Water Utilities: Influencing the Smart Controller Market

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Since the mid nineteen-nineties, water agencies have tracked the development of a new generation of smart irrigation controllers that have the potential to save time, water and money by automatically adjusting the amount of water applied to the landscape according to changes in the weather. Landscape irrigation is the single largest end use of water in California's urban sector. One third of all urban water (residential, commercial, industrial and institutional) is dedicated to landscape irrigation and over half of residential water is applied to landscapes. Thirty-six states anticipate that even under average conditions, they will experience freshwater shortages in the next ten years. Capital and environmental costs of building additional storage are dramatically higher today than in the past. Today water conservation is the most inexpensive and responsible way to extend water supply needed for new customers. In California it is estimated that 1,000 to 2,000 million gallons per day (MGD) of water demand will be supplied through conservation measures over the next twenty years. Manufacturers claim that weather-based irrigation controllers (WBICs) can save twenty to forty percent of the water currently being applied by traditional controllers. Water agencies hope this new generation of smart irrigation controllers will help achieve a portion of the savings needed to meet the future water demand.

East Bay Municipal Utility District (EBMUD), located in Oakland, California, received a $1.6 million California Department of Water Resources (DWR) grant to provide financial incentives for 2,600 WBIC retrofits in pre-qualified residential, commercial, industrial and institutional landscapes by October 2008. EBMUD is lead agency and one of six northern California partner agencies participating in this three-year program. Controller installations began in September 2005 in the service areas of EBMUD, Alameda County Water District, Contra Costa Water District, City of Davis, Santa Clara Valley Water District, and Sonoma County Water Agency. At the same time, Metropolitan Water District of Southern California (MWD) received a similar $1.7 million grant as lead agency for 18 southern California water agencies with plans to install 5,500 WBICs. To date, these two California programs represent the largest effort to distribute and evaluate emerging WBIC technology. The DWR grants include funds for a consultant to analyze product performance, customer satisfaction and the effectiveness of the States 24 water agency distribution and marketing programs in a final report. Although the primary purpose of the DWR grants is the ambitious goal of saving fifty-thousand acre feet of water over an assumed 10 year useful life of the combined total of 8,100 controllers, these two programs also seek to accelerate market transformation of this emerging smart controller technology.

Will WBICs be an effective water conservation tool?

Pilot studies conducted in California, Colorado, Utah and elsewhere show that if WBICs are installed and programmed properly, water savings are achieved. However, questions remain, as to whether WBICs will actually save water outside of professionally controlled pilot studies and whether WBIC programs will produce the savings manufacturers claim and water agencies hope for. Unlike many indoor water conservation measures such as the installation of ultra-low-flow-toilets (ULFTs), outdoor water conservation measures are

much more difficult to implement. Indoor savings are virtually guaranteed when a piece of hardware using more water is replaced with a piece of more efficient hardware that does as good a job (or better) with less water.

Traditional irrigation timers are just clocks that turn the irrigation on and off according to a pre-set schedule regardless of whether or not the landscape actually needs to be watered. As a result, plants are often watered too frequently and for too long. Before WBICs were introduced to the marketplace, outdoor water savings relied on the customer actively adjusting the irrigation timer as the seasons changed or in response to unseasonably high or low temperatures. To achieve outdoor savings, some water agencies provided educational consultations to teach customers how to properly program and adjust their irrigation controllers. Water savings from educational consultations vary widely based on the skills of water agency staff in communicating recommendations and how well customers understand and implement them. Traditionally, outdoor water savings have been more difficult to achieve than indoor savings because it is harder to change a person's behavior than to change a piece of hardware.

Achieving outdoor water savings is made even more difficult by the fact that it is not just controller management that accounts for water savings. Poor quality in the irrigation design, installation and routine maintenance can reduce water savings potential significantly. The sprinklers in older and poorly designed irrigation systems often overspray pavement. Less commonly observed, but just as wasteful, is the unintentional over-spray from one planting area into an adjacent planting area resulting in areas being watered twice. Uneven sprinkler spacing and zones that have different types of sprinklers installed on the same circuit create wet and dry areas. The circuit must run long enough to keep the driest area green, even if it is only a small area, resulting in wasteful over-watering in the rest of the zone. Although traditional timers can be programmed to minimize run off, they seldom are programmed correctly and water is commonly seen running down the curb and into the storm drain even in newly completed projects. In spite of the complicated nature of landscape irrigation and all the limitations that rightfully should be considered when developing an incentive program, this author believes there is enough evidence to support manufacturer's claim that WBICs can be an effective water conservation tool.

