



Making Guam’s safe tap water taste better with home filters

Peter-Joseph C. San Nicolas and James R. Hollyer
Extension & Outreach, College of Natural & Applied Sciences, University of Guam

Introduction

According to required laboratory tests performed by the Guam Waterworks Authority (GWA), Guam’s drinking water is safe and adheres to U.S. Environmental Protection Agency standards. However, Guam’s drinking water contains naturally occurring and safe minerals that not everyone enjoys.

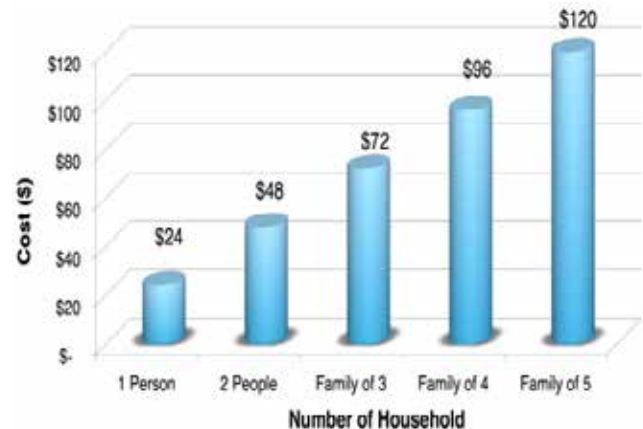
As a result, many Guam residents visit their neighborhood store to buy water for drinking and cooking. Filling up a 5-gallon container costs about \$0.40/gallon (not including the cost of going to the store), which is considerably cheaper than buying a gallon of water from a convenience store for more than \$2.00/gallon. By contrast, the water out of a home faucet is less than \$0.003/gallon.

What if there was a way to have both: tasty and inexpensive water? By installing a proper and durable home water filtration system, tap water can taste identical, or nearly identical, to water purchased at the store and at a much cheaper price. In fact, home filtered water can cost more than 100 times less per gallon compared to store bought!

In this fact sheet, the following graphs will highlight the estimated true cost of annual water consumption, vehicle usage, and the opportunity costs that deal directly with purchasing and consuming water.

Graph 1 shows the annual cost of purchasing water by the gallon. For comparison, Graph 2 shows the annual cost of drinking unfiltered tap water from the home faucet. The annual cost of vehicle usage is another cost in purchasing water and is shown in Graph 3. Graph 4 shows the cost of time spent purchasing water, which is the last in purchasing water by the gallon.

Graph 1. Annual cost of store-purchased water store relative to household size.

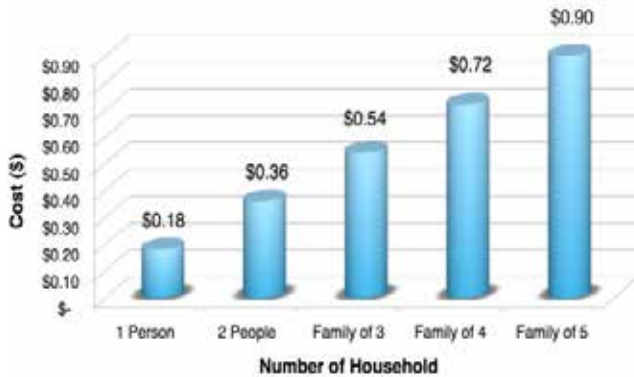


Results of Graph 1 are based on the national average consumption of 60 gallons of water per person per year and current water prices from local stores. 60 gallons of water x \$0.40/gallon x No. of people in the household.
Sources: Water retail stores on Guam, 2017.

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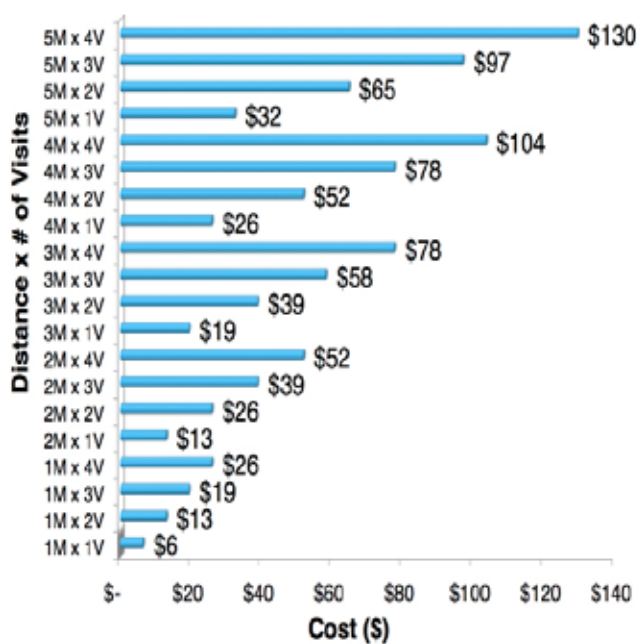


Graph 2. Annual cost of unfiltered tap water from the faucet.



