The cost of urban rainwater harvesting in the Sonoran Desert.

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Introduction

Water is a scarce resource, especially in hot-arid areas like the Sonora Desert. In urban areas like Hermosillo city with an average precipitation of 250 mm/year, it is of imperative interest to save as much water as possible and apply alternative solutions, such as rainwater harvesting systems.

Hermosillo city has been struggling with water scarcity for decades. Nonetheless, water demand is expected to increase 57% in 2030 compared to 2006. This disarrangement between the availability and the increment in water demand causes a severe problem for the economic and social development of this city.

In this line, cost is a critical factor in the decision process.

The aim of this study is to present the life cycle cost results as a helping way to alleviate water supply problems in cities with similar conditions.

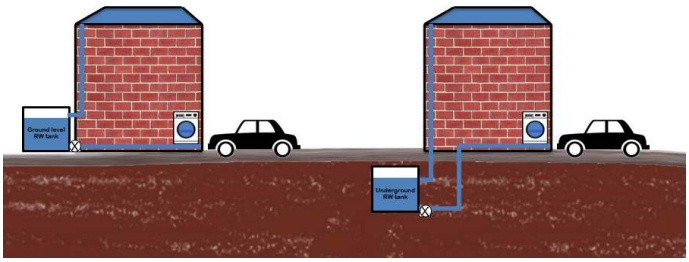

Figure1. Tank installation diagram. Left: ground level; Right: Underground

Materials & Methods

Six different scenarios were defined to study the applicability and feasibility of rainwater harvesting systems in Hermosillo, varying the size of the house (78 m^2, 130 m^2 and 210 m^2) and the location of the tank (ground level or underground). Figure 1 represents ground level and underground storage tank.

Potential rainwater supply and storage tank size were calculated using Plugrisost®, a free simulation model developed by Gabarrell et al. (2014)$_{(2)}$.

Demand was based on two household activities: laundry and car-washing. Laundry demand was estimated based on average behavior, considering 3 wash loads per week and 92 liters of water per wash load. And car-washing was estimated as one car-wash per week and 63 liters of water per car. Table 1 summarizes rainwater demand and supply for each of the three house sizes.

Characteristics	Collecting area (Roof)		
	78 m^2	130 m^2	210 m^2
Total demand (year) Laundry Car-washing	17.7 m^3 14.4 m^3 3.3 m^3	21 m^3 14.4m^3 6.6m^3	21 m^3 14.4m^3 6.6m^3
Tank size	1.10 m^3	2.5 m^3	2.5 m^3
Rainwater supply (year)	17.3 m^3	19.2 m^3	19.2 m^3

NOTE: Tank sizing was calculated using Plugrisost software and then adapted to available market solutions, in consequence, supply was reduced in some cases.

Table 1. Rainwater demand and supply basics

Results & Discussion

Results show that scenarios with bigger collection surfaces and with the tank installed at ground level have better financial outcomes.

TANK LAYOUT	HOUSE SIZE	INITIAL INV.	PV	IRR	PB
GROUND LEVEL	78	582	838	9%	14.92
	130	700	838	11%	13.36
	210	700	838	11%	13.36
UNDERGROUND	78	835	838	6%	18.84
	130	953	838	6%	17.00
	210	953	838	8%	17.00

Table 2. Financial results for each scenario in Euros

Conclusions

The results from this study lead us to conclude that a rainwater harvesting system is potentially economically viable for domestic laundry and car-washing in this city and others with similar conditions. Table 2 shows the financial results where ground level scenarios obtain better results compared to underground scenarios.

References

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