Original comments in black, author responses in ***bold italics***.

Overall comment-Nice paper using innovative evaluation techniques and a realistic case study. I recommend that it be published after addressing some minor comments that are listed below.

1. Study area is in a single family, affluent neighborhood with 151 houses in San Ramon, CA in eastern SF Bay area.

(a) Describe the water use data that are available. I only saw mention of the use of bi-monthly data.

The metered data is from the time period of 2006-2011. This note was added to the manuscript both in the abstract and the introduction. The original metered data was of irregular sampling duration, but usually finer than once daily. The coarseness of the raw data doesn't seem to be too relevant since we are looking at seasonal averages, so we did not include that.

(b) Source of population data for each house to calculate gpcd, Figure 3.

Almost all plots and text use gphd (gallons per household per day), as that is a common measure of urban water use in the US. We have added lphd (liters per household per day) in a vertical axis to have this measure in metric units. However, many studies only report per-capita water use, so in order to make a fair comparison in Figure 3, the gphd numbers had to be converted to gpcd. This was done by dividing the total amount of modeled water use by the total number of people sampled in the model. The number of people in a particular house is sampled each time from the base assumed distribution. The average household size turned out to be 2.78 people for this particular run—if the model were run again by simply clicking "recompute", it could have been 2.8 or 2.75 or somewhere in there depending on how the sampling turned out. So the source of the population data used in the figure is really the sampling results.

(c) Ages of houses to estimate ages of end use fixtures.

The ages of end use fixtures were not included in this analysis. This is not a study that looks ahead a number of years and projects fixture replacements over that period—the paper looks at whether or not it is worthwhile <u>now</u> for household owners to change fixtures solely due to potential water savings. The ages of homes are important only to get a good idea of what kinds of fixtures are potentially installed in the homes. In section 2.1, it is mentioned that most houses are built around 2000.

(d) Prevalence of irrigation systems.

It was taken for granted that all of the houses have irrigation systems of some sort, which is probably a safe assumption, given that the houses are near a golf course, newer, and located in San Ramon.

(e) Existing water rates.

An average rate of $0.002 per liter was included in the revised for the neighborhood in the study.

(f) Six droughts are studied. Are they serious, mild?

There are probability numbers in table 3 that explain how frequent the droughts are. 70% of the years are "Regular Delivery", 20% are "Shortage", and 10% are "Severe Shortage".

(g) Show the time series of overall water use during the study period to give the reader an idea of the relative importance of indoor and outdoor water use.

This plot is included in the thesis reference yet to space limitationsis not in the paper. An appropriate link to a version of Cahill's thesis containing the plot is included in the revised manuscript.

(h) Was an end use tabulation done to estimate the total number of fixtures?

No, tsuch calculation is beyond the scope of the paper. The paper is more concerned with the percent of devices that could be retrofitted rather than an absolute number, so that the utility could scale up the results to an area larger than the 151 households in the sample..

(i) Was outdoor irrigable area measured?
It was estimated for each of the houses from Zillow.com, and then a probability distribution was fit to the data and used in the analysis. This process is outlined in section 2.1

2. Authors calibrated to existing water use conditions using MC simulation. Did you split the data to test your calibration results? The calibration is a vital element of conservation studies that is seldom done. It was nice to see it in this paper.

Yes, the data was split into summer and winter periods to try to catch some seasonal variation, as shown by figure 2. A possible model extension could be to split into smaller periods (e.g. months), but for calibration purposes these two time periods seem appropriate.

3. I like the two stage optimization model.

Thanks. We think it is a powerful approach to represent water use decisions in households.

4. Other studies have shown that irrigation controllers can increase water use for irrigators who under-irrigate at present. Thus, it is important to not encourage increasing irrigation application rates. It would be helpful to show how existing application rates compare to benchmark irrigation application rates for their area.

That would be an interesting hypothesis to test yet somehow beyond the current paper where the application rates have been modeled with less detail than appliances. However, it is noted in section 2.3 that the metered homes have more outdoor use than

the “standard new homes” dataset, and figure 3 suggests that the studied neighborhood is higher than other bay area outdoor results.