WBICs could be the single most cost effective outdoor water savings recommendation
The fact that WBICs may be able to simplify water management and minimize or eliminate over-watering and run off issues inherent with traditional irrigation controllers are key reasons why water agencies are interested in promoting this technology. Smart controllers are designed to apply the right amount of water at the right time and in a manner that reduces wasteful run off that can carry harmful lawn and garden chemicals into nearby waterways. Although, it is unlikely that the water savings on sites with poor design, improper installation and deferred maintenance will be as great as the water savings on well designed sites, some savings are still possible because WBICs automatically make program adjustments much more frequently and accurately than traditional controllers. In addition, WBICs are easy to program, convenient to use and save time since they don't have to be manually reprogrammed every time the weather changes. Retrofitting a traditional controller with a WBIC, and properly programming it, could be the single most cost effective outdoor water savings measure a water agency can recommend. The reason for

this is that good irrigation management can save water even on a poorly designed system and the cost of upgrading the controller is usually far less expensive than upgrading a poorly designed system. Irrigation upgrades require specialized knowledge that few contractors currently possess and often involve digging up portions of the landscape. None the less, irrigation upgrade programs that provide education or additional financial incentives to correct system deficiencies will enhance water savings and compliment WBIC incentive programs. To assure that an adequate workforce with knowledge of water conservation practices is available to customers, water agencies should encourage the development of certification programs. Certification programs are necessary to promote and enhance WBIC programs, raise irrigation industry standards and to increase the pool of contractors with the specialized knowledge necessary to upgrade irrigation system efficiencies.

A not well known but very significant side benefit of smart technology is that WBICs not only have the potential to save water and protect the environment; they also have the potential to save energy. Seven to eight percent of California's energy use is consumed moving water from the northern third of the state where most water is collected and stored to the southern two thirds of the state where the majority of people live. If consumer end uses are included such as heating water and agricultural pumping, nineteen percent of California's electrical and thirty-nine percent of the States natural gas energy loads are related to water and could be reduced through more efficient irrigation. Since installing WBICs can reduce energy demand by using less water to irrigate the landscape, water agencies should explore the possibility of funding WBIC programs with grants provided by power companies. More importantly, if the public can see the energy connection with water savings it could be a helpful supporting influencer in their decision to adopt this smart technology.

Influencing the smart controller market

At the Irrigation Association International meeting in 2002, ten water agencies (including EBMUD) engaged irrigation manufacturers in a discussion with the purpose of influencing manufacturers to build more water conserving products that would reduce irrigation waste. The manufacturers thought they were already building products that saved water and that the real issue was that water agencies were not doing enough to educate the public in how to use existing technology. At the time there were only a few start-up companies producing WBICs for the commercial and residential markets. Established manufacturers seemed to view emerging WBIC technology with skepticism.

The formation of the Smart Water Application Technology (SWAT) committee was an outcome of this initial and several subsequent meetings. Although the purpose was to promote all water saving technology, the initial focus was clearly on WBICs and their moisture sensor counterparts. The committee quickly established two sub-committees, the first to produce test protocols to measure the water saving claims of WBIC manufacturers and the second to promote market transformation of WBICs and other water saving technology.

Test protocols were important because the last thing water agencies needed was a repeat of the debacle that occurred with the introduction of ultra low flow toilets (ULFTs). Some

early models did not perform well and to this day some people believe ULFTs do not perform as well as higher water using models. The Center of Irrigation Technology (CIT), under the direction of the SWAT committee, created protocols for testing both climate based controllers and soil moisture sensors. Many believe that independent testing of these products will enhance consumer confidence. The mission of the SWAT market transformation sub-committee was to create demand for water saving technology so manufacturers would compete in the marketplace to produce high quality water conservation products. The committee produced generic marketing materials that can be customized by any water agency wanting to implement WBIC programs in their service areas. EBMUD was one of the first agencies to modify these materials for its targeted direct mail marketing program to 30,000 residential and commercial customers using more that 750 gallons per day for irrigation. The centerpiece of the suite of marketing materials is the brochure which is reproduced in Figures 1. and 2.

