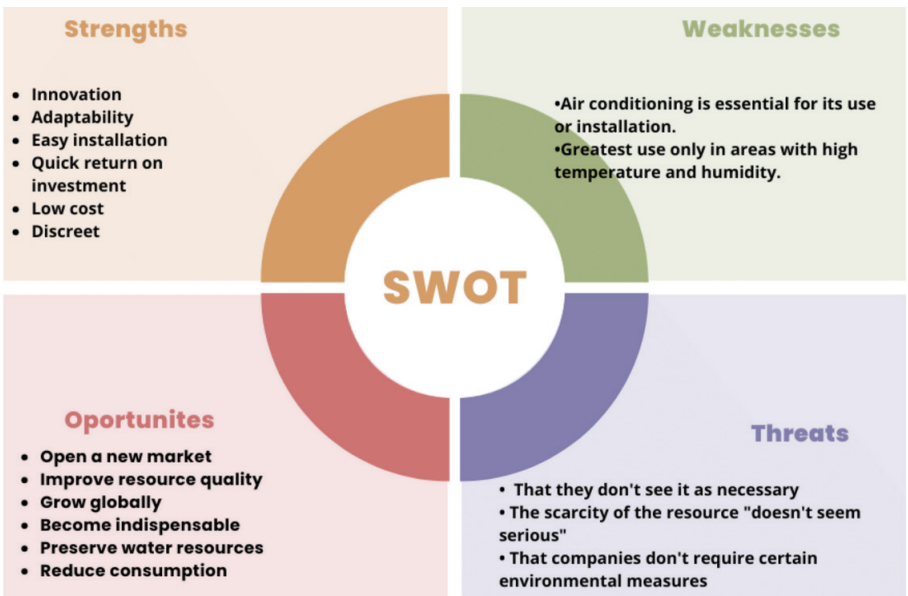
### BUILDINGS AND FACILITIES

Some of the buildings constantly run out of water either inside the bathrooms or laboratories, such as the chemistry lab, there are certain hours when the pressure decreases and even there is no water, which is indispensable, so having a reserve for these events would be very useful, besides it would contribute to cleaning from mopping the floors, cleaning windows, as well as external facilities such as the benches, the garbage island, among others.

