



JURY NARRATIVES

**Washington State University
U.S. Department of Energy Solar Decathlon 2017**

WATER

PACIFIC NORTHWEST ROOTS

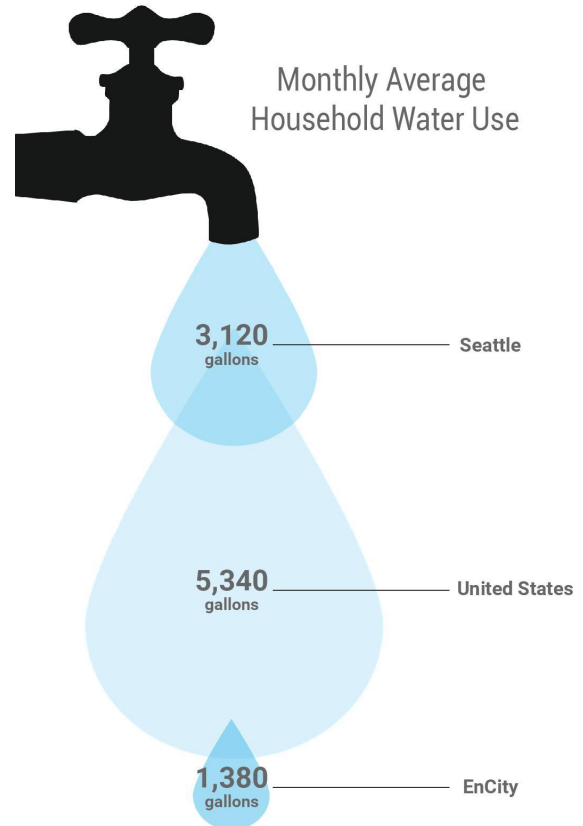
As the only team located in the Pacific Northwest, EnCity has a unique opportunity and challenge to capitalize on the abundant rainwater from our region. Water has been an integral inspiration throughout the design and construction of EnCity, from technical performance and water saving appliances, to aesthetics and celebration of our environment, we let water guide and shape our design.

CONSERVE

Seattle residents are very water conscious despite the abundance of rainwater. Average water use for a couple in Seattle is 104 gallons per day, well below the national average of 178 gallons per day (Seattle Times, 2015). Although Seattle residents are water conscious, they face some of the highest water costs in the country with a couple's average water bill just over \$90.00 (Seattle Times, 2015). In order to reduce our water footprint, EnCity employs various strategies to conserve and reuse water. Improving further upon Seattle's conservation of water, EnCity cuts water use to approximately 50 gallons per day (per couple) less than half of the average. That equates to a yearly savings of over 20,000 gallons and \$620.

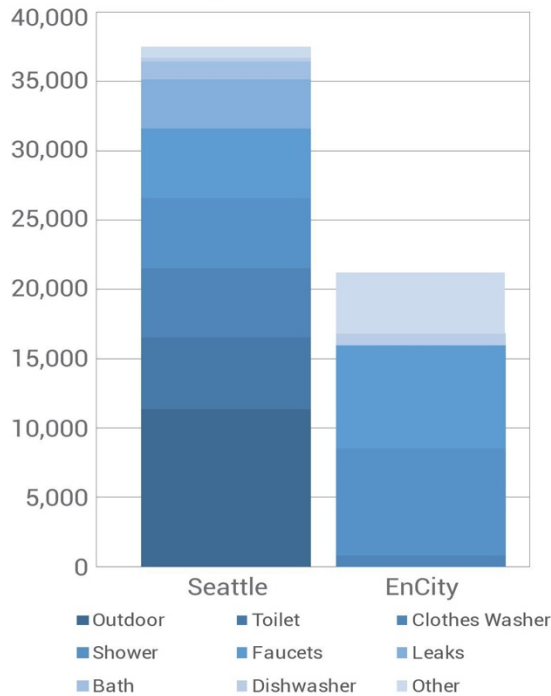
Water Costs and Savings		
	EnCity	Average
Monthly Water Use (2 people - gal)	1380	3,165.00
Monthly Water Savings (gal)	1,785.00	
Monthly Cost	\$ 40.02	\$ 91.79
Monthly Savings	\$ 51.77	
Yearly Water Use (2 people - gal)	16,560.00	37,980.00
Yearly Water Savings (gal)	21,420.00	
Yearly Cost	\$ 480.24	\$ 1,101.42
Yearly Savings	\$ 621.18	

