



SpiroFlo: Residential Hot Water and Energy Savings: Quick Review

Abstract

In 2010, the Colorado Governor's Energy Office awarded SpiroFlo Holdings, Inc. (SpiroFlo) a grant through the Innovative Funding for Energy Efficiency (IFEE) program. This grant enabled SpiroFlo to test its water-saving device in homes around the Denver Metro area through early 2011. During the trial, participants recorded their wait time for hot water at the designated outlet for 5-7 days both before and after the installation of the SpiroFlo device.

This IFEE study concluded that the patented SpiroFlo device allows for a faster shower for most homeowners (4 out of 5), all while conserving water and providing green benefits on day one. The average wait time for hot water in positive installs went down from 62.41 seconds to 40.77 seconds—a 34.82% reduction. In addition to the wait time benefits, there is also an average water volume savings of 3.5% at every hot water outlet in the house. With the combined benefits in wait time and volume savings, a four-person household can conserve an average of 3,869 gallons a year. Using these average numbers as the standard, if only 20% of Colorado housing units had a SpiroFlo device installed, this could translate into saving nearly 1.68 billion gallons annually. If every housing unit in the U.S. had a SpiroFlo device, the total amount of water conserved in a year would be over 500 billion gallons.

There are also anecdotal benefits from the SpiroFlo device. These include getting *hotter* water (confirmed in 40% of trial households), less energy being used to re-heat the water, higher water pressure and softer skin (this benefit was confirmed by a hydrologist). One SpiroFlo installed at the outlet of a hot water tank is a complete system for the whole house. There is no need for the costly modifications and ventilation requirements associated with tankless and recirculating devices. Savvy DIY homeowners are able to install the SpiroFlo device themselves and several plumbers expressed interest in absorbing the cost of the SpiroFlo device within their standard installation costs.

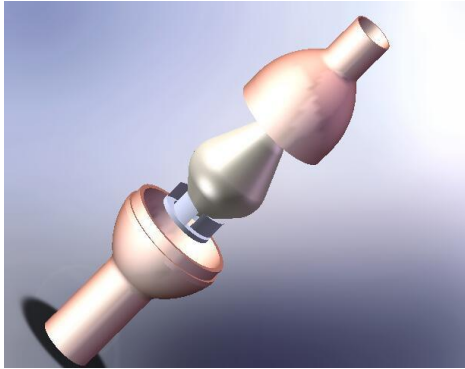
SpiroFlo: Allowing homeowners to go green while improving their routine.

The Need

Everyone has a morning routine, but for some households, this routine involves gallons of water going down the drain while waiting for the shower to get hot. Though it may seem like mere minutes per day, within this time frame, billions of gallons of water go down the drain unused each year in the Denver Metro area alone. This water still ends up at a wastewater facility, thereby increasing both a household's water and wastewater bill and the state's treatment costs. The cost of reheating the replaced water also adds to a household's carbon footprint and energy bill. At a time where several counties in a naturally dry state like Colorado are draining the aquifers faster than they're being replenished, this kind of waste is no longer optional.

With this in mind, SpiroFlo believes it's time for water to be treated like the valuable commodity it is.

IFEE Grant



In 2010, SpiroFlo Holdings, Inc. (SpiroFlo) was awarded the Innovative Funding for Energy Efficiency (IFEE) grant from the Colorado Governor's Energy Office (GEO).¹ This grant enabled SpiroFlo to test its patented water-saving device (exploded graphic of the device pictured left) in homes around the Denver Metro area through early 2011. By placing a SpiroFlo device in an existing water line (usually just after the hot water tank), a household can receive consistent hot water faster, without the need for costly additions. A single SpiroFlo device is all that is needed for a "whole-house" solution. As the turbulent water flows through the SpiroFlo device, it is spirally shaped into an

organized flow that accelerates the delivery of hot water to the target outlet. For example, a household with a shower outlet in the master bedroom (often at the end of the water line) can receive hot water significantly faster, thereby increasing efficiency, reducing water usage, and lowering energy and treatment costs. This patented SpiroFlo device contains no moving parts, meaning there is nothing to wear out.

SpiroFlo had already proven the value of the technology in industrial applications (for biofilm, bacteria and salt removal/mitigation) and in the oil and gas industry—where over 1,450 tools have been sold under the Vortex Tools brand name to mitigate paraffin buildup, improve natural gas liquid recovery, enhance efficiency in flowback start-up times, and to reduce freeze-ups/liquid drop-out/gas pockets. SpiroFlo's goal throughout this study was to bring increased energy efficiency to residential hot water lines, allowing homeowners to "*Go green while improving their routine*" on day one. Although it's only a modest saving in terms of gallons of water per household per day, a small amount of water savings from a lot of households can make a big difference in a state's footprint (in terms of water consumption), especially given the projected low cost for the SpiroFlo device.