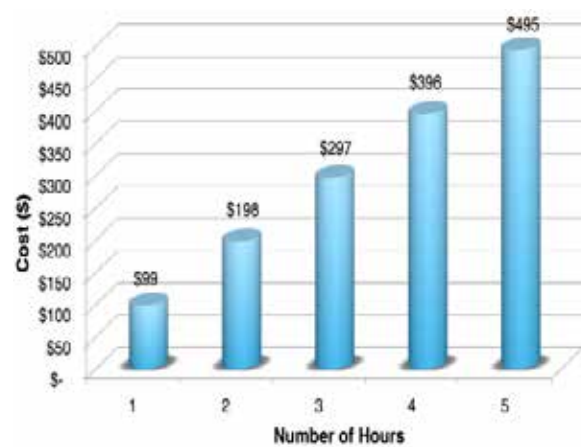
Results of Graph 2 are based on the national average consumption of 60 gallons of water per person per year and the current GWA residential water rate. 60 gallons of water x \$0.003/ gallon (GWA rate) x No. of people in the household. Source: Guam Waterworks Authority, 2017.

Graph 3. Annual cost of using a vehicle to pick up water from the water store.



Results of Graph 3 are based on roundtrip miles to the water store per month, the number of visits per month, and the US Federal cost per mile. Number of miles per month x number of visits per month x 12 months x US Federal cost per mile. Source: 2016 Standard Mileage Rates for Business, Medical and Moving Announced, 2015.

Graph 4. Cost of time spent purchasing water at the water store.



Results of Graph 4 are based on the number of hours spent purchasing water per month and minimum wage (\$8.25). Number of hours spent per month x \$8.25 x 12 months. Source: Wage and Hour Division, 2017.

The savings between buying water for 3 people and receiving water from the tap for 3 people is significant. The cost of buying water is 133 times more than receiving water from the tap! There are even more savings from the time spent and vehicle usage constantly going back and forth to the water store. The biggest savings is from the time spent purchasing water, which is multiplied by the minimum wage. However, if you work at a higher rate than minimum wage, your cost is even higher.

Potential savings: Common water purchase scenarios

These typical scenarios illustrate potential savings opportunities by comparing the cost of purchasing and maintaining a home filtration system to store water purchase in the first year and over a 10-year period. Table 1 describes each of the scenarios that were used for Graph 5, 6, and 7. Each scenario takes into account the number of people in a household, the number of water store visits, the distance travelled to purchase water, and the time spent to purchase water.

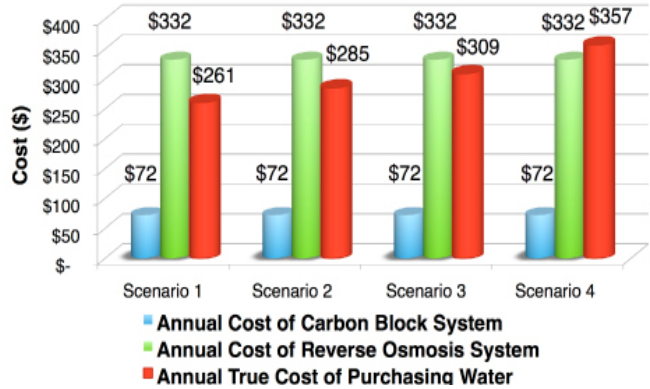
Table 1: Common Water Purchase Scenarios

Scenario 1- # within household: 1 person	Scenario 2- # within household: 2 people
# of store visits/month: 3 visits	# of store visits/month: 3 visits
Distance/month: 5 miles	Distance/month: 5 miles
# of hours spent/month: 2 hours	# of hours spent/month: 2 hours

Scenario 3- # within household: 3 people	Scenario 4- # within household: 5 people
# of store visits/month: 3 visits	# of store visits/month: 3 visits
Distance/month: 5 miles	Distance/month: 5 miles
# of hours spent/month: 2 hours	# of hours spent/month: 2 hours

