# Shower Duration Behavioral Study

## Project Number ET25SWG0005

### GAS EMERGING TECHOLOGIES PROGRAM (GET)
### March 2026

Prepared by ICF for submission to Southern California Gas Company

SoCalGas
*Glad to be of service®*

ICF

# CONTENTS



# LIST OF TABLES

## LIST OF FIGURES

## LIST OF EQUATIONS

## Acknowledgements

ICF is responsible for this project. This project, ET25SWG0005, was developed as part of the Statewide Gas Emerging Technologies Program (GET) under the auspices of SoCalGas as the Statewide Lead Program Administrator. Anoushka Cholakath, PMP conducted this technology evaluation with overall guidance and management from Steven Long, P.E. For more information on this project, contact Steven.Long@ICF.com.

## Disclaimer

This report was prepared by ICF and funded by California utility customers under the auspices of the California Public Utilities Commission. Reproduction or distribution of the whole or any part of the contents of this document without the express written permission of ICF is prohibited. This work was performed with reasonable care and in accordance with professional standards. However, neither ICF nor any entity performing the work pursuant to ICFs authority make any warranty or representation, expressed or implied, with regard to this report, the merchantability or fitness for a particular purpose of the results of the work, or any analyses, or conclusions contained in this report. The results reflected in the work are generally representative of operating conditions; however, the results in any other situation may vary depending upon particular operating conditions.

# Executive Summary

**Project goal:** The objective of this project was to deploy and evaluate the potential water and natural gas savings, including the behavioral impacts on shower duration, associated with the use of the ShowerStar™ smart shower timer. This exploratory, Phase 1 feasibility field study represents the first known deployment of this technology in the United States. and aimed to assess its effectiveness, user experience, and feasibility for potential inclusion in future energy efficiency programs.

**Technology description:** ShowerStar™ is a sensor-based, smart shower timer that automatically detects shower activity using vibration sensing and provides real-time visual feedback through high-visibility LED "traffic-light" alerts (green, amber, red). The device is a do-it-yourself retrofit that mounts directly to the shower pipe or shower head and pairs with a mobile application that records shower duration and estimates associated water, energy, and cost impacts.

**Key Findings:** Out of 50 devices initially planned for testing, only a limited subset of participants consistently connected their devices and produced sufficient data for analysis. Seven "good sites" enabled pre- and post-comparison of shower duration. Five of these seven sites experienced reduced average shower times when ShowerStar™ operated in "normal" mode with alerts enabled. Modeled results from these sites indicate total estimated annual savings of approximately **14,773 Gallons of water**, **70.5 therms of natural gas**, and **$259 in combined utility cost savings**. Statistical analysis showed that the observed reduction in shower duration was not statistically significant at the 95% confidence level, largely due to small sample size and data variability. Survey results suggest that users generally found the device easy to install and reported increased awareness of shower duration and water use.

Initial survey results indicate there were significant set-up and accurate shower tracking issues when the devices were initially deployed. Based upon the field trial work and program input, the manufacturer made many near real time changes to account for differences in California vs their initial testing in Australia, including updated user assumptions, improved firmware, and new autocalibration mode to account for multifamily housing vibration impacts and the improved clip-on mounting cradle. While these updates created a much-improved product, it also likely impacted the pre/post comparison and may have resulted in a higher drop-out rate due to device configuration fatigue. The second survey implied that the changes were having a positive impact on operation.

**Recommendations:** Future studies should prioritize larger sample sizes and a more supportive delivery approach, including additional training and outreach, due to the device's reliance on user-initiated data uploads for evaluation and system configuration to ensure sufficient data quality. Sampling over a full year is recommended to adjust for seasonal effects on shower usage. Additionally, enhanced installation controls such as

switching to the updated clip-on cradle or having a field technician install the legacy zip tied mount may be beneficial to avoid challenges with installation and smart phone setup. Mandatory device calibration (now the default set-up), and periodic monthly communication with customers are also recommended for the purpose of getting users to connect to their devices frequently to ensure data collection. The study also recommends testing in "Normal Mode" as opposed to "Field Trial" mode since this has caused problems, especially with users not turning on the correct setting.

With these improvements, ShowerStar™ shows promise as a behavioral efficiency measure that could support water and energy savings at scale within California residential energy efficiency programs. The manufacturer, TouchGrid remains actively engaged in continuous improvement efforts, and is currently evaluating options to automate the data upload process.

# Introduction

According to the Environmental Protection Agency (EPA), the average shower time across the United States is about 8 minutes with each shower consuming an estimated 16 million gallons of water annually [1]. Showers are a growing scope 3 carbon emissions issue globally. A simple modification of shower time from 8 minutes to 4 minutes, results in roughly 43,800 L of water savings and 51.9 therms per shower/year [2]. In Southern California, this results in approximately $66.3 of savings on water and gas bills every year for one shower [2]. Energy consumption from shower usage can impact greenhouse gas (GHG) emissions. A study in Australia found that shifting water use can reduce GHG emissions by up to 3% during summer months and 2% during winter months [3]. Changing people's everyday behaviors to encourage shorter shower times is a critical strategy for reducing water use, energy demand, and GHG emissions. Because showers are frequent, habitual, and energy-intensive, even small changes in duration can produce disproportionately large environmental benefits, when adopted at scale.

Typical shower timers include mechanical sand or dial timers, often with set durations that start when you flip or turn them when you start a shower. The timer runs out silently or with a small bell or chime. These devices are commonly sold as low-cost awareness tools for water and energy use, and have been linked to short-term awareness since users may fail to manually restart the timer every shower and revert back to baseline shower behavior without constant reinforcement.

For this project, a newer sensor-based, smart shower timer known as ShowerStar™ was tested to determine how it impacts user shower behavior over a period of approixmately 6 months. The ShowerStar™ technology automatically detects when water flow starts by using vibrational sensing. Compared to typical shower timers, this smart shower timer was designed explicity for persistent behavior change. The product has been independently

verified to provide savings of up to ~30% per shower at scale and significant energy and cost savings across various field trials in Australia [4].

The main objectives of this field trial were the following:

1. Deploy ShowerStar™ at ~50 residential households
2. Gather and analyze 3-6 months' worth of behavioral, water, and energy data including potential savings and determine the drop-off rate after the first three months of usage
3. Conduct customer surveys to learn more about the customer experience

The expected outcome of this preliminary field trial was to quantify any water and energy savings of the ShowerStar™ technology and its behavioral impact on household shower duration.

## Background

The ShowerStar™ smart timer uses high-visibility LED "traffic-light" cues (green ->amber -> red) to indicate when your ShowerStar™ starts, when it is halfway through, and when to stop, as shown in Figure 1.


**Figure 1 ShowerStar™ Product and App Interface [5]**

The settings are configurable via the ShowerStar™ smartphone app which is available for free, where users can set their utility costs, shower warmup time and target shower time or just use the device's default 4-minute timer. The device logs shower duration data and estimated water, energy, and cost impacts are viewable on the customers dashboard on the smartphone app. The device can be mounted directly on the shower pipe or shower head with no plumbing work required. Thus, this is marketed as an easy, DIY retrofit smart shower timer.

Currently, this technology has been deployed across various field trials in Australia but has not yet been tested at scale in the United States. This small field trial will be the first time this technology has been assessed in the United States.

## Emerging Technology

Table 1 breaks down the differences between existing mechanical shower timers and the emerging ShowerStar™ technology.

**Table. 1 Existing Shower Timer vs. ShowerStar™ Comparison**

| Item | Mechanical Shower Timer | ShowerStar™ |
|---|---|---|
| Cost | Very low ($5-$15) | Moderate (~$48 USD) |
| Installation | Instant | ~2 minutes (no tools for updated cradle bracket) |
| Power | None | USB Rechargeable (6-8 months per charge) |
| Shower Data/History | None | App (track showers) and online dashboard |
| Cost and Energy Savings | None | App |
| Start Mechanism | Manual (flip/switch) | Automatic (detects vibration) |
| Warm up Water Period Included | Often excluded | Included warm up delay by default |
| User Forgetful risk | High | Low |

The bottom line is that mechanical showers measure intention, while ShowerStar™'s technology intends to shape long term behavior. Mechanical shower timers are affordable, simple, and easy to install. But they are also easy to ignore, since individuals need to remember to turn them on. Additionally, there is no link to actual water or energy use by using these shower timers. The emerging ShowerStar™ technology which has a higher upfront cost, with costs expecting to drop once production is scaled up. When paired with the app, users are able to track their shower logs, and configure their buildings heating cost information to determine accurate energy and water savings, shown in Figure 2.

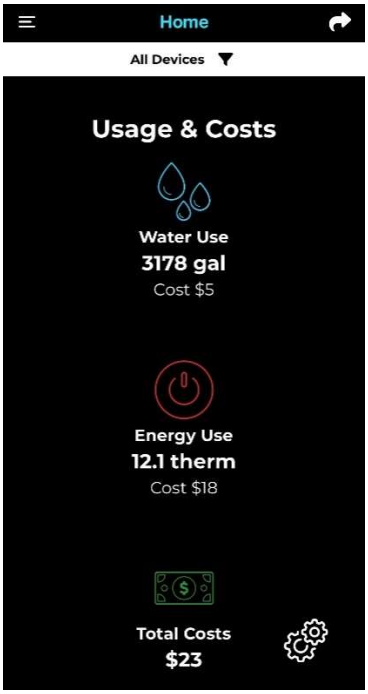



**Figure 2. View of User Dashboard showing Water, Energy, and Cost savings**

There are several market barriers that could impact widescale deployment of ShowerStar™. Firstly, general consumer awareness and perception could be a barrier since this technology is not yet broadly available to the American public. There is a general lack of familiarity with the new tool or people may associate it with typical basic mechanical or digital shower timers that have limited capabilities. Another barrier Is the higher price of the ShowerStar™ tool compared to typical mechanical timers. Finally, Americans are generally not aware that their shower habits also carry a costly energy load, and mainly associate it with water usage, thus marketing ShowerStar™ as a water and energy tool needs to be quite strong to promote meaningful energy efficiency as well.