Making customers aware of WBIC technology and benefits

EBMUD contracted with the same marketing firm that produced the SWAT marketing materials to explore alternative ways of reaching and communicating with target residential and commercial customers. This effort was specific to EBMUDs individual program but the information was shared with the other five northern California partners. Key to getting EBMUD customers to participate in a WBIC program is convincing them that they can save a specific amount of money on their water bill by using a WBIC and how long their payback period would be. In addition, it was important to assure the customer that the WBIC would allow their landscape to remain healthy and flourish and to view customers as responsible people wanting to do the right thing rather than people negligent of wasting limited water resources. Probably the biggest challenge is that most customers are not even aware of WBIC technology, WBIC water saving potential and other WBIC benefits. The research indicated that public agency programs lend credibility to products and will likely improve acceptance. EBMUD expects their marketing plan and materials will be useful tools to help introduce WBICs to customers who know very little about them and to inform them about the benefits. Another interesting finding was that both residential and commercial customers relied on landscape professionals to advise them if a WBIC was a worthwhile investment. EBMUDs market research report with specific recommendations for messaging and product positioning is available for review by contacting ssommerf@ebmud.com.

Six northern California WBIC programs compared

Providing a financial incentive for customers to replace their traditional controller with a new smart controller is the most direct way water agencies can influence the smart controller market. Table 1 on the next page compares six different northern California incentive programs. All northern California programs target high water using customers which was necessary to make the programs cost effective and to meet the water saving goals of the DWR grant. Some agencies qualify customers based on consumption while others use minimum square feet of irrigated area. One agency only targets customers that previously used their large landscape upgrade program. A few agencies limited the choice of eligible manufacturers by using a competitive bid process for the manufacturer selection and other programs allow any manufacturer to participate.

Table 1. Comparison of six northern California WBIC programs:

