

**Revolution**

New technologies offer dealers opportunities to maximize efficiency for customers.

**Softening Through the Years**

The salt-based softening market blossomed after World War II and is the gold standard by which all other softening technologies are judged. The first residential water softeners were portable exchange tanks. They were simple, fool-proof and provided soft water—nothing more, nothing less. Brine efficiencies had not yet entered the dictionary.

Progressive water dealers soon realized that the portable exchange model was seriously flawed, and pushed manufacturers to develop “regenerate-in-place” systems they could sell to customers. A removable lid was incorporated into the tank, whereby homeowners could load salt regenerant dosage into the system and then manipulate a series of gate valves in a specific sequence to regenerate the system and rinse away the regeneration byproducts. This was more convenient for dealers, but not necessarily homeowners, because they were periodically opening a pressurized vessel and exposing their families to the inevitable bacteria and leak liabilities.

As time became an increasingly valuable commodity to homeowners and plant operators, manufacturers introduced the “automatic” softener, which uses an onboard mechanical timer and automated regeneration component assemblies. This simple technology was revolutionary in its day, saving people time and bringing the industry closer to the ultimate goal of ensuring an uninterrupted supply of soft water to every home and business. These systems were so simple, reliable and easy to operate that many people still buy them in areas where they have not been banned yet.

Environmental consciousness awoke in the U.S. in the 1970s, ushering in an era of increased awareness of pollution control and conservation issues. The consumer market demanded a more efficient solution than merely guessing which day of the week to regenerate the softener.

Residential softener manufacturers began marketing “upflow” (counter-current) regenerated softeners that induced brine into the tank opposite the service flow, allowing for a more complete cleaning cycle and squeezing further efficiency out of the synthetic gel resins. This technology, when properly deployed, provided significant salt savings and improved water quality, but the market still demanded more.

Mechanically metered softeners were introduced to allow dealers to control regeneration frequency based on consumption rather than the amount of time that had passed. These systems could monitor water consumption and clean on demand, saving salt, water, time and money. As with all analog systems, mechanical meters contained numerous gears, which made them complicated to service and increased the likelihood of mechanical failure.

Cost-effective microcontrollers and hall-effect sensors were introduced in the 1980s. They allowed one-piece flowmeters and improved control and flexibility, especially over reserve capacities. Reserve capacity is the minimum amount of water available during a 24-hour period. The industry decided that 2 a.m. was a good time for regeneration, because most people would be asleep and not using the hard water that was bypassing when a single-tank system regenerated.

Formulas for the perfect reserve were developed and still are the subject of spirited debate among soft water technicians and dealers. Innovative manufacturers introduced algorithmic advances, like adaptive and floating reserves, that adjusted over time based on the measured average daily water consumption in the home, eliminating much of the guesswork involved with standard calculations. Proportional, variable and fractional brining software further enhanced single-tank softening efficiency; salt dosages could be precisely calculated to use only the exact amount of salt required for each regeneration cycle. Manufacturers and software developers poured massive amounts of time and money into making this software as efficient and user friendly as possible.

Some manufacturers and dealers do not even bother selling single-tank softeners anymore. They instead promote softeners with two alternating resin tanks, effectively supplying the home with 100% soft water, 100% of the time. Twin-tank technology is far more salt efficient and redundant than single-tank technology, because reserve capacities are not required and ion exchange tanks can switch multiple times per day without bypassing to regenerate. Apart from noise or water pressure loss during regeneration, the time of regeneration now is

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**By Mike Mecca & Greg Reyneke**

**The residential softening market blossomed after World War II, when the standard was portable exchange tanks. Since then, new technologies have greatly increased softener efficiency.**
A Quality Product will become the new standard for performance, the resin. It is believed that this configuration concentrated brine solution to thoroughly clean rarely forego the regular salt- and water-saving regeneration time before cleaning itself. because it is forced to wait until the designated the barn when deployed on a single-tank system, closing the door after the horse has already left ness front reaches the sensor, but it is essentially adjusting the system capacity once a hard- in which the water softener senses a change of water quality or resin charge condi- tions. Some sensor designs work well, automatically adjusting the system capacity once a hard- ness front reaches the sensor, but it is essentially closing the door after the horse has already left the barn when deployed on a single-tank system, because it is forced to wait until the designated regeneration time before cleaning itself.

**New Developments**

A new and exciting innovation embodies a twin-tank softener with upflow regeneration functionality and dual resin exhaustion sensors in each tank. These epitomize some of the best features in salt-based softening that the industry currently has to offer: redundancy, intelligent sensing and efficient regeneration. After each regeneration, the control creates a new profile of the water conditions for the upcoming tank to use in its next operational capacity setting. But then the question is: Wouldn’t this ultra-high efficiency be detrimental to the life of the resin?

One manufacturer has addressed this concern through smart software that performs a “deep cleaning cycle.” Deep cleaning is a simple concept: Knowing that the resin media slowly loses functional capacity after extended “economy” regenerations, the system will initiate a deep cleaning cycle after a certain number of regular high-efficiency cleanings. The onboard software uses an artificial intelligence algorithm to determine how often to do this based on how many gallons have been processed, the age of the system and, of course, what the onboard sensors detect about the status of the resin media.

During deep cleaning, the control will temporarily forego the regular salt- and water-saving settings to perform a regeneration with a more concentrated brine solution to thoroughly clean the resin. It is believed that this configuration will become the new standard for performance, consistency and efficiency in the 21st century.

Even though electrodeionization and capacitive-deionization water conditioners have been available for a number of years, they are now available at an affordable level for home and light commercial use. Industry professionals who have designed, manufactured, sold and installed salt-based systems for a long time sometimes have a hard time understanding these new technologies and they can even be intimidating.

Prominent manufacturers as well as small designers are working to be first to market with a reliable product that will produce sufficient flow throughout at a price point viable for residential deployment. It is not inconceivable that these technologies will provide water as good as or better than salt-based ion exchange through the use of electricity within the next five years.

Fundamental to the adoption of these technologies is that they will not bring water to “zero soft” (less than 1 gpg calcium carbonate), because they address both cations and anions during the treatment process. If these devices were to remove all calcium from water, it would produce potentially corrosive water. Because the current alternatives to traditional salt-based water softeners are physical treatment devices that do not remove hardness, consumers now have a viable option to reduce the amount of calcium as well as anions in their water, which traditional softeners do not touch, without adding sodium or potassium ions. The paradigm shift required is for the user/dealer to be happy with a small amount of minerals in the water. This will be a natural, logical decision, because the alternative is no softening at all.

A disappointing observation on the current state of this industry is that the technologies mentioned in this article have been available for many years, but few dealers have had the courage to embrace change and adopt technologies that help our industry to be more efficient, effective and environmentally friendly. Well-meaning yet misguided legislators have banned or attempted to ban traditional salt-based ion exchange softeners because they are concerned about salt and water efficiency. While we can argue that the benefits of water softening outweigh traditional environmental impacts, this is assuming a weak defensive position. We should instead take the initiative to do everything within our power to make our water quality management solutions more efficient and effective. 

Mike Mecca is director of marketing and innovation for Performance Water Products. Mecca can be reached at mikemecca@performancewater.com.

Greg Reyneke is managing partner for Red Fox Advisors. Reyneke can be reached at gregreyneke@redfoxadvisors.com.

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