## Assessment Objectives

The goal of this technology assessment is to quantify potential water and energy savings, and the behavioral impact on household's shower duration over time by testing the ShowerStar™ technology.

The first objective of this project was to deploy ShowerStar™ with a goal of ~50 units being delivered across multifamily and single-family residential households. Participants were recruited using a combination of direct outreach and community-based engagement methods. The project team approached potential participants through door-to-door engagement in targeted neighborhoods, as well as through word-of-mouth referrals to identify interested participants across California. To support effective engagement, the project team worked closely with an experienced program outreach staff member for the

door-to-door outreach. The outreach staff were encouraged to clearly communicate the purpose of the study and encourage voluntary participation.

The next objective of the study was to gather and analyze 3-6 months' worth of water and energy data from field study. Data was collected throughout the trial to first establish a baseline (first 60 showers in field trial mode), and the last data collection effort was 6 months later to determine the water, energy, behavioral changes, and drop-off rate over time.

The final objective was to survey customers on their experience using ShowerStar™ to learn more about the customer experience of the project and gather feedback.

## Technology Assessment

A field study was selected for this technology assessment, since it will rely on customers to install a ShowerStar™ unit at their places of residence. The assessment took place across California, starting with 48 units, but this fell to with 29 units located in Southern California across LA County, Orange County, San Diego County, and San Bernadino County, and 3 units in Northern California near the greater San Fransico area. Users in other states were not considered for this assessment. The period of study was from July 1st, 2025 to January 30th, 2025.

### Site Selection Criteria

Both single-family and multifamily residences were included in the field trial as shown in Figure 3.

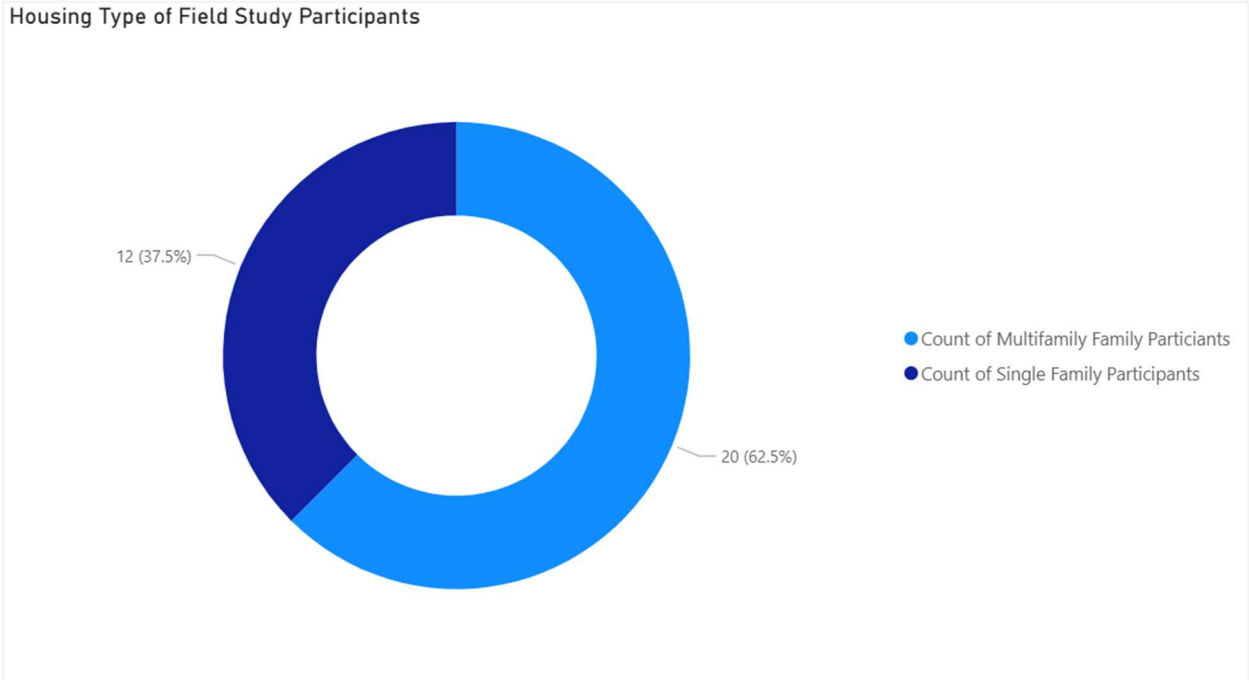


**Figure 3. Housing Type of Field Study Participants**

Most sites consisted of multifamily homes, which include apartments, attached condos, and attached town homes.

Sites were selected to minimize extraneous factors that could bias test results while maintaining real-world applicability. The primary site selection criteria included:

- A functioning residential shower with consistent use
- Ability for participants to self-install the device without professional help
- Access to a smartphone capable of pairing with the ShowerStar™ application
- Customer willingness to follow installation and setup instructions and periodically connect the device for data upload

**ShowerStar™ Field System Configuration**

Identical equipment, standardized instructions, and a uniform self-installation process were distributed to individuals who opted to participate. Users were instructed to self-install the unit and were provided directions on how to do so. Each kit came with the ShowerStar™ device, charging cable, zip ties, and the cradle for users to install the unit, as shown in Figure 4.

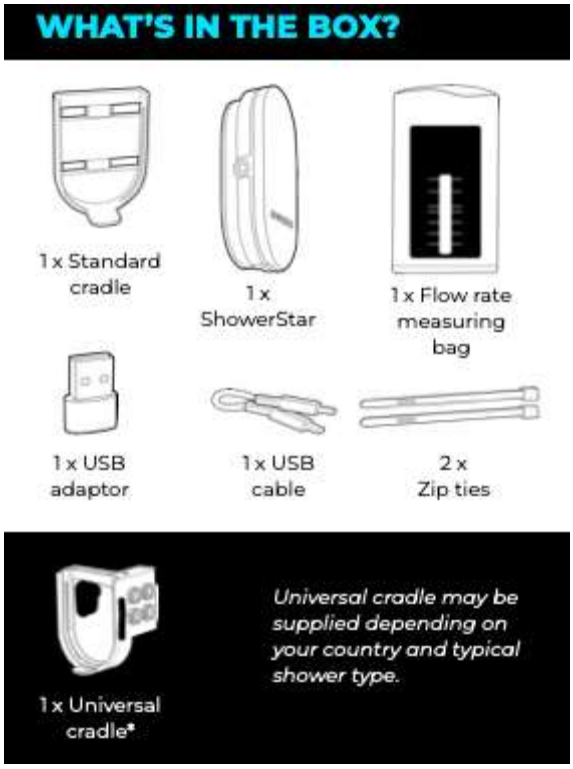


**Figure 4. ShowerStar™ Instrumentation**

Users also received an instructional guide with information on how to correctly install the device and configure the ShowerStar™ app to ensure proper pairing for the study. Instructions are shown in Figure 5 and Figure 6.

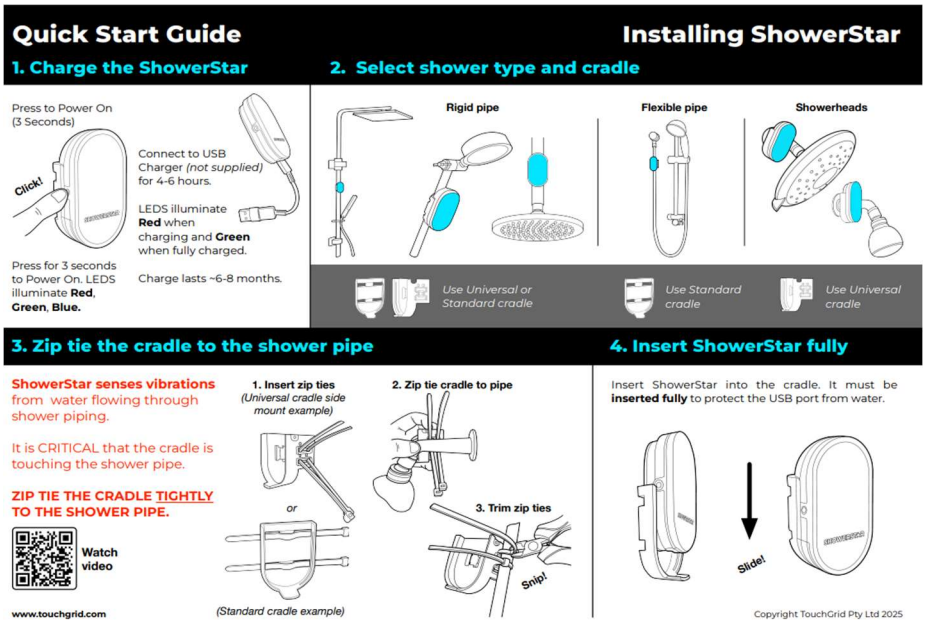



**Figure 5. User Installation Instructions**

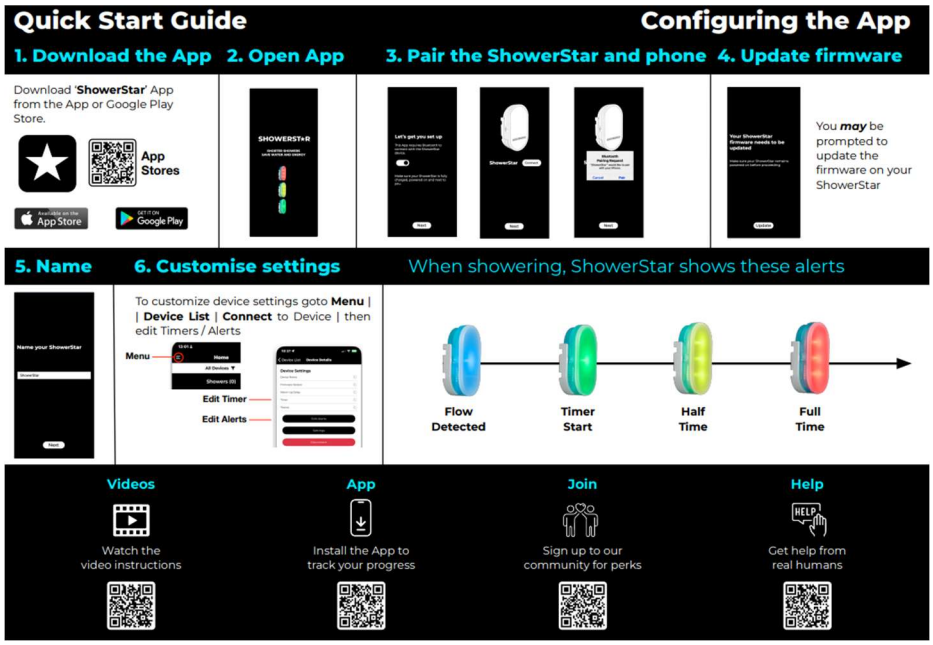



**Figure 6. User App Configuration Instructions**

Since this is considered an easy, Do-It-Yourself (DIY) retrofit solution, the project team did not work with any contractor for the installation. The program team provided ongoing

support along with the help and guidance of the manufacturer, TouchGrid who worked closely with the team to help support ongoing customer challenges.

