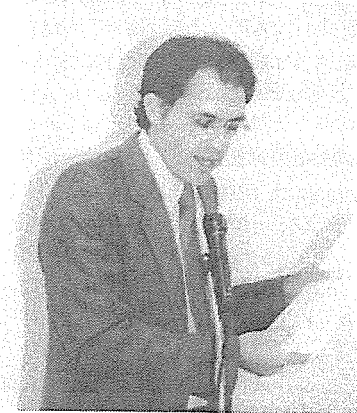


Gary Woodard is the associate director for research at the Water Resources Research Center in the College of Agriculture at the University of Arizona. As such he directs and conducts research into a wide array of water policy issues and natural resource management within Arizona. Gary holds a B.S. in Chemistry, a Juris Doctorate in Law and a Master of Public Policy Studies, all from the University of Michigan. He has studied numerous policy issues including forecasting municipal water demand, evaluating water conservation strategies, interbasin transfers in the West and their impacts on rural areas; the cost effectiveness of various regulatory approaches to reducing urban air pollution, and evaluation of approaches for water conservation programs. Gary serves on several state and local advisory boards and panels for Tucson Water, Arizona Department of Water Resources, and Southern Arizona Water Resources Association.



TUCSON'S WATER CONSERVATION PLAN

*Gary Woodard
Associate Director
Water Resources Research Center
University of Arizona
350 N. Campbell
Tucson, AZ 85721*

Our panel monitor distinguished for us the two kinds of water conservation; the kind that is implemented hastily if there's a drought or the dam breaks or some other temporary supply interruption occurs, and the kind that deals with a long-term shortage, as for example, Tucson Water's conservation program. You here in New Mexico really have to work on programs that make conservation permanent, built-in, automatic and not rely on changing people's behavior permanently. People have to feel there's a crisis in order to change their behavior, and water supply issues should not be continual crises. People are not willing to sacrifice forever by taking a very short shower, but if they can get an ultra low-flow toilet that does the job with less water, their quality of life isn't lowered very much and they will accept the change.

Tucson has been active in water conservation since the mid-1970s. The rest of Arizona got into the act a bit later when the 1980 Groundwater Management Act was passed. A lot of people in Tucson think

that we were first because we're somehow morally superior, but actually we just got ourselves in trouble with our dwindling water supply sooner than others. Tucson likes to refer to itself as the largest municipality that relies solely on groundwater for its water supply. As of 8:00 a.m. yesterday, November 4, 1992, we can no longer say that. Valves were turned and Colorado River water, flowing some 355 miles through the Central Arizona Project (CAP) and purified in a \$60 million treatment plant, actually entered the water mains of Tucson. You might have thought that would be a red letter day in Tucson, with big parades and celebrations. That was not the case. People are actually pretty unhappy because they are concerned about the quality of the water and its reliability. Home improvement stores are running full-page ads on water softeners, reverse osmosis systems and other in-home treatment systems.

The CAP is in trouble on a larger scale. Farmers who had agreed to sign contracts for the water are not

taking it. We have a couple of irrigation districts on the verge of bankruptcy in part because studies that justified the CAP a couple of decades ago projected that cotton would be selling today for about \$2.45 per pound. Today's actual price is less than \$.65 per pound.

Under-utilization of Colorado River water is the major concern in Arizona right now, which makes it awfully hard to push for more conservation. Nevertheless let's discuss what Tucson has done. Basically the city has tried just about everything that they could think of or that other utilities have brought to their attention—everything from a goofy public relations campaign called "Beat the Peak" (featuring a human-size duck called Pete the Beak) to water audits, and even "water cops,"—you name it, they have tried it.

Let me focus very briefly on three areas of activity: pricing; education, prepayments and incentives; and ordinances and codes. The synergies among these categories are very important. Some people respond to carrots, others to sticks, but if you wave both in the air you get just about everyone's attention. If you have both a pricing "stick" and rebate incentives at the same time, you might get results that are more than the sum of the results of individual programs. It is sometimes difficult, however, to justify a major price increase. We just heard about the very low prices for water in Denver. Maybe Denver will get lucky and find they have lead in their water or run afoul of the Safe Drinking Water Act in some other way that causes their water bills to double.