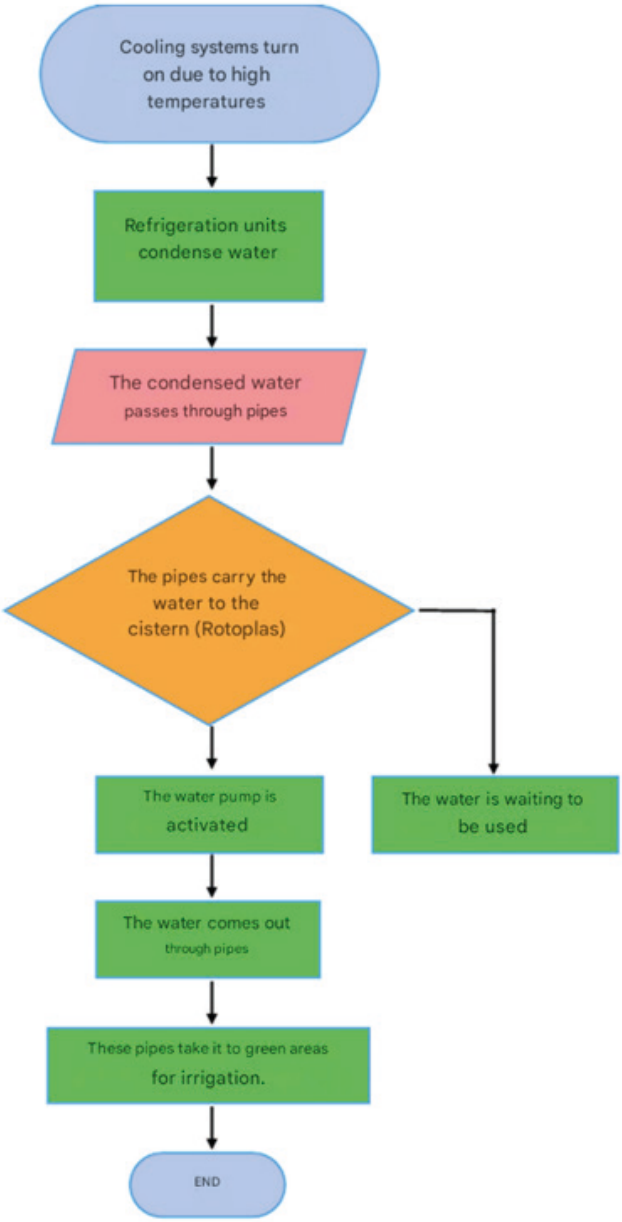
**The research was carried out**

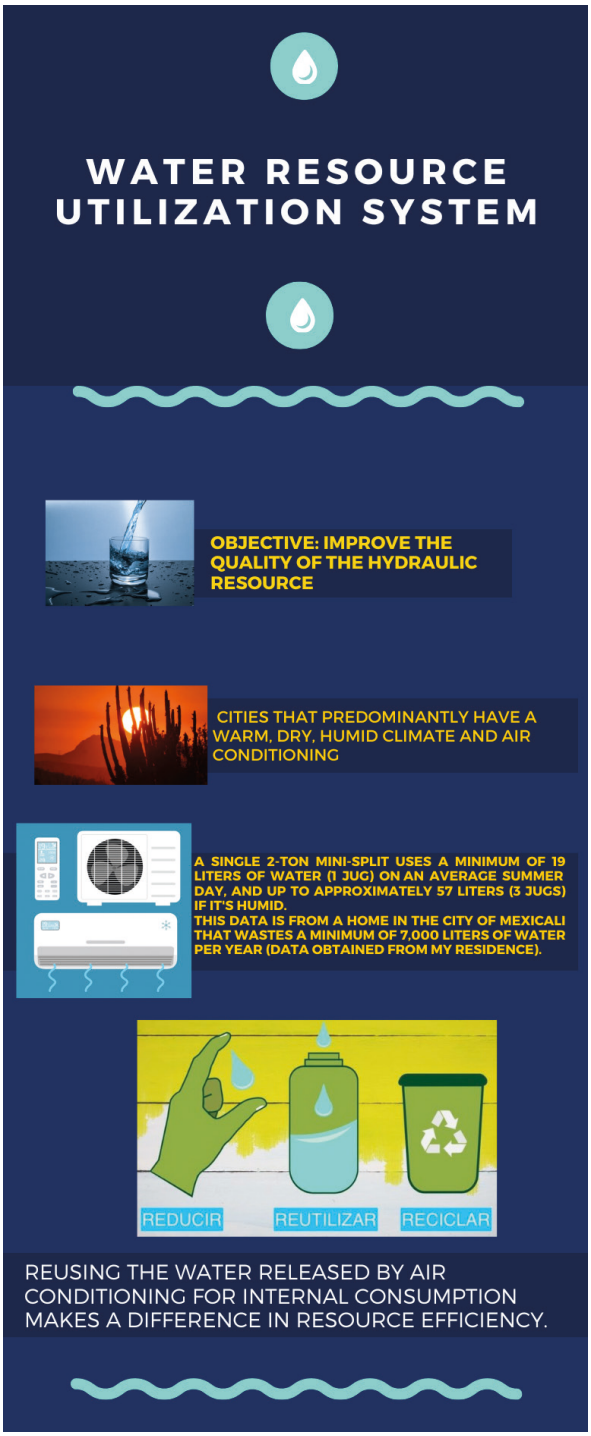
- Information gathering
- Surveys applied
- Analysis of the current situation and future scenarios
- Reusing a/c water in our homes