Process

With the IFEE grant covering the manufacturing of the SpiroFlo devices, SpiroFlo built a test group of households (which included participants from Denver Water's internal Green Team) from press releases, advertisements, a booth at the Colorado Fall Home Show, and extensive word of mouth promotion.



After an initial review and a qualifying phone call/email by SpiroFlo staff, a home analyst visit was scheduled. During the visit, the home analyst recoded household data and took pictures of the tank/tank equivalent configuration, making sure there was room for the 24" bypass rig (pictured left) to be installed for the trial. While this bypass is not considered necessary in a standard home installation, it allowed for water sampling with and without the SpiroFlo device during the study. Also, in the unlikely event that the SpiroFlo device failed, the homeowner could bypass the broken tool to get hot water again.

If the home analyst made a positive recommendation for install, the trial agreement was signed and SpiroFlo’s plumber would contact the homeowners directly for installation (unless they planned on self-installation). Homeowners recorded 5-7 days worth of data both before and after the SpiroFlo device was installed—timing how long they waited for hot water at the target outlet (usually the master shower)—along with any anecdotal comments. Additionally, SpiroFlo personnel revisited some of households in order to get volume data, comparing data both with and without the SpiroFlo device.

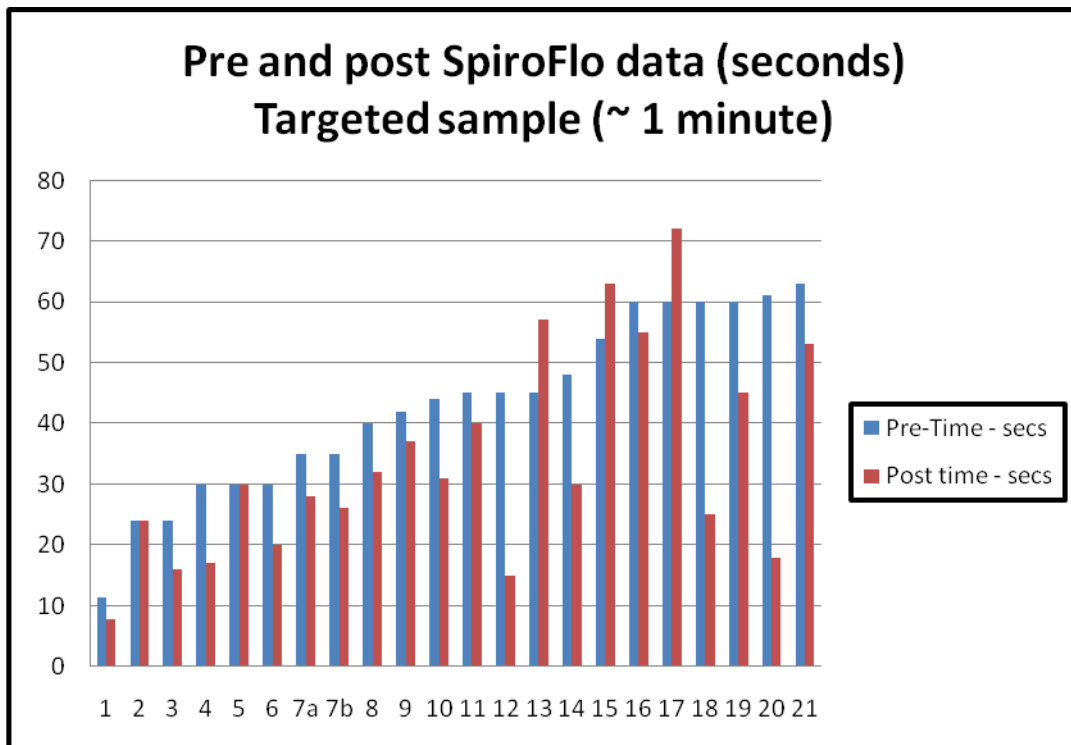
Data

Almost 4 out 5 households saw a shorter wait time for hot water with the addition of the SpiroFlo device. Of the households that did not receive hot water faster, half saw no change in their wait time. Even in neutral/increased wait time installations, some households still saw anecdotal benefits like receiving *hotter* water.