But, if you can get people's attention with pricing you better be ready once you've got their attention to direct their response to those higher water bills in a positive way. When Tucson doubled rates back in 1975, it didn't implement the increase very well. The city didn't warn people that the increase was coming and they started it in the summertime. It turned out to be a record hot, dry summer. People's responses were not directed in a positive way. Instead, they recalled the entire city council. So timing is very important.

Price does work though. There is a real price elasticity. Studies have shown very modest changes in demand with changes in price, but a lot of these studies were done sometime ago when the price variable was misspecified in the econometric model—in other words, the economists botched it! Researchers also sometimes studied areas where rates were so low, or water bills were such a small percentage of incomes or water bills were so small compared to other utility bills, that even though they implemented a large percentage increase, nobody even noticed. However, if

water bills are significant, you can get a response. Some studies done by myself and colleagues show that in Tucson, every one percent increase in price (inflation adjusted or "real price"), results in a six-tenths percent decrease in demand. Work I did in Phoenix shows that a one percent increase results in about a half percent decrease in demand, so pricing really can reduce demand. But, you must be careful how you design your rate structure.

Tucson Water started with a very simple rate structure and then over time really began to tinker with rates to encourage conservation and pursue other utility objectives. Eventually, there were eight customer classes with different types of rate structures.

Today, there are many rate features—one rate structure for winter, another for summer, increasing blocks, fixed charges, remote service area charges, and so on. It's so complicated that no consumer has any idea of how their bill is determined or how much money they might save if they reduce their consumption. In fact it got to the point where apparently some people at Tucson Water didn't quite understand how it worked either.

Figure 1 compares the water bills as a function of how much water is used. Note the rate break between the small commercial and large commercial categories. Some businesses in the large commercial category decided "to do the right thing" and put in drip systems and low-flow plumbing fixtures and were subsequently moved to the small commercial category. Their usage went from about 120 ccf per month to about 90 ccf. They were rewarded for their efforts by having their bill go up. The lesson is: keep rate structures simple.

Not only are there problems among customer classes—you can also have problems with increasing block rate structures. I'm a strong advocate for anything other than increasing block rate structures. These are rates that increase with increasing water use. There are built-in inequities in increasing block rates and they also do not produce as strong a conservation signal as economic theory predicts. For example, a typical Tucson residential customer's water bill will decrease by about 7 percent if they drop their water consumption by 10 percent. That is not a big reward. I prefer rate structures based on a summer surcharge where customers are charged higher prices for water use in summer months that exceeds the customer's winter usage. Tucson Water is about to abandon increasing blocks. They also will reduce the number of customer classes from eight to three.

A few years ago Phoenix copied Tucson and went to increasing block rates. Phoenix caught on to the