**SWOT method**



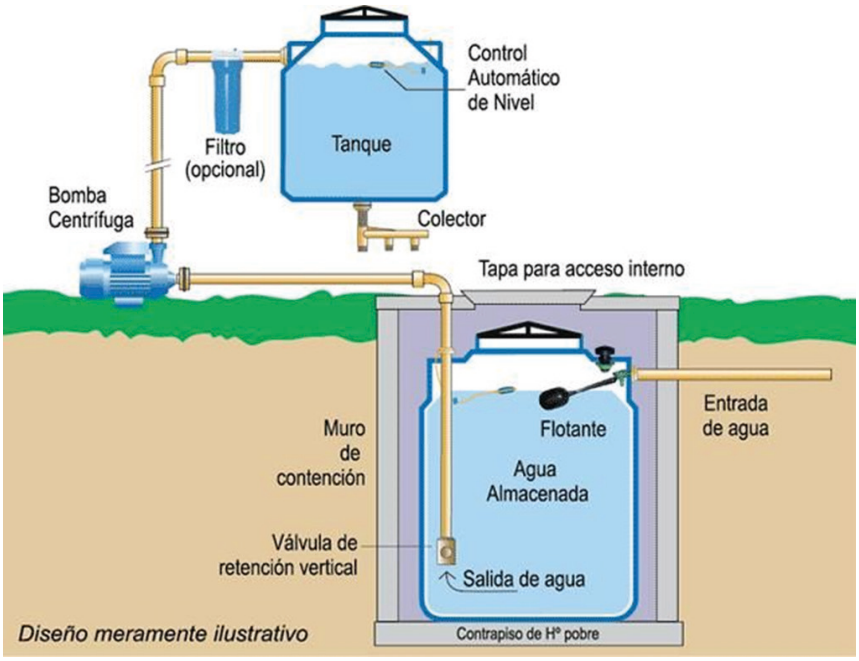
## System operation




### Storage

All pipes go to the same place to the container, which should be a cistern to store it for use, unless one is intended for drip irrigation of green areas.




**Installation technique**

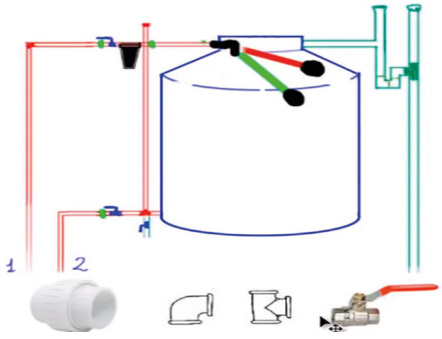
1) Tank installation

To raise it to the roof you must unscrew the lid by turning it counterclockwise. Then pass a rope through the outlet connection and pull it out through the mouth of the Rotoplas tank and make a tie on the outside, approximately the size of the tank. This way you will be able to lift it more easily and then place it on a flat and smooth surface. It is recommended that there be at least two meters of difference between the highest outlet of the house (such as showers) and the tank outlet to have a good pressure



2) Filling Valve Installation

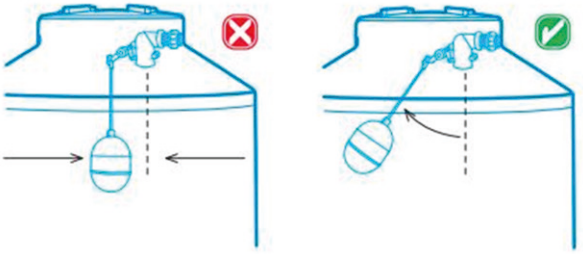
You must insert the filling valve through the hole in the neck of the tank and fasten it on the outside, screwing on the locknut. Then make sure that the water outlet is always at a 90 degree angle to the tank wall.

Finally, you must screw a connector on the outer end of the valve and install the supply pipe, which must be welded to the elbow and the elbow to the pipe coming out of the neck of the tank.

3) Float installation

You must insert the filling valve through the hole in the neck of the tank and fasten it on the outside, screwing on the locknut. Then make sure that the water outlet is always at a 90 degree angle to the tank wall. Finally, you must screw a connector on the outer end of the valve and install the supply pipe, which must be welded to the elbow and the elbow to the pipe coming out of the neck of the tank.