Table 1: Water Costs and Savings (Average compared to EnCity)



EnCity utilizes low-flow appliances and faucets, a structured plumbing recirculation loop for hot water delivery, and a water treatment system to cut water use in both the tiny home and clubhouse. Compared to an average home, the graph below illustrates the breakdown of water use throughout the home. Through the use of our water treatment system, EnCity utilizes treated storm and greywater for toilet flushing and irrigation, eliminating additional water draw for these purposes. Although some uses appear higher than average, it is important to note that it is representative of both the tiny house and the clubhouse building. For the competition one tiny house and the clubhouse will be constructed, however in concept EnCity is intended to support multiple tiny homes and a single clubhouse building on one lot. Thus with additional tiny homes, overall water consumption per couple would decrease even further.

Yearly Water Usage Breakdown

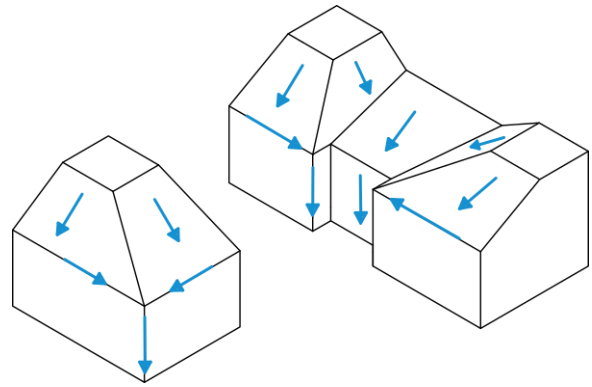


We have designed our plumbing recirculation loop with a motion sensor that is activated when a resident stands in front of any faucet. At which point the recirculation pump moves the water in the line back to the hot water heater to ensure that hot water is available as soon as the faucet is turned on. This eliminates water wasted waiting for hot water at the faucet and minimizes energy draw from constantly heating water.

Beyond minimizing water use through appliances and technology, EnCity encourages residents to adopt water saving habits through its smart home system. The smart home system learns residents habits, provides water use data, and suggests water saving habits to help residents learn how to further reduce their water footprint. This feature is imperative, furthering the impact of EnCity by educating residents on how to live a more sustainable lifestyle and how their habits directly impact the environment.

RECLAIM & REUSE

With abundant rainfall in mind, the roofs were designed to efficiently capture as much rain as possible. The slant of the roof diverts water into the custom integrated gutters and downspout for each peak, allowing simplified and maximum rainwater collection. Specifically on the clubhouse building, water is diverted to flow down the green wall and into the pond, a design choice to draw attention to and celebrate our abundance of rainwater.