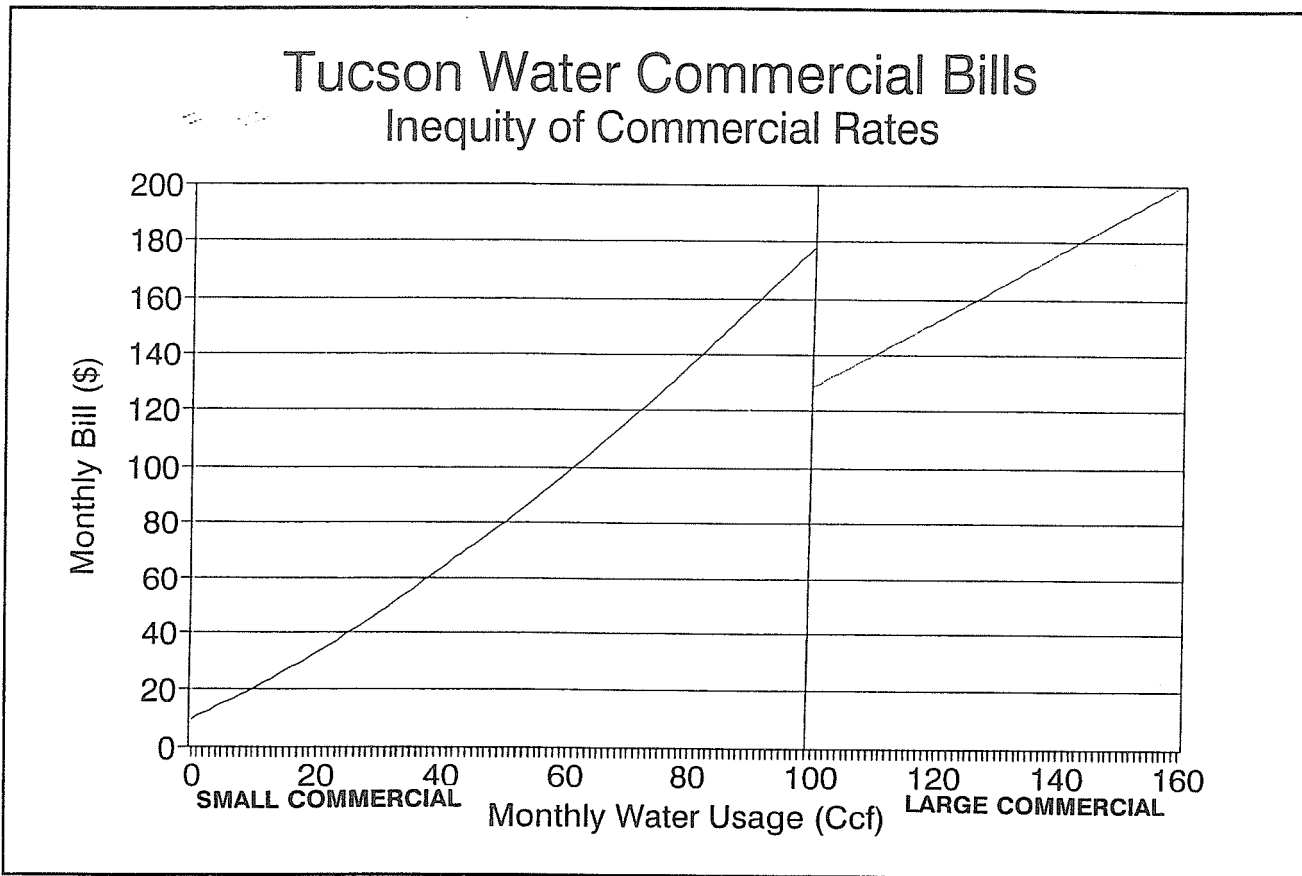


Figure 1. Comparison of water bills as a function of how much water is used.

shortcomings of increasing block rates a little quicker and abandoned that rate form. I particularly like one aspect of what they did with the rate structure—they essentially have one customer class so it's hard for any group to argue that they are being treated unfairly.

Incentives and education also are important. Most economists pooh-poo the public service messages and say that they really don't have an impact on customer behavior. But if you have a consistent message year in and year out, coupled with specific suggestions for people—helping them rip out turf, showing them which plants are water efficient, conducting workshops on how to install a drip system, having contests where best homeowner conservation winners have a photo of their house in the Sunday paper—all of these things can have a positive impact.

Tucson Water started a program in January 1990 to encourage people to get rid of their existing toilets and replace them with ultra low-flow toilets that uses about 1.5 gallons of water per flush. The program works. Figure 2 shows that for the over 2,000 people who replaced their toilets between January 1990 and April 1992, indoor water consumption actually

dropped by 12 to 15 percent. That program was initiated by Tucson's mayor and council against the advice of Tucson Water staff because a similar program in Glendale had not worked at all. Essentially the same program was implemented in Tucson and it took off and did very well. There's a lesson to be learned there too—be very careful about trying to apply blindly programs from one area to another.

You also have to be careful these programs don't work too well. One city in California offered a little bit too much of a rebate and everybody decided to take advantage of it, which cost the city in excess of \$1 million per year for the toilets.

