

Analysis of Shower Water Use by UC Davis Students

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Abstract

Each of us leads a busy hectic life, and any moment of peace and quiet is taken as a chance to relax and regroup our thoughts. Our everyday schedules vary widely from person to person, but there is usually one activity that our daily routines share, shower time. While many of us might not spare a thought to how long we shower it is an important factor of indoor water use. As students many of us lead fast-paced and demanding lives. So, we turn to shower time to relax under a stream of hot water during the chilling winter days, or a cool shower to wake up and be ready for that 7:30 chemistry class. We set out to determine just how much water UC Davis students use for their shower needs. We found out that on average for the year of 2013 students will use 1105 acre feet of water. Because of enrollment growth by 2030 this number will increase to 1363 AF/year, and even if showers a temporary sanctuary from the world this high water consumption is not justified. Though our analysis we concluded that water use can be reduced through two main policies; a reduction of shower length and installation of more water efficient showerheads. If our propositions are followed and implemented they could result in saving between 300 and 700 AF/year. A significant amount of water that could be used to secure the fragile future of water resources in the Sacramento region.

Introduction

Our project will focus on urban water use and more specifically indoor water use. The main indoor water consuming utilities are kitchen sinks, laundry washer machines, bathroom sinks and showers, and unbeknownst leaks. Of the three, water use in the bathrooms is the most significant indoor water consumer accounting for 40% to 55% of total indoor water use. The goal of this project is to measure the amount of water used during a shower by UC Davis student. We want to gain more information on this issue because shower use can account for 16.8% to 26.7% of indoor water use (EPA 2013). Furthermore, we would like to see if there are any mechanisms, ideas, or incentives to reduce time spent in the shower.

Objective

The main goal is to analyze the shower water use of students in UC Davis and we set out to determine if there is any leeway in reducing the consumption by promoting better water use. The measuring of water use in showers should provide us with a lead to implementing rules or policies that reduces time in the shower which ultimately reduces water consumption and increases water conservation. The policy we are aiming to provide is incentive to a 'water conservation policy' in which the behavior of the consumer will be altered.

To accomplish the main objectives we collected data from specific targets, in our case currently enrolled UC Davis undergraduate and graduate students. After collecting data for two weeks we were confident we had a large enough sample size. Following that we analyzed our data and calculated current water use by students. Having calculated possible future enrollment we were also able to create models for our proposed methods of either reducing consumption or increasing efficiency.

Data Sources

Our main source for this project was the survey of 135 UC Davis students that responded to the survey. The survey was created using the website [surveymonkey.com](https://www.surveymonkey.com). The free trial only allowed us to see the first 100 responses. We chose this site for our survey tool because it lays out all the responses and you may also create charts and graphs through it. In addition, Samuel Sandoval Solis - Associate professor at the University of California, Davis aided us by helping with calculating the correlation between students that were aware of water origin and how that relates to water usage.

The graph of potential UC Davis population growth was obtained from UC Davis Budget & Institutional Analysis.

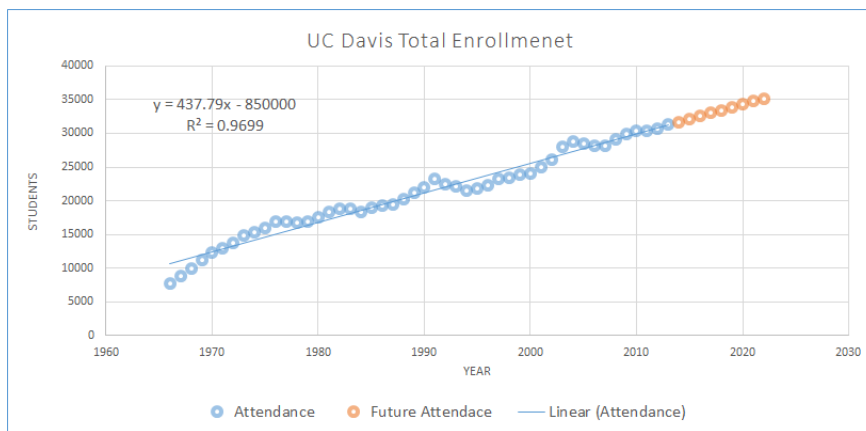
Methods and Assumption

- Internet survey created by us, the group. The survey consisted of 10 questions which asked the subject about where they live; on campus, apartment or single-family residence. In addition, subjects were asked their water usage along with questions about their lifestyle. This includes how long they shower for as well if they participate in physical activities which might influence frequency and duration of showers. An assumption this brings up is that if the subject participates in sports or other activities which causes them to sweat, they will have to shower and we expect to see a rise in shower time and frequency.
 - Survey was sent through social media, and the Dr. Solis sent it through the class listserv.
- We also have to make the assumption that as the UC Davis student population increases, water use will also increase. The larger the population, the higher the demand. In the future, because the global population is increasing in general does not mean that the student population will increase as well. There might be a cap on student admissions that is below our estimate for future student growth.