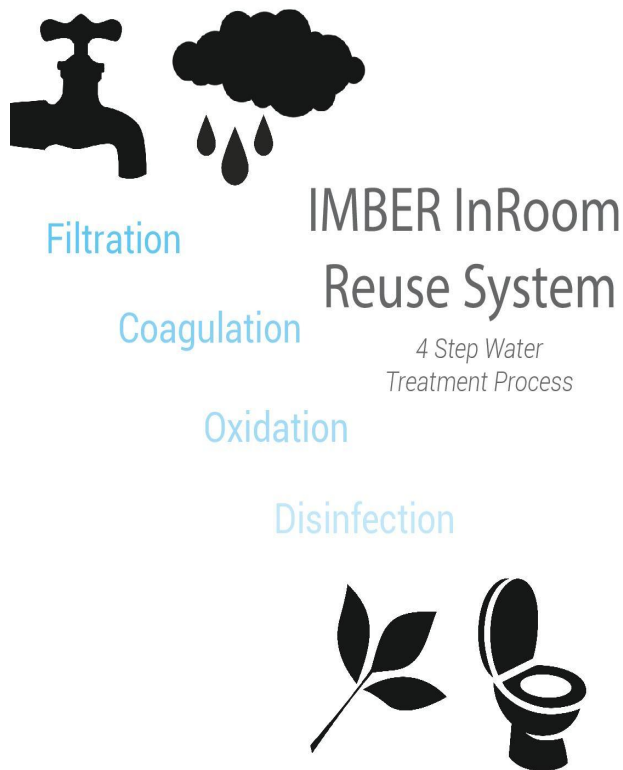


Rainwater filters through the river rocks and is fed into our contained water treatment system. At its final resting place, there will be a rain cistern to collect and store rainwater below the pond. Although Washington has an abundance of rainwater, it also enforces the strictest water reuse standards in the country, requiring a four step treatment process. To capitalize on this valuable resource and further minimize our water footprint, EnCity utilizes the Imber InRoom Reuse system for treatment of both greywater and storm water.

The Imber InRoom Reuse system is an innovative, patent-pending compact and modular self-contained water treatment system. The system is gravity fed, taking water from sinks, washing machines, air handling units, and storm water into the collection stage. From the collection stage water enters the treatment module, designed specifically to adhere to Washington State water reuse standards, and undergoes a thorough four step

treatment process consisting of filtration, coagulation, oxidation, and finally disinfection.

Water is then kept in the storage module, treated to WA Class A reuse water standard this water is suitable and ready for reuse within the home for flushing toilets and all irrigation purposes. The system can treat 1 gallon per minute, conservatively treating 700 gallons per day, well over EnCity's estimated water use. Consuming a maximum of 330 watts during



treatment and an average of 5-20 watts on standby, while generating only about 30 watts of waste heat, it is a complete and efficient water treatment system.

During the collection and treatment process, the water is kept contained through the integrated gutters, downspouts, and rainwater cistern to ensure safe water handling, eliminating the potential for contamination. This intensive treatment system allows EnCity to conserve water by safely treating and reusing water from the home and storm water for all irrigation and

toilet flushing needs, significantly reducing our water footprint.

LANDSCAPE

Landscape architecture students and faculty have been involved throughout the design of EnCity. Their design was guided by climate of the final destination, water usage, water runoff mitigation, and energy efficiency.

Open spaces between the tiny house and clubhouse facilitate increased indoor/outdoor living. Located in eastern Washington (Spokane), increased temperatures and drier weather were considered in order to optimize outdoor space and select plants.

A living green wall on the clubhouse serves to reduce heat islands and manage storm water on site before it enters the water treatment system, allowing us to fully utilize all water that enters our site. Plant selection was guided largely by the climate (Zone 6B) of final destination, and the raised planter designs. Several native plants were selected, focusing on the plant performance when planted in containers with rather low water use to minimize energy use and water use for irrigation.

Irrigation water needs are fulfilled using reclaimed grey and storm water from the Imber system. Water leaving the Imber system is pressurized and pumped into the irrigation system. We implemented a drip irrigation line which will be controlled by an irrigation control system linked to our smart home system. Utilizing weather data and forecasts, this system will calculate the optimal amount of water needed for the various types of plants. Drip irrigation cuts outdoor water use by 70%, additionally weather controlled irrigation cuts down water use even further. This optimizes watering times, avoids excess water use, and ensures plant health regardless of weather patterns.

EnCity handles runoff through the in wall gutter system and rainwater collection. The pond feature celebrates our collection of storm water. Any additional runoff from the deck is diverted into the pond or plants and planters allowing the plants to help clean the water before it enters back into the aquifer. Efficiently using most of the water brought onto the site, and

returning the rest cleaner than when it entered the site.

EnCity's water conservation, reuse, and landscaping strategies allow us to minimize our water footprint, reuse natural resources, and return any excess water to the aquifer cleaner than when it entered our site.

REFERENCES

Guy, G. B. (2015, May 01). Rain-soaked Seattle has nation's highest water bills. Retrieved June 10, 2017, from <http://www.seattletimes.com/seattle-news/data/rain-soaked-seattle-has-nations-highest-water-bills/>