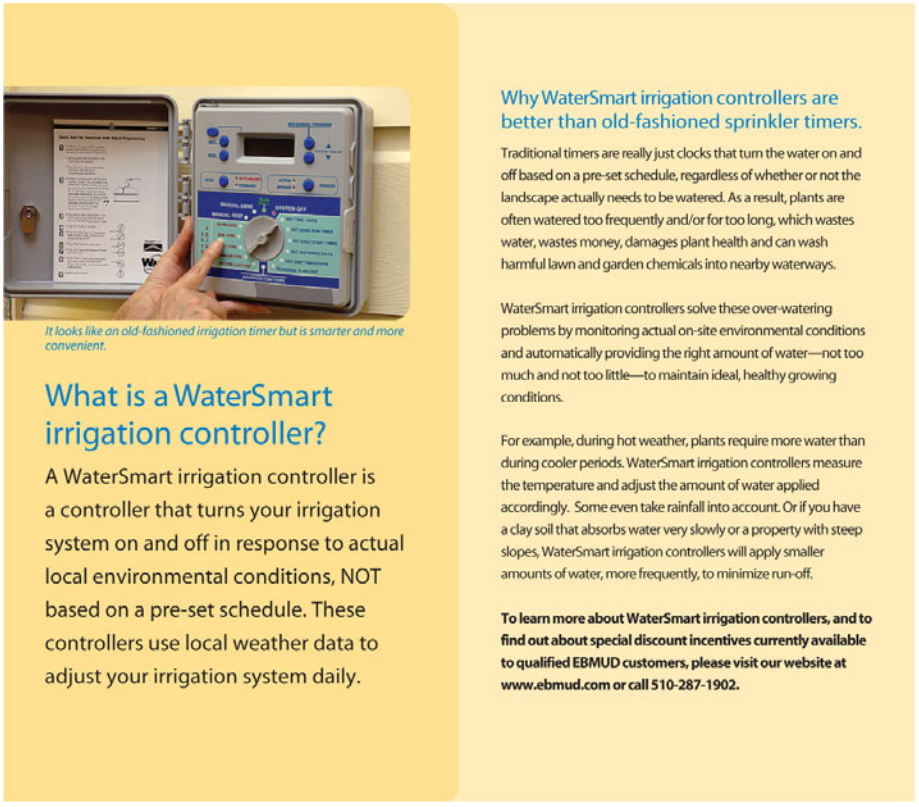
Agency	Incentive Type	Eligible Technology	Incentive Amount	Installation Method
East Bay Municipal Utility District (EBMUD)	Targeted voucher for both residential and commercial customers using more than 750 gallons per day for irrigation.	All technology that posts SWAT performance reports on web site.	50% of controller cost up to a maximum voucher amount based on gallons per day of irrigation use, three tiers: Max voucher/irrigation use (gpd) 1: $300/750 to 2,999 2: $600/3,000 to 5,999 3: $1,200/> 6,000	Self install or referral to manufacturer's certified professional. Customer pays for installation
Alameda County Water District	Targeted rebate for residential sites with at least 1500 square feet and for commercial sites with at least 40,000 square feet of irrigated landscape that includes at least 25% turf	All technology, no restrictions	Residential: full cost of controller up to $475 per controller Commercial: full cost of controller up to $1220 per controller	Direct install. Agency pays for installation by installer contracted by agency
City of Davis	Targeted rebate for residential customers with use greater than 25 % of average per square foot of lot size and commercial rebate to schools	Hunter and Weathermatic only	$169 per residential controller Commercial rebate to schools to be determined	Self install, customer pays for installation
Contra Costa Water District	Targeted rebate for both commercial and residential	All technology, no restrictions	Based on number of active stations up to 100% of controller cost: Residential: $25 / station with 4 station minimum Commercial $40 / station	Self install, customer pays for installation
Santa Clara Valley Water District	Targeted installation program for both residential and commercial	Aqua Conserve and Hydropoint only	50% of controller cost up to a maximum	Direct install, agency pays for installation by installer contracted by agency.
Sonoma County Water Agency	Targeted rebate for both residential and commercial	All technology that posts SWAT performance reports on web site	Residential: 50% of controller cost up to $300 plus 100% of 5 years of pre-paid signaling fee up to $150. Commercial: 12 to 24 stations 50% up to $700 and >25 stations 50% up to $1,100, no commercial rebate for service fees	Self install, customer pays for installation

Note:

The cost of financial incentive programs varies depending upon the program design. Incentives can be set to match expected utility cost savings and avoided costs of providing new supply.

Figure 1. Brochure (Outside)

Figure 2. Brochure (Inside)



Two agencies allow any manufacturer whose products have been tested by SWAT. The incentive amount varied widely among the six partner agencies. Some agencies offer the controller and the installation for free while others require the customer to make a co-payment. To make the incentive cost effective some agencies link the maximum amount of the rebate to how much water the customer is currently using for irrigation. One agency calculates the rebate based on the number of active controller stations to provide a larger rebate for larger sites with more stations. Other agencies simply base the rebate on whether the program participant is a residential or commercial customer.

The relative success of various installation methods will be interesting to look at in the final evaluation report. Installation method may significantly impact the percent of potential water savings achieved by the WBICs. Some believe that the setup and programming is so complicated that only professionals can effectively install the controllers and have therefore chosen a direct install style program. Others believe that professional installation will not boost the savings enough to justify the higher cost of direct installation and have therefore chosen a self install style program or offer the customer a choice of professional installation but at their expense.

Eighteen Southern California programs are not compared in this paper due to space limitations but a full report is available from the California Urban Water Conservation Council (CUWCC) at www.cuwcc.org. In addition to providing further variations of targeted rebate programs, southern California tried one unique distribution method, an exchange program where customers were invited to bring in their old controller and were given a free WBIC along with on-the-spot training on how to install their new smart controller.

Labeling programs support WBIC market transformation

Water agencies, including EBMUD, helped persuade the Environmental Protection Agency (EPA) to introduce a labeling program for water efficient products similar to the energy sector's EnergyStar. Water efficient products, that meet specific water conservation standards, will soon receive a WaterSense label and designation. The water conservation standards will become more restrictive over time to promote further efficiency improvements. WaterSense will increase customer awareness and use of water conservation products and encourage the free market to produce increasingly more efficient water conserving products.