### Experimental Design and Data Collection

The experiment leveraged ShowerStar™'s built-in Field Trial (Pre/Post) mode. During the initial phase, the device operated in **Field Trial** mode and recorded shower durations without user alerts, establishing a **baseline**. After a predefined number of showers (60), the device automatically transitioned to **normal** operating mode (post state), activating visual feedback alerts. Measurements were recorded at the shower pipe location via the ShowerStar™ device's vibration sensor. Shower duration data were logged locally by the device and uploaded periodically through a semi-manual process through the mobile application to a cloud database. In addition to the app savings projections for the user, the project team accessed this data remotely for our analysis and troubleshooting. No additional third-party metering or flow measurement equipment was installed as part of this assessment. The only required customer data collected is the MAC ID number. Typically, no personal Identifiable information would be collected from the Shower usage through the cloud database. For the purposes of this trial, we did collect email addresses to facilitate troubleshooting, for sending out surveys, and distribution of the gift card for participation in the study.

## Results

### Unit Distribution and Participation Rate

Of the 50 ShowerStar™ units that we originally planned to distribute, the project team was only able to distribute 48. The participation rate is summarized in Table 2, which shows that of the 48 devices that were distributed, roughly 66.67% of participants followed through with initially installing the unit and syncing the device to their mobile app to allow for shower time tracking. This means that 32 devices were synced, however of those devices only 29 had usable shower logs that we could track over the project period The reason for this could be that users did not connect to their device after the initial sync, thus no logs were tracked for those 3 units. After initial installation, 16 devices were either uninstalled or not synced to the ShowerStar™ mobile app, meaning that useful data could not be collected. Of the 16 devices that were not initially installed, 4 of them were due to issues with the participants spouse or significant other not wanting them to install the device due to the appearance of product. At the end of the experiment, we noted 8 users still engaged, and connecting to their showers as of January 2026, which suggests an 83.3% drop-off rate. While the six-month drop-off rate was high (83.3%), survey results, described later in the report, indicate that attrition was largely driven by fatigue with the trial's manual syncing and data upload requirements rather than dissatisfaction with the ShowerStar™ device. Users consistently reported liking the visual alert system and feeling more

conscious of their water use, supporting the hardware's core behavioral value despite challenges associated with sustained data collection.

**Table 2. Devices Installed**

| Devices Distributed | Number of Devices Synced | Number of Devices with Logs | Number of Uninstalled or Not Synced Devices | Initial Participation Rate (%) | Initial Drop off Rate (%) | Number of Devices Still in Use/ Connected after 6 months | 6 month Drop off Rate (%) |
|---|---|---|---|---|---|---|---|
| 48 | 32 | 29 | 16 | 66.67% | 33.33% | 8 | 83.4% |

Of the 29 devices with logs, the project team identified **7 "good sites"** where users connected to their app frequently to record the shower logs and turned on "field trial" mode settings to ensure comparison between the field trial mode and normal operating mode. The remainder of the 22 devices with logs that were identified as **"bad sites"** and are summarized in Figure 7.

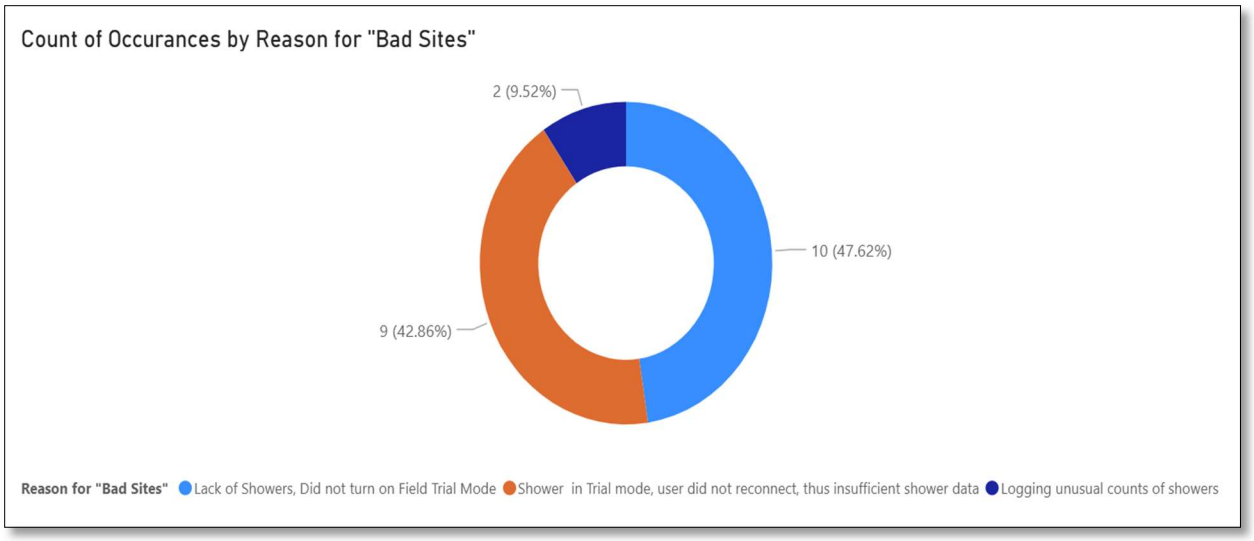



**Figure 7. Unusable Devices for Pre/Post Comparison**

There were several reasons as to why pre and post comparison analyses could not be conducted for the rest of the devices due to insufficient or unreliable data. The primary reason as shown in Figure 7, included a lack of recorded showers during the study period and improper device configuration, meaning that the user did not initially turn on Field Trial mode to establish a baseline state. The next reason included users that initially did turn on Field Trial mode, however the users did not reconnect to their devices either after the initial set up, or there was a lack of shower data in the pre and post states which resulted in incomplete datasets. Finally, a small number of users logged an unusual number of showers per day, including very long (60+mins), or inconsistent shower counts which suggest potential data quality or usage issues. These users reached out to the project team and stated that the shower was logging data when they weren't home or weren't using the shower. We believe these issues were mostly fixed during the trial with firmware updates and newly required calibration but occurred late enough to impact the data collection. Collectively, these factors resulted in insufficient valid shower data for the purpose of establishing a robust pre versus post comparison of user behavior and shower time.

## Data Analysis

Results for the 7 identified "good sites" are summarized in Table 3. The table shows that 5 of the 7 units (Units 1-4, and 7) experienced lower post-state averages while the ShowerStar™ was operating on normal mode compared to the pre-state Field Trial mode.

**Table 3. Pre and Post ShowerStar™ Results**

| Unit | Field Trial Average Shower Time ( First 1-60 Showers) (minutes) | Average Normal Mode Time (Next 60+ showers) (minutes) | Median Field Trial Average Shower Time (First 1-60 Showers) (minutes) | Median Normal Mode Time (Next 60+ showers) |
|---|---|---|---|---|
| 1 | 5.95 | 5.73 | 6.28 | 5.73 |
| 2 | 6.57 | 5.81 | 4.58 | 4.43 |
| 3 | 8.67 | 7.90 | 9.48 | 8.32 |
| 4 | 5.05 | 4.08 | 4.76 | 4.23 |
| 5 | 7.69 | 9.20 | 5.00 | 6.07 |
| 6 | 5.63 | 5.99 | 5.97 | 6.33 |
| 7 | 4.08 | 1.67 | 3.68 | 1.67 |

Data Analysis to estimate savings for these sites were conducted using the following assumptions:

- Average energy cost: $2.00/therm [6] (Note: Monthly average utility costs may fluctuate, $2.00/therm was used as an average gas cost across CA)
- Water Cost: $0.022/MCF ($0.00212/L)
- ~3 Showers/day (Note: varies based on shower occupants and number of users)
- Shower Flow Rate: 2.64 gal/min (10.0 L/min)
- Inlet Temperature: 60.1 °F
- Shower Temperature 105.8 °F
- Water Heater Type: Gas Storage Water Heater (Note: Water heater type was not sampled in this study; Gas Storage water heaters were assumed for the purposes of data analysis and generally are the most common in this area)

Average shower durations, along with the assumptions, were input into a water and energy savings calculator to estimate corresponding annual water, gas, and cost savings. The analysis leveraged the TouchGrid Shower Savings Calculator, a tool developed by TouchGrid to translate changes in shower duration into estimated water and energy savings based on user-defined inputs and utility assumptions [2]. Results of the data analysis are summarized below in Table 4.