Quick Facts

- 78% of households saw a reduction in their wait time for hot water.
- The average wait time for hot water in positive installs (excluding all neutral-time and increased wait time installs), went down from 62.41 seconds to 40.77 seconds—an average savings of 21.64 seconds or a 34.82% reduction.
- The household with the shortest wait time reduced its wait for hot water from 11.4 seconds to 7.8 seconds (a 32% improvement).
- The household with the longest wait time reduced its wait for hot water from four minutes and 45 seconds to two minutes (a 58% improvement).

Since most of the study households’ pre-installation times came in around one minute or less, those installations (and their improvements/detriments) are represented in the chart below. Any number represented with both an a and b indicates readings from two hot water outlets within the same house.



Anecdotal Findings

Over 40% of test households reported back getting *hotter* water. This data was not specifically asked for and included one home that recorded a longer wait time from the SpiroFlo device. The best example of this benefit came from household #13, where the wait time was reduced from 0:40 to 0:32 (a 20% improvement) and the homeowners had steam in their shower where there had never been steam before—a physical representation of the hotter water temperature. They stated, "Actually the water does seem hotter, but we were assured that the temp had not been changed!" Homeowner #83 stated that by the third day of recording post-install data, he had turned down his water tank temperature because of the improved water temperature from the SpiroFlo device. He also believed that despite the nominally reduced volume, that his water pressure was higher. Others cited this increased water pressure, but this is actually increased velocity (given that the pressure to a home is set by city supply).

The energy savings from not needing as much energy to heat the water is also significant:

(C)onsider your water heater's energy factor. This is an overall rating—expressed as a number from zero to one—that indicates how efficiently the machine converts the energy it receives into hot water available for your use. (The higher the number, the more efficient the machine.) The typical gas heater has an energy factor of around 0.6, so you'd need about 17,000 Btus of gas input to warm your shower. If you used a typical electric water heater, with an energy factor of around 0.9, the same shower would consume 12,000 Btus of electricity. There's a big caveat here: Every Btu of electricity delivered to your home requires roughly three Btus' worth of primary fuel at the power plant, raising the total energy cost of your electrically heated shower to about 36,000 Btus.²

Since the SpiroFlo device helps provide hotter water with greater heat retention, there is also an energy savings in Btus. This benefit is of greater significance in colder states like Colorado, particularly during the winter months. Other anecdotal comments included having softer skin (which was confirmed by a Texas-based hydrologist). Household #60 had its wait time reduced from 1:15 to 0:51 (a 32% improvement on hot water delivery). The homeowner, a busy dentist, noted the beneficial value of even 24 seconds in his routine: "Every minute of my day is scheduled, so even saving a little bit of time with the SpiroFlo has caused me to change and improve my routine. I suffer from dry skin and it's especially bad this time of year. However, my skin is much smoother and the only thing I've changed is the installation of the SpiroFlo device."

In addition to the high interest from green-friendly households, most of the interested households involved in the IFEE study perceived having a longer wait time for hot water than the data actually supported, meaning that homeowners are often inclined to have a desire for the benefits of the SpiroFlo device. Savvy DIY homeowners were able to install the SpiroFlo device themselves and several plumbers expressed interest in absorbing the cost of the SpiroFlo device within their standard installation costs.

Volume Reduction

After the GEO study was complete, SpiroFlo also conducted volume testing in some of the IFEE installations. This was done by timing out a water collection from the test shower into a bucket then weighing the sample to the nearest tenth of kilogram. The valves were then flipped to bypass the SpiroFlo device and the same tests were run for comparison. After the testing was complete, the valves were flipped back to give the homeowner the ongoing benefits of the SpiroFlo device.

Although there were a couple of anomalies in the water collection sampling methods, most households saw a water volume reduction ranging between 1.5 and 5%, averaging out to 3.5%. The household with the highest water pressure was on the low end of volume savings (1.5%). In addition to water pressure, another main factor that contributed to the difference in average range was the complexity of pipeline layout throughout the house. Generally speaking, the simpler the pipe layout, the greater the volume savings. Additionally, Ts in the piping soon after the SpiroFlo device reduced both the volume savings and the wait time savings, as the flow set up by the SpiroFlo device cannot efficiently go two different directions at the same time. There is, however, no apparent correlation between wait time savings and volume savings based on this single sample point.