- Students will live in the dorms their first year. Other factors like money or preference might affect student population in student housing.
- We are assuming that households are currently using a 2.5 gpm shower heads.
- Another assumption is that by implementing techniques to reduce indoor water use, a decrease in use will occur. We cannot be certain that our proposals will be followed or implemented.

Calculation/Results

To be able to model the water use of students we first set out to calculate the growth of the campus population. Using data from the office of Budget and Institutional Analysis we were able to create a model for the future enrollment growth. The model predicts future resident



population based on the attendance records for the last 40 years. A linear regression is the best fit for our data, supported by the R^2 value of 0.9699.

Figure 1. Prediction of future UC Davis attendance.

By using the results from the survey and the future attendance at UC Davis we are able to predict the water consumption of students. On average students shower for 12.57 minutes per day, and most households utilize a regular showerhead consuming 2.5 gallons per minute. Using these numbers we created a baseline for water use for the next 16 years. It shows that by 2030, 1362 acre feet of water will be used by students per year just for showers.

We propose two means of addressing this high usage, reducing shower times and utilizing more efficient shower heads. According to the US Environmental Protection Agency showerheads with a consumption of less than 2 gpm are considered efficient (EPA 2013). For

our models we suggest using showerheads that consume *1.875 gpm*, a 25% reduction compared to current conditions. Our other solution is to *reduce the shower time of all students to either 10 or 5 minutes*.

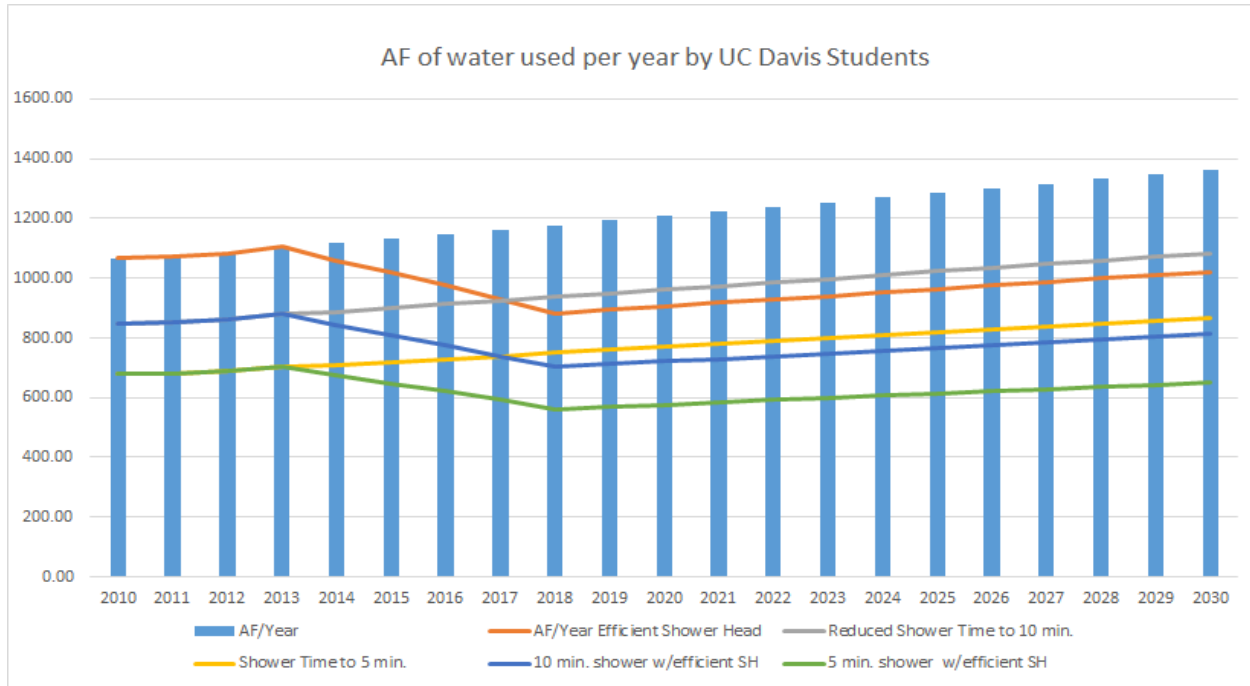


Figure 2. Summary of results, including baseline and proposed reductions.

Since replacing a lot of equipment (showerheads) throughout the city of Davis will not happen over a single year, we decided that it would be more reasonable to model the implementation of water efficiency showerheads in 5% increments each year. This means that

it will take 5 years to complete the improvements.