**Table 4. Changes in Average Shower Duration and Corresponding Annual Water, Energy, and Cost Savings by Unit**

| Unit | Average Shower Time Percent Change (%) | Average Time Difference (min) | Annual Water Savings (Gallons) | Annual Gas Savings (therm) | Total Savings Per Year ($) |
|---|---|---|---|---|---|
| 1 | -3.83 | -0.22 | 627.67 | 3.0 | $11.00 |
| 2 | -13.11 | -0.76 | 2,198.44 | 10.5 | $38.30 |
| 3 | -9.78 | -0.77 | 2,198.44 | 10.5 | $38.60 |
| 4 | -23.77 | -0.97 | 2,805.77 | 13.4 | $ 49.30 |
| 5 | +16.41 | +1.51 | (4,367.82) | -20.8 | $(76.70) |
| 6 | +5.96 | +0.36 | (1,041.37) | -5.0 | $(18.30) |
| 7 | -144.67 | -2.41 | 6,942.44 | 33.1 | $ 121.90 |
| **Total Annual Savings ONLY** | - | - | **14,772.76** | **70.5** | **$ 259.10** |
| **Total Annual Savings Including Increases** | - | - | **9,363.58** | **44.7** | **$ 164.10** |

The average difference in shower times for the unit's water savings ranged from -0.22 minutes to -2.41 minutes as shown in Table 4. For these units, the corresponding modeled savings sum to an estimated 14,773 gallons of annual water use reduction, 70.5 therms saved annually, and $259.10 in total annual cost savings. Units 5 and 6 showed increases in average shower times from +0.36 minutes to +1.51 minutes between pre and post states, resulting in negative savings. Combining both positive and negative differences show savings of 9,363.58 gallons, 44.7 therms, and $164.10 in annual cost savings among all units. Thus, annual savings are not applicable for these units. When normalized across the five sites that demonstrated measurable reductions in shower duration, the modeled results correspond to average annual savings of approximately **2,955 gallons of water, 14.1 therms of natural gas, and $51.80 in combined utility costs per unit/household**. Shower duration

data over time from the good sites are shown below in Figure 8.

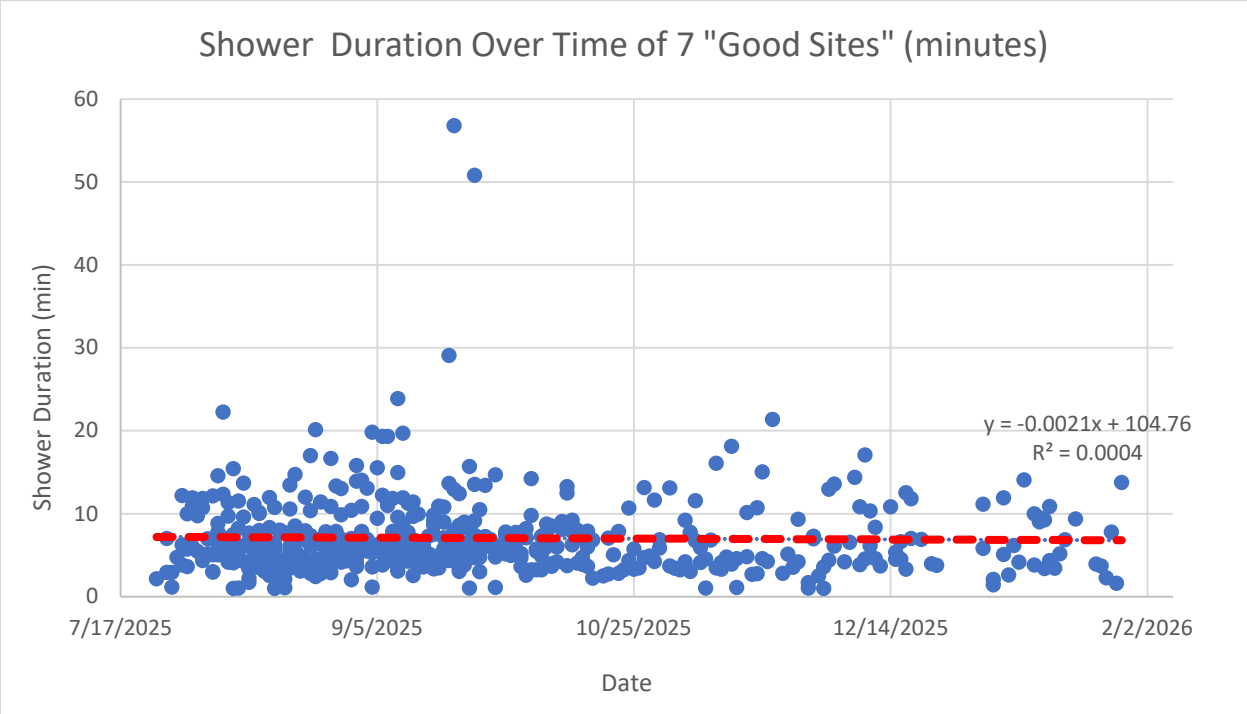



**Figure 8. Average Shower Duration Over time of "Good Sites"**

This graph shows a scatter plot of each individual shower from the "good sites" over time. With a regression $R^2$ = 0.0004 which indicates that the model doesn't show any statistically meaningful relationship between shower duration over time. The scatter shows

Figure 9 shows a graphical representation of average showers in the pre and post state.

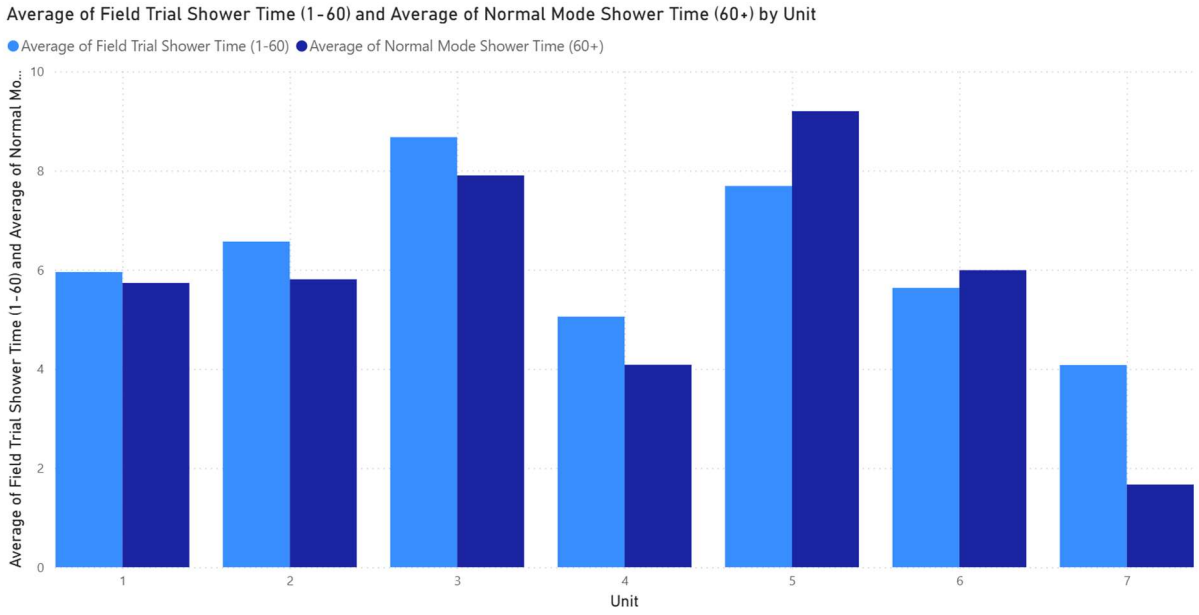


**Figure 9. Graphical Representation of Average Pre and Post State Shower Times in "Good Sites"**

This figure visually shows that 5 out of the 7 sites saw an average reduction in their mean shower time between the field trial vs normal mode state.

A similar scatter plot for all units both "good sites" and "bad sites" with logs is shown below in Figure 10.