As for the two anomalies, one saw zero reduction in water volume, whereas the other saw a 27% reduction in water volume (still without noticeably affecting the water flow). The 0% household had the most complicated piping at the hot water tank out of any of the IFEE participants (with multiple pipelines running into a single line; several twists, turns and Ts; and an uncommon custom tank). The 27% household was a low-pressure Highlands Ranch home on a pump. SpiroFlo has found, with other non-IFEE testing, that pumps can work up to 40% more efficiently with SpiroFlo. However, since most household shower lines operate on city water pressures (without a pump), the results in this household—while worthy of note—are atypical. Additionally, since SpiroFlo allows for more water to travel through a pump, there should have been a volume *increase*, but the 27% household had multi-head showers and other complications that resulted in a volume decrease instead. As a result, SpiroFlo eliminated both the high (27%) and low (0%) numbers when calculating the average water volume savings referenced herein.

It should be noted that this 3.5% average volume savings doesn't just apply to showers, but to *every* hot water outlet—including sinks, dishwashers and washing machines—in the home. According to the EPA, “Americans use large quantities of water inside their homes. The average family of four can use 400 gallons of water every day, and, on average, approximately 70 percent of that water is used indoors.”³ Although the SpiroFlo device installed at the hot water device cannot affect the 30% of water being used outside the home, there are also beneficial applications for SpiroFlo with sprinkler systems.

Impact

In addition to benefitting the homeowner with a faster, better shower, the reduced wait time and a 3.5% average in volume reduction in hot water usage translate to significant water savings:

Average Shower Rates⁴

Average shower volume	16.8 gallons
Average shower flow rate	2.21 gallons per minute
Average shower duration	8.0 minutes

Average Daily Savings with SpiroFlo

Shower time saved w/SpiroFlo – based on wait time	21.64 seconds
Shower water saved w/SpiroFlo – based on wait time	0.80 gallons
Water saved w/SpiroFlo – based on household usage	14 gallons

Annual wait time water saved	292 gallons
Annual volume of water saved per household	3,577 gallons*

Total annual water conserved/household

3,869 gallons*

**Based on a four-person household average*

If only 20% of Colorado housing units had a SpiroFlo device installed, this would translate into an average savings of 1,677,482,330 gallons annually—enough to fill back up the storage capacity of Chatfield Reservoir (8,802,000,000 gallons) in a little more than five years. If every housing unit in the U.S. had a SpiroFlo device, they could save an average of 502,852,587,457 gallons annually—enough to fill back up the same Chatfield Reservoir 57.13 times a year or once every 6.39 days.

Even without the half-trillion-plus gallons visual, these ~15 gallons of water saved from a single household each day from the SpiroFlo device help lower both a household's and state's energy and treatment costs, leading to a win-win situation for both homeowner convenience and statewide green benefits.

Conclusion

With many homeowners believing that they are waiting too long for hot water at their showers, and the value of water (along with its energy and treatment costs) going up—especially in areas experiencing a water shortage—there is both a need and a demand for improved water conservation. However, this water conservation does not need to come in the form of a weaker water flow, as the patented SpiroFlo device uses 3.5% less water to deliver hot water to showers 34.82% faster in 4 out of 5 homes, all without a noticeable negative change to the homeowner in terms of water pressure or volume. This same 3.5% water volume reduction applies to every hot water outlet inside the home; enabling water, treatment and energy savings at the state and household level.

The SpiroFlo device contains no moving parts; meaning there is nothing to maintain. One SpiroFlo, installed at the outset of a hot water tank, is a complete system for every hot water outlet in the household, all without the need for the costly modifications associated with tankless and recirculating systems. Easily installed by savvy DIY homeowners or professional plumbers alike, the SpiroFlo device is a water-conservation wonder offering both convenience and green benefits on day one. These energy savings are for both the homeowner and the state (in energy utility, water/wastewater treatment plants).

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Sources Cited

1. "Press Release - GEO Awards \$800K in New Energy Grants." May 12, 2010. Available: www.colorado.gov/cs/Satellite/OIT-2/OIT2/1251574631949
2. Rastogi, Nina Shen, "Bathing Hot, Hot, Hot." October 27, 2009. Available: <http://www.slate.com/id/2233527>
3. "Indoor Water Use in the United States." Available: <http://www.epa.gov/WaterSense/pubs/indoor.html>
4. Aquacraft, Inc. "Post Drought Changes in Residential Water Use." February 2006. Available: <http://www.aquacraft.com/sites/default/files/pub/Aquacraft-%282006%29-Denver-Water-Post-Drought-Changes-in-Residential-Water-Use.pdf>

Additional Resources

-More info on Vortex oil and gas tools can be found at www.vortextools.com

-SpiroFlo's press release on the IFEE study can be found at www.spiroflo.com/GEOstudy.php

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