4) Installation of the Reinforced Multiconnector with Integrated Valve

You must screw the mu lticonnector into the water outlet connection by hand and tighten maximum one quarter turn with the steelson wrench. *Make sure that the engraved arrow points upwards so that the air jug works properly.


Then check that the purge plug is screwed to the side outlet of the Multiconnector to avoid leakage. And finally screw the air jug into the hole located at the top of the Multiconnector.



**Triple sustainability**

This project is pure human intervention if one day in their homes do not put the bucket or do not use that water one day can stand out and still a couple of water would be wasted and the system does not flow properly because it is to use the 3R, recycle, reuse and reduce water consumption. By not wasting a single drop of water (due to the A/C), it is necessary to clarify that **the more humidity there is in the environment the more water** it releases, we support the preservation of the water resource because when we reuse it we consume less

than usual or what is really necessary, by consuming less water service costs decrease so we save our good pesos a year so the investment is recovered soon and is viable, by implementing it in buildings and in a simpler way in homes, we are making social awareness about the importance of each drop and it would be used in more places and in the future it would be even indispensable for future generations to also have this necessary resource and in the best conditions.

**Reduce (do not waste resources)**

- Control water consumption in hygiene, irrigation and swimming pools.
- Incorporate water saving devices in faucets and cisterns.
- Quick shower; turn off faucets while brushing teeth, shaving or soaping up
- Proceed to drip irrigation, watering early and late in the day.
- Washing the car with a hose or bucket and having the water run out onto the sidewalk (waste) is punishable by a fine in Mexico.

Keep in mind that this system can be adapted according to the needs and conditions in which you find yourself.

- Photographs by GIOVANA murillo (2022)

- Photographs by José Melero (2022)

Water use

- Housekeeping: mopping, washing the car, watering the plants, flushing the toilet.
- Industrial cleaning: cleaning floors, equipment, tools, machines, installations.
- Cleaning exteriors: watering green areas, external facilities, parking lot, benches, sidewalk, entrance.
- If you want to wash dishes, brush your teeth, etc., the water must be filtered, but it is not purified water fit for consumption. This is due to the condensation of the humidity of the environment, so the air pollutants are also found in the water.

**The benefits of buildings that know how to use water**

- Cost savings: using less water can reduce operating costs by 11%.
- Energy savings: reducing water use can reduce energy use by 15%. Therefore, less energy is required to process, supply and heat water, resulting in reduced air pollution.

- Reduced stress on natural resources: water conservation practices can reduce water use by 10%, which helps minimize the effects of drought and water shortages over time.

## RESULTS

Based on the results obtained from the survey "Water resources (2020)" (with a total of 11 questions and 98 answers), we can say that only 3 questions were agreed with 100%. Therefore, the following can be affirmed.

The engineering students of the Mexicali technological campus consider:

It is necessary to deepen the issues of pollution and water waste in schools.

Necessary to reuse water as they do not see it as insignificant.

Leaks must be stopped as soon as possible.

## IN CONCLUSION

There are cities that do not have this privilege and that also have high temperatures and even have humid climates, which can cause up to three times more water to be released than in the city of Mexicali, which has a dry climate. Even so, we should all manage water responsibly and be aware that it is a limited resource that we must take care of in order to have it in the best conditions for ourselves and future generations. I believe that according to the above it would be more indispensable and viable in areas such as the cities of Sonora that have this climate and shortage because on the outskirts of Ciudad Obregon there are towns that have several hours without water commonly called "dry hours", not to mention that the price is higher and in other areas the pressure of this is very low so having stored this water would be very useful for when they do not have the service in addition to being able to use it also in the day as well to reduce their consumption and save money that here if it would make a noticeable difference. As well as different topics that are very interesting and practical for the city where I live such as the CFE rates, as we have a subsidy since we easily exceed 38°C in summer, the duck curve (phenomenon in California USA), what is the MEM (Wholesale Electricity Market) as well as the national reconnection project.

I would like to end with the phrase "Water is life.... If we don't end it, we end ourselves."