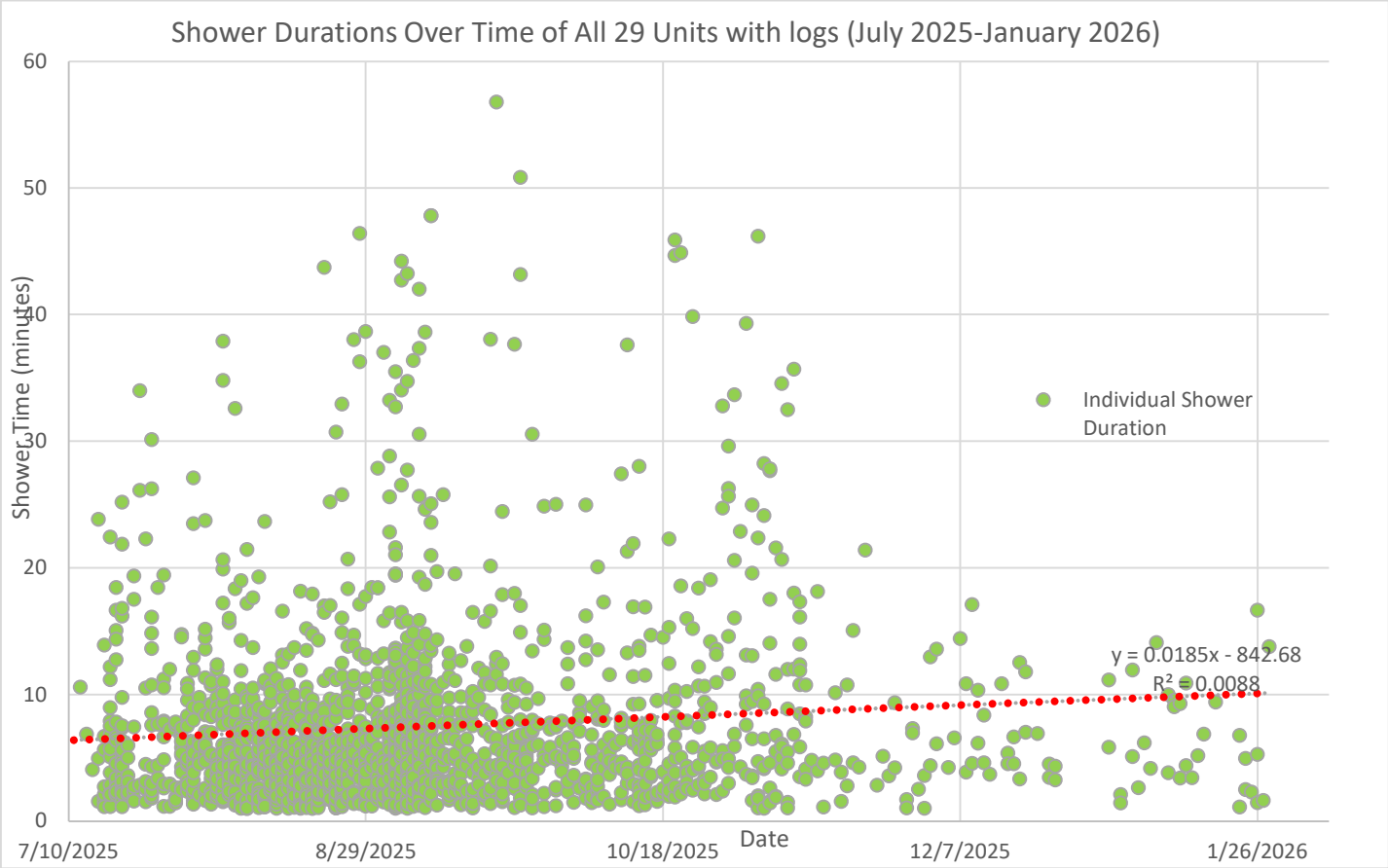



**Figure 10. Individual Shower Duration Over Time of All Sites**

This shows a slightly positive slope, and again a very low corresponding regression $R^2$ = 0.0088, which indicates that the model doesn't show any statistically meaningful relationship of the shower duration over time. Figure 10 also points out the extra "noise" in the scatter, due to some of the bad sites in the earlier months of the study. Towards the last few months, some of this noise has reduced, likely to the firmware updates and calibration improvements that TouchGrid had implemented throughout the course of the project. The average shower time for all sites is graphically shown in Figure 11.

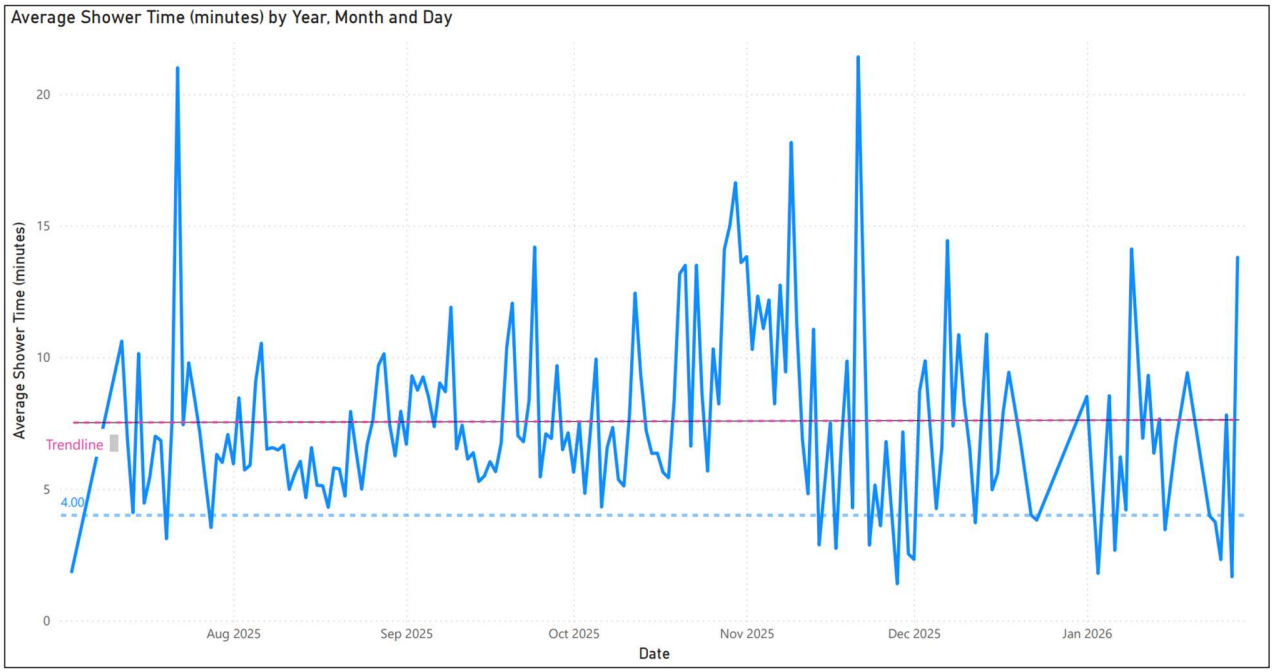



**Figure 11. Average Shower Duration Over Time of All Sites**

Based on this chart, there is no major trend that can be identified from looking at the average shower time for both "good sites" and "bad sites" over the 6-month period. However, one observation is that as time progressed, more averages were hitting close to or below the 4-minute mark, denoted by the dashed blue line. This is notable, since ShowerStar™ sends flashing red light alerts at the 4-minute mark and we do see more averages around that time as the study progressed overtime. This could also be attributed to the "bad sites" dropping off earlier in the study, thus the "good sites" with consistent users are more likely to be reflected as time goes on.

### Statistical Analysis

Statistical Analysis was conducted to evaluate whether mean shower duration during Field Trial mode is higher than during Normal Mode. This hypothesis was tested to assess whether Field Trial settings may be associated with longer average shower durations relative to Normal Mode. The goal of this statistic test was to determine if the ShowerStar™ device reduced shower durations while on Normal Mode, where users were typically receiving the green->amber->red alerts.

Seven units had sufficient data in both periods and were included in the analysis. Because the same units were observed under both conditions, a **one-sided paired t-test** was used to test whether the mean shower duration during Field Trial mode exceeded that during Normal Mode.

The difference in mean shower duration is calculated as follows:

$$\boldsymbol{d_i = Field\ Trial\ Shower\ Time\ Average_i - Normal\ Mode\ Shower\ Time\ Average_i}$$ **Equation #1**

The Null hypothesis was that the mean shower duration during the Field Trial mode is not greater than during Normal Mode.

$$H_0: \mu_d \leq 0$$

The Alternative Hypothesis is that the mean duration during Field Trial mode is greater than during Normal Mode.

$$H_1: \mu_d > 0$$

The test was conducted at a confidence level of $\alpha$=0.05. The degrees of freedom is 6, based on this equation:

$$\boldsymbol{df = n - 1}$$ **Equation #2**

Where:

- n = number of samples. In this case n=7.

The t-value was calculated using equation:

$$\boldsymbol{t = \frac{\bar{d}}{s_d/\sqrt{n}}}$$ **Equation #3**

Where:

- $\bar{d}$ = mean of the paired differences
- $s_d$ = sample standard deviation of the paired differences
- $n$ = number of samples

The outputs of the statistical analysis are shown in Table 5.

**Table 5. Statistical One-Sided T-Test Results**

| | |
|---|---|
| Number of Units (n) | 7 |
| Mean Shower Time Field Trial Mode (min) | 6.2354 |
| Mean Shower Time Normal Mode (min) | 5.7684 |
| Mean Difference ($\bar{d}$) (min) | 0.4669 |
| SD of Differences $s_d$ | 1.215 |
| t-statistic (t) | 1.0168 |
| Degrees of freedom (df) | 6 |
| One sided p-value | 0.18 |
| Confidence Level | $\alpha$= 0.05 |

Table 5 shows a test statistic t(6) = 1.0168 which corresponds to a one-sided p-value of 0.18. Although the average shower duration was higher during Field Trial mode by approximately 0.47 minutes, the one-sided paired t-test indicates that this difference is not statistically significant at the 0.05 level. The observed p-value of 0.18 exceeds the chosen significance threshold, and therefore the null hypothesis cannot be rejected. Based on this one-sided paired t-test, there is insufficient statistical evidence to conclude that mean shower duration during Field Trial mode is greater than during Normal Mode. While the direction of the observed difference is consistent with the alternative hypothesis, the magnitude of the difference and the limited sample size result in substantial uncertainty. A larger sample would be ideal and necessary for determining more accurate statistical significance. Thus, given the very small sample size (n = 7) and the confounding influence of colder winter conditions—known to increase shower duration—the observed lack of statistical significance (p = 0.18) is best understood as a data limitation rather than evidence against the efficacy of ShowerStar™

## Survey Results

Participants were asked to complete surveys on 2 separate occasions. The first was after roughly ~2 months of use and the next was after ~6 months of use. A total of 8 responses were collected for both the first and second surveys. The survey questions asked are noted in Appendix 1 and Appendix 2 respectively.

## Survey #1 Results

Figures 12-25 show the results from Survey #1.

Figures 12 and 13 are based on the 5-point Likert scale, where a rating of 1 is "Easy" and 5 is "Difficult".


**Figure 12. Survey #1 Question #1**

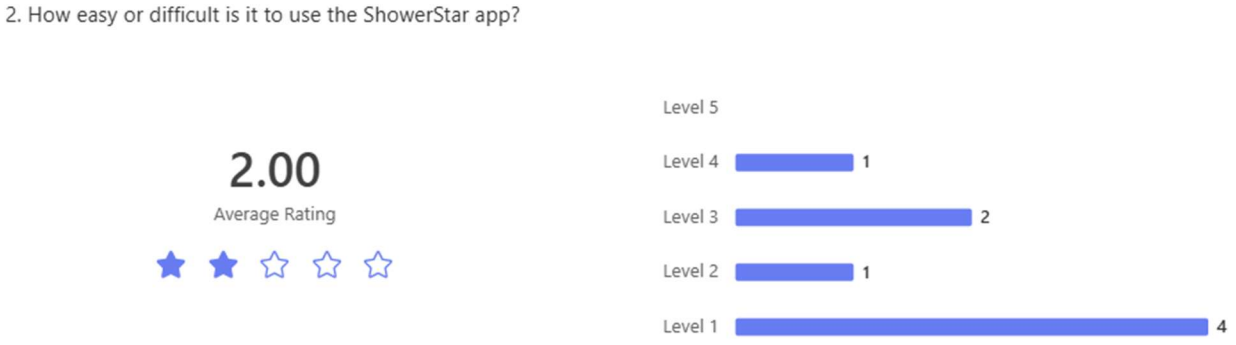



**Figure 13. Survey #1 Question #2**

3. Have you encountered any issues or challenges while using the device? If so, please describe them.

8 Responses

| ID ↑ | Name | Responses |
|---|---|---|
| 1 | anonymous | The device is attached to my shower head but it turns on and flashes the "water running" light everytime I flush my toilet in the same bathroom |
| 2 | anonymous | I have noticed the device will activate when I'm not in the shower. It may be too sensitive to motion such as opening the door or running the sink faucet. |
| 3 | anonymous | I don't think the device detects water flow in my shower at 100% accuracy. Sometimes when the shower water is not running, the device gives me the GREEN light to start showering. |
| 4 | anonymous | I wouldn't necessarily call it an issue, but sometimes the different colored lights will go off at times that does not correspond to the color |
| 5 | anonymous | Sometimes it flashes red a minute after I turn the shower off. |
| 6 | anonymous | Yes. It only recorded 11 of our showers. We probably took about 50 in the time period. Also, the device would go off in the middle of the night and wake us up. We think it might have been picking up the vibrations of our water softener? |
| 7 | anonymous | The device randomly disconnects from the app. I have had to reconnect it at three times since I first installed it back in July. Additionally, the lights randomly flash when no water is running and even when the bathroom is completely empty. |
| 8 | anonymous | Mounting issues |

