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Water-Saving Bathroom Retrofits

This policy brief summarizes the results of water saving retrofits undertaken as part of the "Sustainable Saunders Initiative" in Saunders Hall. The majority of the water use in Saunders Hall occurs in the bathrooms, so water saving fixtures have a significant impact on overall water use. The results of our pilot study, which included one women's and one men's bathroom, show that not only will fixture retrofits save a considerable amount of water and money, but it will also be easily accepted and appreciated by the workplace community.

Saunders Hall can become significantly more sustainable by reducing the water resources it currently uses. The public restrooms of the building feature 42 toilets, 21 urinals, and 42 sinks. None of these fixtures are low-flow. In a 2004 report about University of Hawaii water fixtures,. the Hawaii Board of Water Supply (BWS) estimated that 17 gallons per day would be saved for each toilet that was replaced by an "ultra-low-flush" model. Replacement of the existing urinals with ultra-low-flush units was estimated to save approximately 15 gallons per day per urinal.

As BWS acknowledged in their report, the water savings estimates are extremely rough - they are not based on documented usage of the bathrooms, because accurate estimates are generally not available. Industry estimates for water savings range from 17 to 57 gallons per day for low-flow toilets and from 20 to 49 gallons per day for low-flow urinals. BWS adopted the lowest estimate in their 2004 assessment, based on some population calculations across the campus. Thus, water savings for bathroom retrofits might be significantly different in our test site at Saunders Hall.

The 11 month pilot study began with a retrofit of most of the bathroom fixtures in the men's and women's 6th floor bathrooms of Saunders Hall. This included 2 waterless urinals that save 1 gallon per flush, 1 low flow urinal that uses only one pint per flush, 2 low flow toilets that save 2.22 gallons per flush and 6 automatic faucets with sensors. One waterless urinal was donated by Waterless Inc. and all other fixtures were donated by Zurn. To accurately assess the number of uses, a proximity sensor and counter (also donated by Zurn) was placed above each urinal.

Waterless urinals saved 17.8 gallons per workday, on average, at our pilot site, based on the annualized rate of 12,893 urinal uses. Of the three urinals in the men's bathroom, the one closest to the entrance was used over 5 times more than the center urinal and nearly 10 times more than the farthest urinal.

Key Findings

- Replacing 21 urinals and 42 toilets in Saunders Hall would save enough water to fill over 4 Olympic-size swimming pools annually.
- Saunders would save $4170.20 every year in water and sewage fees.
- Replacing only the fixtures closest to the entrance shortens the pay back period by nearly 2/3 while still realizing 72% of the possible water savings.

Because we verified that urinals closest to the bathroom entrance are used far more frequently, we proposed the following scenario: prioritize urinals closest to the entrance first, and retrofit with waterless urinals. Retrofit the urinal furthest from the bathroom entrance with a low-flow urinal (lower priority). If all 21 urnals in Saunders Hall were retrofitted according to this scenario, 95,813 gallons of water would be saved each year. This retrofit prioritization and scenario has the added advantage of keeping some water movement in the pipes, to limit crystalline buildup, because the main sewage drain was closest to the bathroom entrance at our pilot site.

We arrived at water savings estimates for the low-flow toilets through indirect means, because we were unable to document actual number of uses for the toilets. We were able to measure the total number of urinal uses during our test period, and adjust to an annual rate. We then adopted an industry-standard assumption that each toilet in a men's bathroom is flushed once for each urinal flush, on average, and that women's toilets are used twice as often as men's urinals. Given our toilet-use assumptions, we estimate that the men's toilet retrofits saved 39.4 gallons per toilet per workday, and the women's toilet retrofits saved 78.8 gallons per toilet per day. If all the 42 toilets in Saunders Hall were replaced with low-flow models, 662,813 gallons of water would be saved each year.

Overall, then, replacing all 21 urinals and 42 toilets in our test building would save 761,326.4 gallons of water annually - enough water to fill over 4 Olympic-size swimming pools.

We also examined the installation costs and payback periods for various retrofit scenarios. The University of Hawaii paid $2.24 per 1,000 gallons supplied at the time of our study, and paid $3.42 per 1,000 gallons as a sewer fee, so for every 1,000 gallons of water saved, the University saves $5.66. At that cost, the full - building retrofits would save the university $4,309.11 per year. With the cost of the fixtures in the $700-800 range, it would take just over 10 years to pay back the price of the fixtures.

The much more frequent use of bathroom fixtures closer to the entrance means that if only the toilet and urinal closest to the bathroom entrances were retrofitted in Saunders Hall, 78% of the total potential water savings would be realized. This would reduce the simple payback period to under 5 years.

The simple payback period for these retrofits could be reduced by utility rebates. The Hawaii BWS used to subsidize low-flow bathroom retrofits at $6 per gallon per day saved. If only the urinal and toilet closest to the door were retrofitted at Saunders Hall, 921 gallons per day would be saved. This amounts to a one-time subsidy to the University that would further reduce the payback period to only 1.72 years.

The sensor faucets saved water by ensuring the water was turned off after every use, though we were not able to document the actual amount saved, in this initial pilot study. An anecdotal observation from the custodial staff was that the original faucets were discovered by staff to be left on 7 – 10 times per week.

This pilot also demonstrated that waterless urinals are hygienic and odor-reducing, because they preclude the mixing of urine and water - a significant producer of odors.. Our qualitative interviews with custodial staff informed us that the waterless urinals did reduce odors, as intended. Other benefits include a reduction in operation costs due to less moving parts, easier maintenance and improved sanitary conditions since bacteria exposure on the flush handle is eliminated.

About the Author

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A copy of the spreadsheets on which this Policy Brief is based can be found at www.publicpolicycenter.hawaii.edu/reports.html