Finally, I believe that plumbing codes and certain legal restrictions on water use have a place in conservation efforts. It's much cheaper to build-in conservation than to retro-fit it. Tucson and Pima County, and just recently the entire state of Arizona, require low-flow fixtures for new construction or renovation projects. In Tucson and Pima County, if you want to build a golf course or other large turf facility, you must use effluent, you have no choice. Developers initially warned of dire consequences. The economy

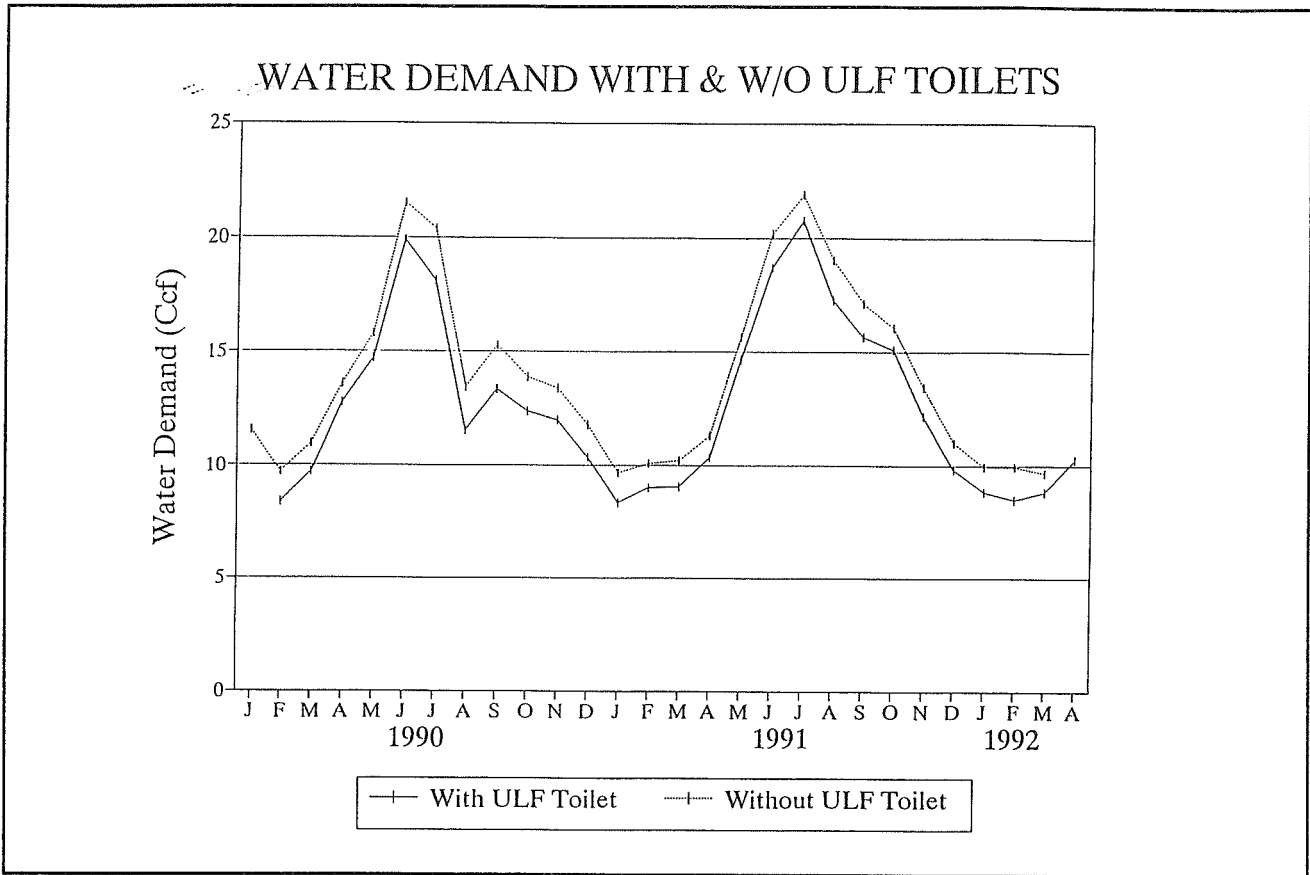


Figure 2. Water demand with and without ULF toilets.

did grind to a halt last year but nobody is blaming it on the effluent reuse provisions. It has turned out to be not that big a deal. Once everyone quits fussing about it, they adapt quite well and it is the most cost effective way to lower your demand permanently.

Thank you.