**Figure 14. Survey #1 Question #3**

For Figure 14, a rating of 1 corresponds to "Not Satisfied" and 5 is "Very Satisfied"

4. How satisfied are you with the overall ShowerStar experience?


**Figure 15. Survey #1 Question #4**

5. What is your building type?

| | |
|---|---|
| Multi Family (Apartment, Condo, Townhome) | 4 |
| Single Family | 4 |
| Mobile Home | 0 |

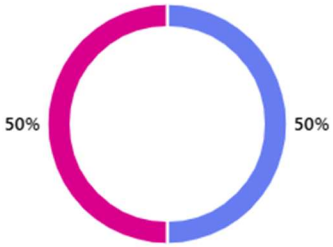



**Figure 16. Survey #1 Question #5**

6. On average, how many people use this shower?

| | |
|---|---|
| 1 | 2 |
| 2 | 6 |
| 3 | 0 |
| 4 | 0 |
| 5+ | 0 |

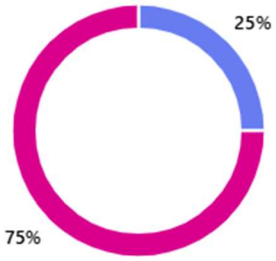



**Figure 17. Survey #1 Question #6**

7. Do both adults and teenagers/children use this shower?

| | |
|---|---|
| Adult | 7 |
| Kids | 0 |
| Both | 1 |

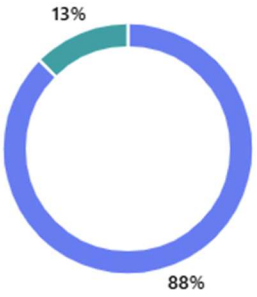



**Figure 18. Survey #1 Question #7**

8. Have you noticed any changes in your showering habits since using ShowerStar? If so, what?

7 Responses

| ID ↑ | Name | Responses |
|---|---|---|
| 1 | anonymous | It has definitely sped up my shower time |
| 2 | anonymous | I have tried to limit my showering time to when the RED light flashes. |
| 3 | anonymous | I think my showers tend to be shorter ever since using ShoweStar |
| 4 | anonymous | I became more conscious about how much time I spend in the shower |
| 5 | anonymous | Yes, I did try to finish my shower before the final red light. |
| 6 | anonymous | The lights make me aware of my time in the shower, but I wouldn't say it has caused my to change my habits. |
| 7 | anonymous | Mindful of time spent |

**Figure 19. Survey #1 Question #8**

9. Has ShowerStar influenced your water usage or conservation efforts? If yes, how?

7 Responses

| ID ↑ | Name | Responses |
|---|---|---|
| 1 | anonymous | I like having a timer now. Before the shower was kind of a timeless zone and I had no sense for how long it took me to shower. |
| 2 | anonymous | Yes, I have tried to shorten my shower time. |
| 3 | anonymous | Yes, overall, it makes me take shorter showers |
| 4 | anonymous | Yes, I try to stop before it flashes red and sometimes if it flashes red, I stop at the most a minute after |
| 5 | anonymous | Same as above. |
| 6 | anonymous | It has made me more aware of my water usage. |
| 7 | anonymous | Yes. I try not to exceed the 5-minute time limit. |

**Figure 20. Survey #1 Question #9**

10. Could the ShowerStar feedback be improved? If so, how?

4 Responses

| ID ↑ | Name | Responses |
|---|---|---|
| 1 | anonymous | I still don't have a handle on how to get the app to record a shower. I've tried a few combinations of Bluetooth connection and phone proximity etc. probably just my own error |
| 2 | anonymous | N/A |
| 3 | anonymous | Yes, it should record every shower. I don't understand why it didn't. |
| 4 | anonymous | If vibration is the trigger for the sensors it should be evaluated for sensitivity since the lights and alerts go off whether or not there is water running. It could also be noting false information as a result. |

**Figure 21. Survey #1 Question #10**

11. What features do you like the most about ShowerStar? Why?

6 Responses

| ID ↑ | Name | Responses |
|---|---|---|
| 1 | anonymous | Traffic lights to signal start and stop shower. |
| 2 | anonymous | Being able to see the logs of my shower duration times |
| 3 | anonymous | The light that alerts you and the data collected on the app |
| 4 | anonymous | I like that it motivated me to take quicker showers. |
| 5 | anonymous | I like that it forces you to acknowledge time in the shower. |
| 6 | anonymous | App is easy to use |

**Figure 22. Survey #1 Question #11**

12. What features do you dislike about ShowerStar? Why?

6 Responses

| ID ↑ | Name | Responses |
|---|---|---|
| 1 | anonymous | The lights are so bright I had to turn it to face the shower wall because it would hurt my head to see |
| 2 | anonymous | Water flow detection does not seem to be 100% accurate. |
| 3 | anonymous | N/A |
| 4 | anonymous | nothing much |
| 5 | anonymous | Only that it wasn't working consistently and flashing at times when no one was in the shower. |
| 6 | anonymous | I don't like how it looks in my bathroom and I'm not sure that the zip ties provide enough stability around the shower pipes. |

**Figure 23. Survey #1 Question #12**

13. What improvements or additional features would you like to see in future versions of ShowerStar?

5 Responses

| ID ↑ | Name | Responses |
|---|---|---|
| 1 | anonymous | Having sounds to signal showering time would be good since sometimes I have my eyes closed during the shower and I would miss the LED light signals. |
| 2 | anonymous | I would just like to see the blinking of the lights to be more consistent since I have run into situations in which they don't work how they should |
| 3 | anonymous | maybe a led screen that also shows more details |
| 4 | anonymous | I can't think of any. |
| 5 | anonymous | I think a static light would be more appealing for my rather than the flashing lights. I found the flashing abrasive and at times startling. It made for not so relaxing shower times. |

**Figure 24. Survey #1 Question #13**

14. Would you recommend ShowerStar to others? Why or why not?

7 Responses

| ID ↑ | Name | Responses |
|---|---|---|
| 1 | anonymous | I've got everyone in my apartment using it now. Awareness is information gathering. |
| 2 | anonymous | Yes, it really helps to save water by reducing shower time. |
| 3 | anonymous | Yes, because it is easy to install and requires pretty much no effort to maintain once it has been installed. It does serve its purpose of making us more aware of our water consumption, so it can have a positive impact |
| 4 | anonymous | yes, it would be great to help them conserve water |
| 5 | anonymous | I'm not sure. |
| 6 | anonymous | Yes. I think the overall concept is great and I believe that more should be done for conservation and stability within the home where individuals are in control and can make a difference. |
| 7 | anonymous | Yes. It helps with water conservation |

**Figure 25. Survey #1 Question #14**

These survey results capture the user experience approximately 2 months into the study. Overall, users found that it was easy to install ShowerStar™ with an average rating of 1.88 on the 5-point Likert scale for the installation and a 2.0 for the App user experience. Users were satisfied with their experience, but many users reported issues with the device's

sensitivity, particularly with the lights flashing or activating when not showering, and challenges with app connectivity and recording showers.

Of the users who completed the survey, half were in single family homes and the other half in multifamily residential buildings. Most of the users were adults, with one household including kids. Many of the observed tracking issues were found in multifamily buildings which were not previously tested and were the source of many product firmware changes during the field trial.

Overall, users surveyed have stated that they like the alert features and they are more aware of their shower duration and water usage, with several respondents noting increased consciousness and efforts to shorten shower time, supporting ShowerStar™'s purpose of promoting water conservation. Some users suggested improvements such as more ability to configure lighting alerts, adding sound signals, and an LED screen to show details that are shown on the App. Most of the responses were positive and suggest that the ShowerStar™ device helps motivate them to reduce their shower time.

## Survey #2 Results

Figures 26-31 capture the results from Survey #2. A total of 8 users completed this survey.