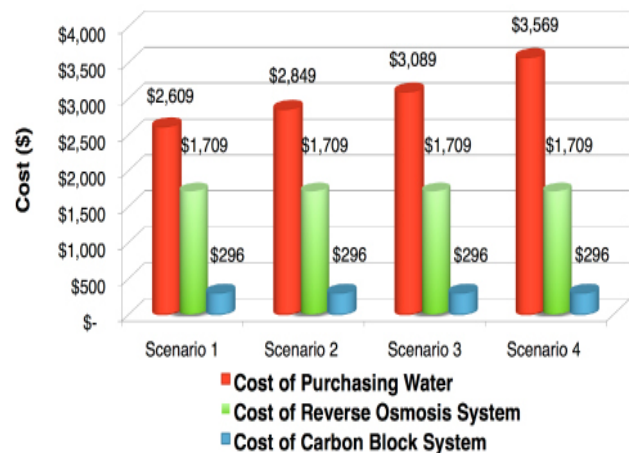
Graph 5 compares the annual cost estimation of purchasing water with the cost of purchasing a carbon block system and a higher priced, reverse osmosis system. The carbon block system shows immediate savings, but the reverse osmosis system only shows savings with a family of 5 or more people within the first year. However, savings accumulate for both systems within the following years. This is because for as long as the filtration system lasts, only filter replacements will need to be purchased which greatly reduce the annual cost every year after the purchase of each respective filtration system. Graph 6 gives a 10-year comparison of the cost of purchasing water with the cost of a carbon block system and a reverse osmosis system. On the next page, Graph 7 shows the 10-year savings accumulated from the purchase and use of a carbon block system and a reverse osmosis system. Each scenario will accumulate savings from purchasing either of the filtration systems.

Graph 5. Annual cost estimation of purchasing water compared to the unit cost and maintenance of a carbon block and a reverse osmosis filtration system.



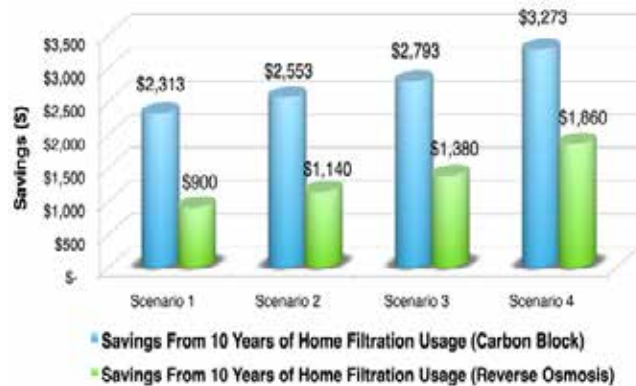
Results of Graph 5 are based on the total cost of purchasing water from the store, the cost of vehicle use, and the opportunity cost compared to the cost of a carbon block filtration system (\$45.99) with an annual water filter replacement (\$25.99) and a reverse osmosis system (\$179.00) with proper replacements (\$152.98). Source: Combination of references used in previous graphs.

Graph 6. 10-year cost comparison of buying water at the water store and the cost and maintenance of using a filtration system.



Results of Graph 6 are based on the summation of the cost of purchasing water from the water store, the cost of vehicle use, and the opportunity cost for 10 years compared to the cost of a carbon block filtration system (\$45.99) with an annual water filter replacement (\$25.99) and a reverse osmosis system (\$179.00) with proper replacements (\$152.98). Source: Combination of sources used in previous graphs.

Graph 7. Savings from 10 years of using a home filtration system.



Results of Graph 7 are based on the annual true cost of buying water for 10 years subtracted by the price of a carbon block filtration system (\$45.99) with an annual water filter replacement (\$25.99) and a reverse osmosis system (\$179.00) with proper replacements (\$152.98) for 10 years. Source: Combination of sources used in previous graphs.

Best filters for tap water

In order to create desirable taste from the tap, knowing what's in the tap water is important. Guam Waterworks Authority publishes water quality reports annually for public transparency. This document shows that Guam's tap water meets all regulatory safety requirements for public use and consumption.