Pending legislation supports WBIC market transformation

In California, legislation (AB 1881) has passed the legislature and is awaiting the Governor's signature. AB 1881 will amend the 13 year old California Model Water Efficient Landscape Ordinance (AB 325). If the Governor signs the bill, it will require performance standards and labeling requirements for irrigation equipment including smart controllers. The bill will require the energy commission to adopt those requirements for irrigation controllers and moisture sensors by 2010 and would prohibit the sale or installation of an irrigation controller or moisture for the landscape use unless the controller or sensor meets those adopted requirements by 2012.

Lessons Learned

One drawback of the California programs is that each agency developed their own program rather than collectively developing a regional program. This shortcoming required extra time and expense for each agency to develop their respective programs and delayed program launch. A regional approach was considered prior to the initial grant proposal (November 2002) but was abandoned because agencies had unequal resources available to commit to a WBIC program and there wasn't enough experience in water smart technology to confidently develop a regional program that fit all agencies needs and concerns. The development of separate programs is now presently an opportunity to compare the different approaches and learn which are most effective.

Not all early WBIC programs have been successful in reducing water use. Early indications are that getting the WBIC programmed correctly still presents a challenge for many users and may be the reason potential water savings are sometimes not realized. Most traditional controllers sold in the last five years have good water conservation features built in, but they still require the end user to enter the number of minutes and how often to run each station and this is a very complex task to get it right. One of the most innovative features incorporated into most (but not all) WBICs is a scheduling program that asks a series of questions about each irrigation zone or station. For example "is the plant type lawn, shrubs…"? "Is the irrigation type spray, rotary, drip…"? and so on. The WBIC then calculates the minutes for you. WBICs that offer scheduling programs are using tangible information customers can identify (some controllers even provide pictures) rather than an abstract concept such how many minutes to enter. This appears to be a very good idea that will significantly improve the ability of customers to program the WBIC accurately and minimize over watering. It will be interesting to see how the water savings compare between WBICs that incorporate a scheduling program and those that do not.

The proper programming of the WBIC is such a critical step in achieving water savings it may be worthwhile to include a site visit to validate the initial WBIC set-up in the program design. Once set up and programmed properly, however, WBICs are designed to automatically adjust the water applied every day and this should prove to be a huge breakthrough for dependable outdoor water savings.

Water agencies that have the ability to monitor on-going consumption may want to include this function in WBIC programs. If current consumption is compared to a baseline consumption established before the WBIC was installed and found not to meet water saving expectations, the agency can intervene with a phone call or site visit to assist the customer in getting back on track. If the water agency has the resources to measure the irrigated area of participating customers, it may be useful to calculate a water budget and compare the budget to how many inches of water are actually applied to a site. This comparison can be used to evaluate what percentage of potential water savings a WBIC is achieving.

One useful feature that WBICs currently do not have is the ability to show how many inches of water are actually applied to each landscape zone for a given period of time (day, week, month, year). We know that most shrubs require about half the amount water as turf to stay healthy. Knowing how many gallons of water are applied to a zone requires a calculation to evaluate if the gallons applied are an appropriate amount. If an "inches

applied" feature was added to the WBIC , the water manager could immediately compare a zone of turf to a zone of shrubs. If about half the number of inches was being applied to the shrub zone as to the lawn zone and both zones were healthy the manager could assume the irrigation schedule was about right. If, on the other hand the number of inches being applied to both the turf and shrub zones was about equal the manager could potentially fine tune the turf or shrub zone up or down to water more appropriately and potentially water more efficiently.

Conclusion

Water agency market transformation efforts have already been fruitful. Four years ago only a few startup companies existed. Today there are more than twenty companies producing water smart technology including every major irrigation manufacturer who only four years ago were skeptical of the technology. The two California programs are not only helping the market transformation process but will provide valuable information to shape future programs. An impact analysis of California's two smart Irrigation controller programs will present results on a statewide, regional, and local level. The evaluation will include a statistical analysis of water savings, a comparison of program distribution and marketing methods, an assessment of product performance and customer satisfaction and a cost-benefit analysis from both the customer and utility perspectives. This evaluation is scheduled to be completed in October of 2008 which allows enough time for at least one full year of post-installation data to be collected and analyzed. The report will be available at www.cuwcc.org.