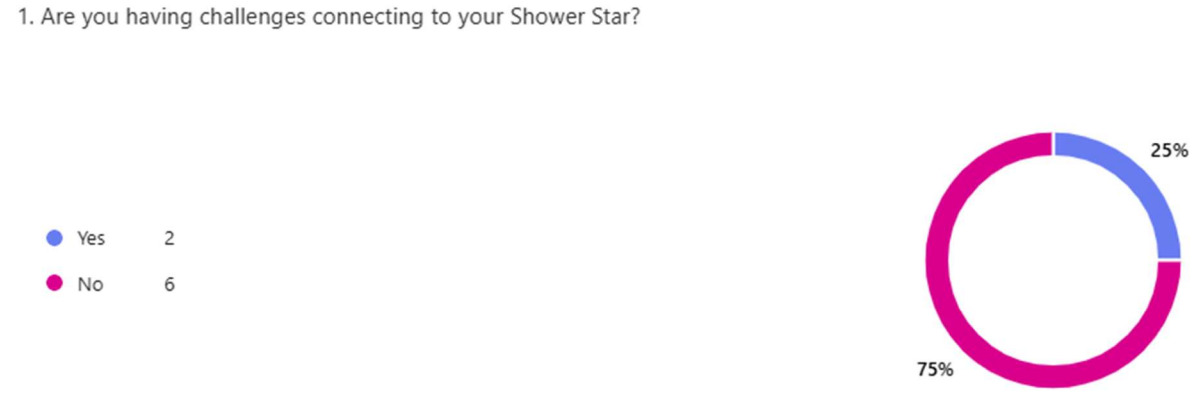



**Figure 26. Survey #2 Question #1**

2. If yes, please describe the challenges you are facing.

3 Responses

| ID ↑ | Name | Responses |
|---|---|---|
| 1 | anonymous | I am able to connect to the device but it says that it's not positioned correctly and not passing the calibration test. I don't have additional zip ties to reconnect. It also hasn't logged any of the showers from the past 2.5 months since October |
| 2 | anonymous | I was not able to pair with the Shower Star device after changing to a new phone. |
| 3 | anonymous | Shower star sensor connected to mobile app. However, auto calibration failed a couple of times inspite of green flashing light. |

**Figure 27. Survey #2 Question #2**

3. Are you still using your Shower Star even if you haven't connected recently?


**Figure 28. Survey #2 Question #3**

4. Why haven't you connected to your shower star device frequently?


**Figure 29. Survey #2 Question #4**

5. After updating the firmware and performing autocalibration, are you still experiencing unexpected flashing lights or phantom showers?

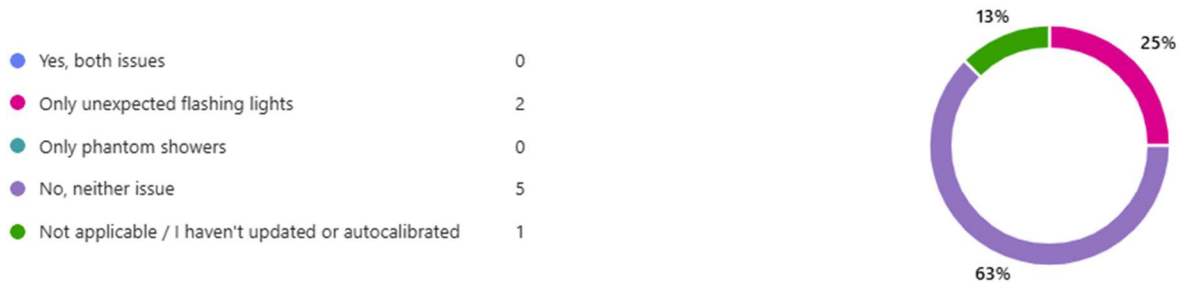



**Figure 30. Survey #2 Question #5**

6. Please provide any additional comments or suggestions to help us improve your Shower Star experience.

4 Responses

| ID ↑ | Name | Responses |
|---|---|---|
| 1 | anonymous | Great product |
| 2 | anonymous | The device hasn't logged any recent showers |
| 3 | anonymous | Works great to track my shower times I can reduce the amount of time I am in the shower. I would reccomend a better mount for showers maybe included mounts for different shower heads or give you the option to use another professional sort of tie or strap thats good quality. Device itself is great quality |
| 4 | anonymous | Since the Shower Star device can only pair with one phone at a time, instructions should also include what to do when changing phones. |

**Figure 31. Survey #2 Question #6**

Overall, the results from Survey #2 capture the group of the most invested and engaged users 6 months into this study. Most users (6 out of 8) reported no challenges connected to their ShowerStar™. Some users reported challenges connecting after changing to a new phone, and not being able to complete the auto calibration, which means that their device was not installed correctly. Some have stated that they were missing shower logs after reconnecting.

Despite some challenges, most users (6 out of 8) continue to use their ShowerStar™, with others are using it occasionally. Common reasons for infrequent connections include being away at college, not checking the app, and perceiving the device as requiring too much time commitment.

User suggestions highlight a desire for improved mounting options, better quality straps, and more reliable shower logging. One user specifically mentioned calibration and positioning difficulties, indicating a potential area for product improvement.

# Discussion

The most significant barrier in this field study was getting participants to frequently connect to their devices on the ShowerStar™ App. The only way data is transferred to the cloud for the project team to view and analyze, is if users connect to their devices periodically throughout the study. Significant outreach was made to make this happen. The project team continuously sent out email reminders, encouraging the participants to connect to the unit. During the 6-month period, a $50 gift card incentive was even offered for those who connected to the unit, updated the app and firmware, along with running data calibration. We found that a small number of users who connected to their app at the 6-month mark, after not connecting for a long time had a gap in their logged data. TouchGrid believes that this may be due to the device's flash memory which can store up to 128 logs. If the app remains disconnected from the device for a long period, the memory will be overwritten, resulting in the loss of older logs. Thus, it is critical that users connect frequently, especially if the shower use in that household is high, e.g. multiple users, multiple showers per day. During the study, TouchGrid even implemented push notifications on their ShowerStar™ app, to remind users to connect every month. Both the project team and manufacturer tried various forms of outreach to encourage ongoing connection, however only a handful of users remained engaged throughout the study. The fact is, getting good data depends on engaged and ongoing participation and connecting to the users device on the app. Thus, failure to do so results in inadequate data to judge long term user behavior over an extended period of time.

### Explanation of Increases in Average Shower Duration

Some units exhibited increases in average shower duration during the study period. The field trial was conducted from July through January, spanning summer, fall, and winter months. Seasonal effects likely contributed to some of the observed increases, as colder weather is commonly associated with longer and hotter showers, driven by comfort and thermal regulation needs. Behavioral studies note that individuals tend to take longer showers during winter due to lower ambient temperatures and reduced humidity, which increases the appeal of extended warm showers for comfort and warmth. One study found that shower time increases by 2.8 minutes on average between summer and winter months [7]. In addition to seasonal influences, other factors may have contributed to increased shower durations for some units, including:

- Behavioral adaptation over time, where users become less responsive to feedback or reminders after an initial novelty period.
- Changes in household routines or occupancy, such as holidays or guests during the winter months.
- Individual user preferences, which may outweigh conservation cues under colder conditions.

- Data variability, loss of logs due to intermittent device connectivity.

Taken together, these factors suggest that increases in shower duration are not unexpected given the timing of the trial and likely reflect a combination of seasonal behavior patterns and user-specific dynamics, rather than device performance issues.

**Observations of Faulty Data**

There are a few reasons why users were experiencing "flashing lights" when the shower isn't on, or incorrect shower logs:

- Device may be installed incorrectly (zip ties, used for the initial roll-out are loose)
- User did not perform auto calibration (later added during the trial) or update their firmware when asked to (multiple updates during the trial)
- User HVAC system vibrations and/or other plumbing fixtures (especially in multifamily housing) are picked up by the sensor

## Recommendations

The study recommends additional work and a follow-up study with key recommendations and considerations noted below:

1. The study recommends sampling over the course of a year to minimize seasonal variation and encouraging users to connect once a month to ensure adequate data uploads.

2. Provide training and context using utility-based communications. Users need to be educated on why shower time matters, and corresponding energy and water savings they can gain from changing their shower habits. Working directly with utilities has been successful in past ShowerStar™ studies in Australia.

3. Send devices in **normal mode** as field trial mode can cause problems for some users or they may not remember to turn it on. Additionally, with the field trial mode, participants are aware that a new device has been installed on their shower, which alone can prompt conscious or subconscious behavior change, even in the absence of alerts (even though it was meant to overcome that issue). Users can also look at their shower logs on the app even when alerts are turned off. This awareness effect may lead to:

- Shorter showers immediately following installation
- Eliminates initial conscious or subconscious behavior change

Whereas sending the devices in normal mode may lead to:

- Less confusion

- Less potential for set-up errors

4. Ensure users run the setup wizard which now does the auto-calibration. This will help determine if the device has been installed correctly and ensure that the sensors are reading the showers and not any extra background noise from other showers or HVAC equipment.

5. The sample of participants should be high (about ~400 users) to ensure that a variety of housing types and users are surveyed.

6. Although this is a self-install DIY retrofit, the study recommends having a field technician install the units and configure the data connectivity to avoid any future challenges with the shower head being installed incorrectly and communicating. It's worth noting that since this study, TouchGrid has deployed improved clip-on cradles instead of cradles that need a zip-tie, which may eliminate some problems with users installing the zip-ties incorrectly. They also added an auto calibration mode, which when done correctly minimizes false positives or negatives.

7. Have periodic communication and checkpoints every month for one year to ensure people are connecting to their device every month. Ongoing reminders for users to connect is the only way the study will be able to get usable data over time unless TouchGrid is able to resolve the automatic data collection challenge.

8. Work with Touch grid to ensure recommended device enhancements, including automated uploads, are added before the next trial. Automated uploads were discussed and not addressed at this point due to IOS security features.

A larger assessment is recommended to provide additional information for the adoption of a Shower Behavioral Measure for use in Energy Efficient Programs statewide. A larger study can also help pave the way for developing a formal Measure Package in California, to allow for rebates and savings to be claimed through Energy Efficiency Single Family and Multifamily programs. This field trial served as more of an exploratory trial, as this was the first time these units have been deployed in the United States for a small field study. While the study identified, and ironed out numerous challenges along the way, a larger study with a significantly increased sample size and a clean device baseline will be crucial for determining accurate behavioral changes over time, along with better estimates on energy and water savings.

## Conclusion

This field trial evaluated the ShowerStar™ smart shower timer as a behavioral intervention to reduce residential shower duration and associated water and energy use. The study represents the first known deployment of this technology in the United States and provides

early insights into both its potential impacts and the practical challenges of collecting behavioral data through user-connected smart devices.