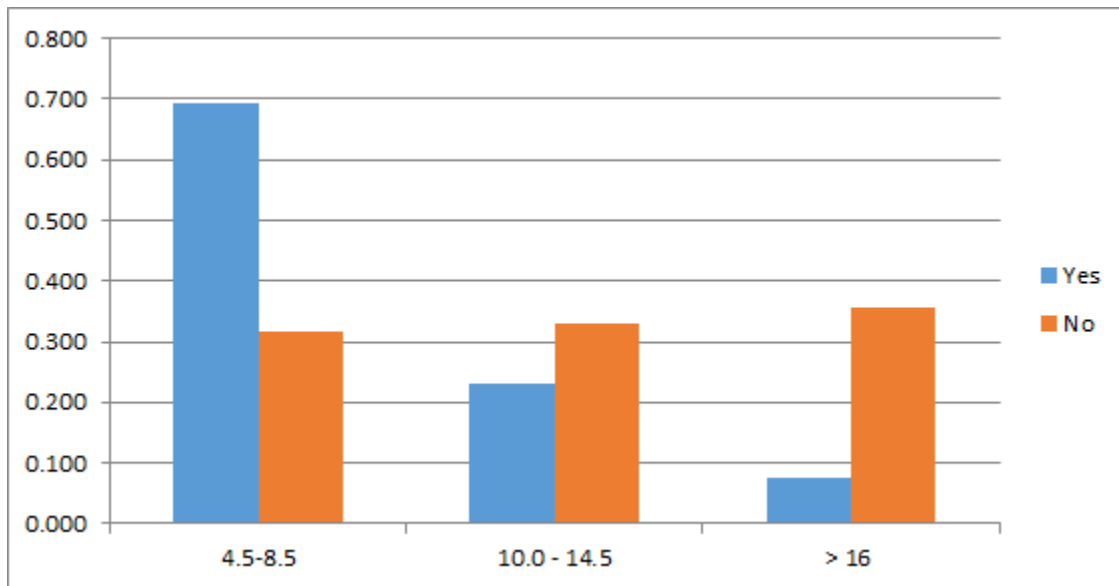


Figure 3. Table showing whether or not participants knew the origin of water for Davis, and depending on that how long their showers took.

We also noticed that there was a relation between whether students know where the water they use comes from. That is shown in **Figure 3**. There is an inverse relationship between knowing where water comes from and the length of showers. Students that did not know the origin had a linear relationship, meaning that *a consistent amount of those students took short (4.5-8.5), medium (10.00-14.5) and long showers (>16)*. While, if a student was aware of the water origin he or she would take a shorter shower. Approximately 63% of those students took showers shorter than 8 and a half minutes long.

Conclusions

The results from the survey support our hypothesis, students are using a lot of water during their showers. This is an additional stress on an already diminishing resource. As the attendance at UC Davis continues to grow so will the demand for water. We see this as an issue that can be addressed in two main methods. Raising awareness about the origin of water within the city of Davis, and requiring more efficient showerheads within apartment building and dormitories.

All incoming students are housed in places ran by UC Davis, dormitories for freshmen students and either dorms or apartments for transfer students. We propose that while students are residents of a UC Davis ran housing unit they should attend a mandatory course on water conservation. This course will cover the importance of efficiency and conservation of water use. It would educate students that water is a finite local resource that has to be preserved. By taking this seminar we expect to see reductions in shower time for most students. We represented this in our data by adding two additional scenarios reflecting a reduction in average shower time to either 10 or 5 minutes. Both of these cases have a very strong impact in future water use saving about *278 or 495 AF/year for either a reduction to 10 or 5 minutes respectively.*

Our second proposal was the installation of more efficient shower heads. Through our survey we found out that 82% of students live in either a dorm or an apartment. For maximum effect we suggest a required change of showerheads within all dorm building and apartment building in Davis. This will not happen in the time frame of one year so while modeling the implementation we spaced out reductions to be completed within a period of five years. The implementation of this policy will results in *a yearly reduction of 341 AF of water starting from the year 2018.*

To maximize the effects of the policies we are proposing, we suggest the implementation of both policies concurrently. By increasing awareness among students and enforcing mandatory installation of efficient showerhead we will see the greatest reduction of water usage. Ranging *between 550 and 712 AF/year* depending on whether shower times decrease to 10 or 5 minutes.

Recommendation/Limitations

While our proposed solutions look good on paper that might not be enough to convince UC Davis Student Housing to implement a water awareness program to their curriculum for incoming students. It will also be a hard to convince apartment managers to update their current showerhead units to more efficient ones. This is because it will be an investment that is not ensuring increased returns on monetary profits. The benefits of our program are not local but regional. However, the expenses are all taken on by local businesses, so the implementation of our conservation measures will be dependent on their philanthropy.

References:

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