To create a similar taste to purchased water, chlorine and natural minerals must be removed from tap water. An activated carbon block filter with a screen size of less than 1 micron can remove chlorine, chlorine byproducts, additional tastes and odors, and volatile organic chemicals, but it isn't always able to completely remove the taste from dissolved minerals (i.e., calcium). Reverse osmosis systems can remove minerals but a user needs to know how much water can be processed before the replacement membranes are needed because it is an additional system cost. Table 1 shows the cost of multiple filtration units and their filter replacements that are available on Guam.

Table 1. Home filtration systems available on Guam.

Type of Filtration	Unit Cost (\$)	Filter / Light Replacement		Replacement/Yr.		RO Membrane	RO Replacement/Yr.	Annual Cost of Filters Per Year (\$)	
		Advanced	Premium	Advanced	Premium			Advanced	Premium
Carbon Block Faucet Mount	\$25	\$15 (2-pack)		2				\$15	
Carbon Spun Fiber Under the Sink	\$50	\$35		2				\$70	
Carbon Block Under the Sink	\$46		\$25		1				\$25
Dual Carbon Block Under the Sink	\$127		\$50		2				\$100
Reverse Osmosis Under the Sink	\$179		\$49		2	\$55	1		\$153
UV Light Treatment	\$135		\$30		1				\$30
5-Stage RO System w/ UV Light Treatment (Special Order)	\$186		\$34		1	Included	1		\$34

The units shown in Table 1 have been found at Guam's main hardware stores. Source: Hardware stores on Guam, 2017.

There are, however, many filtration systems that incorporate both activated carbon block and reverse osmosis filtration methods. The bottom line is that the most difficult part of creating water identical to what is currently purchased is by removing the dissolved calcium from Guam's aquifer and natural minerals from southern side watersheds.

Filtering harvested rainwater

Collecting rainwater for drinking and cooking is also a viable option on Guam. The water is "free" and does not contain the chlorine and minerals that most people want removed in their tap water due to taste preferences.

However, rainwater collected from rooftops brings its own set of issues, namely debris, particulates, and pathogens. This is because rainwater does not hold any natural minerals like Guam's groundwater and is not chlorinated like the municipal water. A proper sediment filtration system with ultraviolet light treatment or chlorination will produce rooftop-collected water that meets hygienic standards. Table 2 shows filter capabilities.

Table 2. Types of filters and their capabilities.

Type of Filter	Size (Microns)	Filter Capability	Pros	Cons
Activated Carbon Block	0.4-10	Most organic chemicals, chlorine, bacteria, lead, iron copper, and radon	Inexpensive, effective, and improves taste	Ineffective of removing all pathogens and other minerals
Ceramic	<1	Particulates, bacteria, cysts, and larger protozoa	Great for removing pathogens and many models are combined with carbon block filters	Due to its small pores there is a slow water rate (however, this can be solved with multi-cartridge systems)
Mesh	20-1000	Sand and debris	Inexpensive	Ineffective of removing harmful chemicals and pathogens
Reverse Osmosis	<1	Bacteria, cysts, viruses, organic chemicals, heavy metals, and radium	Removes greatest amount of metals and chemicals along with pathogens	Highest initial and maintenance cost of all options
Spun Fiber	5-40	Sand, debris, silt, rust, and lead	Inexpensive	Ineffective of removing harmful chemicals and pathogens
UV Light Treatment	-	Pathogens	Great for removing pathogens and only 1 replacement per year	Initial cost can be high for some homeowners

Source: Guidelines on Rainwater Catchment Systems for Hawaii, 2010.

Safety first

The most important aspect of using a home water filtration system is maintaining, cleaning, and properly replacing the filter. Otherwise bacteria and other microbes can grow inside it.

There are a few signs that indicate when a water filter needs replacement: decreasing water pressure and noticeable change in water taste or smell. Also, if the filter cartridge is leaking, this most likely means that the filter has reached its maximum capacity. Again, know and follow the maintenance directions that came with the filter unit.

For support

Contact the College of Natural & Applied Sciences' Extension and Outreach at 735-2080 for help or more information. Find additional publications on our website at: www.cnas-re.uog.edu under the Publications tab.

Summary

For many Guam residents, filtering tap water can save time and money. Though monetary savings may seem small by the week, the break-even point is reached within the year and savings amass in the long run with an average of over \$1,000 in five years. The most immediate benefit is the amount of time saved by the individual responsible for regular water fill-ups. The main chore in buying a filtration system is installation and the simple task of maintaining and replacing the water filters as recommended by the manufacturer. These activities are just a small fraction of the time compared to getting water from the water store, as well as a fraction of the cost.

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