Among the limited subset of participants with sufficient and reliable pre- and post-installation data, results indicate that ShowerStar™ has the potential to reduce average shower duration. Although 50 sites were targeted, there were only a few "good sites" that collected adequate data for analysis. 5 of the 7 "good sites" experienced shorter average shower times when the device operated in normal mode with visual alerts compared to the Field Trial (baseline) mode. Modeled estimates based on these reductions suggest measurable water and gas savings at the individual household level, as well as total projected annual water savings of **14,773 Gallons**, **70.5 therms**, and **$259.10** in savings for the 5 sites. However, results varied across users, and two sites experienced increased shower duration, highlighting the influence of user behavior, seasonal effects, and data quality on observed outcomes.

Statistical analysis using a one-sided paired t-test showed that while average shower duration was lower during normal operating mode, the observed difference was not statistically significant at the 95% confidence level. This outcome is largely attributable to the small effective sample size and high variability in individual shower behavior. As such, while the direction of the results aligns with the intended function of the technology, the findings are insufficient to draw definitive conclusions about statistically significant behavioral change at scale.

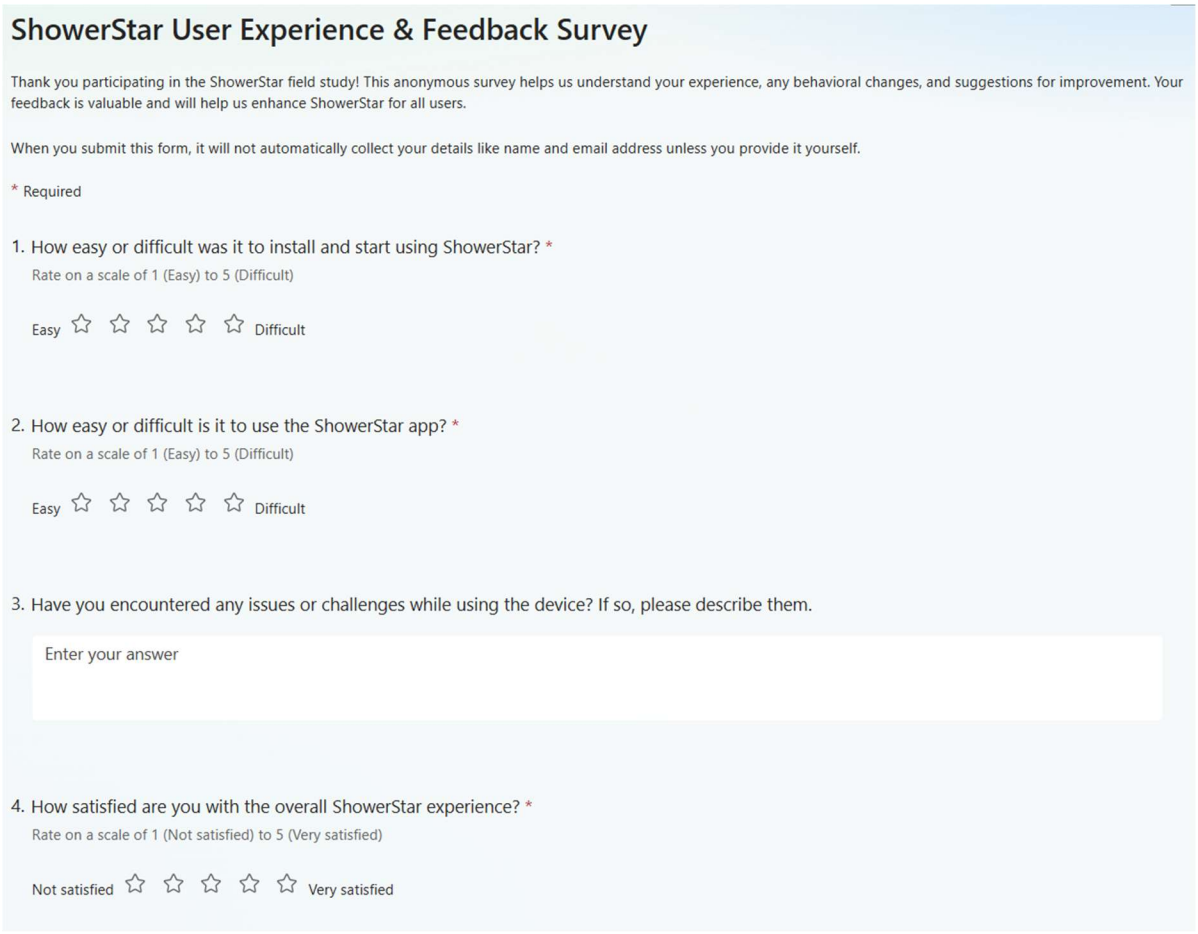
A key limitation of the study was participant engagement and device connectivity. A substantial proportion of distributed units were either never installed, not regularly connected to the mobile application, or produced insufficient data for analysis. Because data uploads required active user engagement, lapses in connectivity led to data loss and reduced the number of usable sites over time to 7. TouchGrid also implemented updates to resolve issues with data collection such as firmware, app, and auto-calibration changes throughout the trial. Users were given instructions to make frequent updates throughout the trial, which may have led to possible user connection fatigue. These challenges underscore that sustained participant engagement is critical for both program evaluation and long-term behavioral persistence when using app-dependent, behavioral technology evaluations.

Despite these limitations, survey responses indicate that users generally found ShowerStar™ easy to install and use, and many reported increased awareness of shower duration and water use. Visual "traffic-light" alerts were frequently cited as a motivating feature that encouraged users to shorten showers or be more mindful of time spent bathing. These qualitative findings suggest that even when quantitative impacts are modest or difficult to measure, the device may still play a meaningful role in promoting conservation awareness.

Overall, this exploratory, Phase 1 feasibility study demonstrates that ShowerStar™ shows promise as a behavioral tool for influencing shower duration, but it also highlights critical considerations for future studies and potential program deployment. Larger sample sizes, improved installation and calibration controls, reduced reliance on user-initiated connection, and longer evaluation periods will be essential to more accurately quantify savings, assess persistence, and determine the viability of this technology as a scalable behavioral efficiency measure within California energy and water efficiency programs.

# Appendices

## Appendix 1. Initial Survey After 2 months



ShowerStar User Experience & Feedback Survey

Thank you participating in the ShowerStar field study! This anonymous survey helps us understand your experience, any behavioral changes, and suggestions for improvement. Your feedback is valuable and will help us enhance ShowerStar for all users.

When you submit this form, it will not automatically collect your details like name and email address unless you provide it yourself.

* Required

1. How easy or difficult was it to install and start using ShowerStar? *
Rate on a scale of 1 (Easy) to 5 (Difficult)
Easy ☆ ☆ ☆ ☆ ☆ Difficult

2. How easy or difficult is it to use the ShowerStar app? *
Rate on a scale of 1 (Easy) to 5 (Difficult)
Easy ☆ ☆ ☆ ☆ ☆ Difficult

3. Have you encountered any issues or challenges while using the device? If so, please describe them.
Enter your answer

4. How satisfied are you with the overall ShowerStar experience? *
Rate on a scale of 1 (Not satisfied) to 5 (Very satisfied)
Not satisfied ☆ ☆ ☆ ☆ ☆ Very satisfied

5. What is your building type? *

- ◯ Multi Family (Apartment, Condo, Townhome)
- ◯ Single Family
- ◯ Mobile Home

6. On average, how many people use this shower?

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5+

7. Do both adults and teenagers/children use this shower? *

- ◯ Adult
- ◯ Kids
- ◯ Both

8. Have you noticed any changes in your showering habits since using ShowerStar? If so, what?

Enter your answer

9. Has ShowerStar influenced your water usage or conservation efforts? If yes, how?

Enter your answer

10. Could the ShowerStar feedback be improved? If so, how?

Enter your answer

11. What features do you like the most about ShowerStar? Why?

Enter your answer

12. What features do you dislike about ShowerStar? Why?

Enter your answer

13. What improvements or additional features would you like to see in future versions of ShowerStar?

Enter your answer

14. Would you recommend ShowerStar to others? Why or why not?

Enter your answer

## Appendix 2. Follow up Survey Questions After 6 months

### Shower Star Field Study Follow-Up Survey

Thank you for participating in the Shower Star field study project. This follow-up survey aims to understand your experience, challenges, and ongoing usage. Your feedback is valuable to help us improve the product.

1. Are you having challenges connecting to your Shower Star? *

- ◯ Yes
- ◯ No

2. If yes, please describe the challenges you are facing.

Enter your answer

3. Are you still using your Shower Star even if you haven't connected recently? *

- ◯ Yes
- ◯ No
- ◯ Occasionally

4. Why haven't you connected to your shower star device frequently?

- [ ] Too much time commitment
- [ ] No longer use
- [ ] Lack of interest
- [ ] Other

5. After updating the firmware and performing autocalibration, are you still experiencing unexpected flashing lights or phantom showers? *

- ◯ Yes, both issues
- ◯ Only unexpected flashing lights
- ◯ Only phantom showers
- ◯ No, neither issue
- ◯ Not applicable / I haven't updated or autocalibrated

6. Please provide any additional comments or suggestions to help us improve your Shower Star experience.

Enter your answer

# References

[1] EPA, Save Water and Energy by Showering Better, 2017, https://www.epa.gov/sites/default/files/2017-02/documents/ws-ourwater-shower-better-learning-resource_0.pdf .

[2] TouchGrid. (2026). Shower savings calculator. https://touchgrid.com/shower-savings-calculator

[3] Liang, X., & Kenway, S. (2025). Shower energy and greenhouse gas efficiency, significance, and reduction opportunities. Resources, Conservation & Recycling, 215, 108084. https://doi.org/10.1016/j.resconrec.2024.108084\

[4] TouchGrid. (2026). Proven to Save Water Energy & Money. https://touchgrid.com/

[5] TouchGrid. (2026). Product https://touchgrid.com/product

[6] U.S. Energy Information Administration. California Natural Gas Prices.

https://www.eia.gov/dnav/ng/NG_PRI_SUM_DCU_SCA_M.htm

[7] Ibáñez-Rueda, N., Guardiola, J., López-Ruiz, S. et al. Towards a sustainable use of shower water: Habits and explanatory factors in southern Spain. Sustain. Water Resour. Manag. 9, 121 (2023). https://doi.org/10.1007/s40899-023-00905-3