The Status of Legislation, Regulation, Codes & Standards on Indoor Plumbing Water Efficiency

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Introduction

Throughout the U.S., water supply and wastewater infrastructure is in need of repair, replacement and, in many cases, expansion. Water supply, sanitation, wastewater treatment and water reuse are critical issues in over half of the states. When it comes to the built environment, indoor plumbing fixtures, appliances, and other water-using equipment are a straightforward, yet impactful, part of the solution to protecting our water resources and extending the life of our infrastructure.

Both new and aging building projects present an opportunity to make a significant impact on water consumption and water use efficiency through incorporation of the most recent and widely proven indoor plumbing system designs and technologies. Water conservation and water efficiency differ in that efficiencies are measurable by an input vs. an output, whereas conservation is largely an individual behavioral action that is not easily measured. The combination of the two, i.e., efficiency and conservation, is a proven path to overall consumption reduction.

This paper advocates for legislators, regulators, and codes and standards developers to incorporate higher minimum performance and efficiency requirements for indoor plumbing into legislative, regulatory, and codes and standards initiatives.

Furthermore, on the national scale, there are seven (7) recognized green building codes, standards, and rating systems, each with a set of water efficiency provisions.[1] Those provisions are essentially equivalent across all seven, with one exception. That exception is the GreenGlobes Green Building Initiative (GBI)[2], where indoor water efficiency provisions do not exist within a 'level playing field'. That is, proponents participating in GBI may earn 'points' in some jurisdictions for merely complying with the law with respect to indoor water efficiency, while in other jurisdictions they are permitted to avoid those same requirements.

This paper advocates for uniformity across the U.S. in earning indoor water efficiency points within all green codes, standards, and rating systems.

Background

Nearly all buildings in the U.S. offer a potable water (drinking water) supply to occupants. Demands upon the supply system are increasing significantly, but not all of those demands require potable water. As a result, emphasis over the past 40 years has been on increasing the efficiency of the potable water end uses (plumbing and appliances) and removing those uses from the potable water supply that do not require such water (water for cleaning, irrigation, cooling, and those processes that can operate with non-potable water).

Product efficiency improvements in the past 30 years have been significant. Some have been mandated through Federal, state, and local legislation and regulations, while others have resulted solely from the initiative of product developers and manufacturers directed at product improvement.[3] **Table 1** generally illustrates the efficiency changes achieved since the 1980s:

[1] See Table 3.
[2] 2015, *BSR/GBI 01-201X, Green Building Assessment Protocol for Commercial Buildings – Public Comment Draft 1*, August 31.
[3] This is particularly true in the food service, commercial laundry, and medical industries, where emphasis upon significant energy use reductions in process equipment have resulted in companion reductions in water consumption.

TABLE 1. Water Consumption by Water-Using Plumbing Products and Appliances – 1980 to 2015

Water-using Fixture or Appliance	1980s Water Use	1990 Require-ment	EPAct 1992 Requirement	2009 Baseline Plumbing Code	2015 'Green Code' Require-ments	% Reduction in avg water use since 1980s
Residential Bathroom Lavatory Faucet	3.5+ gpm	2.5 gpm	2.2 gpm	2.2 gpm	1.5 gpm	**57%**
Showerhead	3.5+ gpm	3.5 gpm	2.5 gpm	2.5 gpm	2.0 gpm	**43%**
Toilet – Residential	5.0+ gpf	3.5 gpf	1.6 gpf	1.6 gpf	1.28 gpf	**74%**
Toilet - Commercial	5.0+ gpf	3.5 gpf	1.6 gpf	1.6 gpm	1.6 gpm[4]	**68%**
Urinal	1.5 to 3.0+ gpf	1.5 to 3.0 gpf	1.0 gpf	1.0 gpf	0.5 gpf	**67%**
Commercial Lavatory Faucet	3.5+ gpm	2.5 gpm	2.2 gpm	0.5 gpm	0.5 gpm	**86%**
Food Service Pre-rinse Spray Valve	5.0+ gpm	No requirement	1.6 gpm (EPAct 2005)	No requirement	1.3 gpm	**74%**
Residential Clothes Washer	51 gallons/load	No requirement	26 gallons/load (2012 standard)	No requirement	16 gallons/load	**67%**
Residential Dishwasher	14 gallons/cycle	No requirement	6.5 gallons/cycle (2012 standard)	No requirement	5.0 gallons/cycle (ASHRAE S191P)	**64%**

gpm: gallons per minute / gpf: gallons per flush

In the context of water supply, many state and local jurisdictions[5] are setting new product standards[6] with threshold maximums more stringent than those of the Federal government, offering incentives to building owners and businesses to retrofit non-efficient plumbing fixtures and appliances with water-efficient products, encouraging water conservation through education and public outreach, setting incentive-based water and sewer rates, and, in some cases, penalizing water users for wasteful consumption.

Status of Legislation & Regulation

Federal law with regard to the maximum water use by sanitary plumbing fixtures has not changed for over 20 years. Those thresholds are as follows:

Water closets (toilets)	1.6 gallons per flush (gpf)
Urinals	1.0 gpf

[4] The predominant 'green' plumbing codes have tabled reductions in toilet consumption levels for commercial applications pending research on drainline transport. The PERC study directly addresses that issue. For information on PERC, go here: http://www.map-testing.com/content/info/menu/perc.html

[5] Includes municipalities, water providers, wastewater agencies, and others.

[6] Where pre-emption by Federal regulations was not an issue.

Until 2010, however, states were prohibited from adopting lower water use thresholds because of preemption by the Federal government. On December 22, 2010, that preemption was lifted by the Department of Energy (DOE) for faucets, showerheads, water closets, and urinals;[7] states (and other jurisdictions) are now permitted to establish their own water use maximums for these products.

Without waiting for this DOE action, California established new thresholds for efficiency of water closets (toilets) and urinals in Assembly Bill 715 (AB715), signed into law on October 11, 2007. This legislation was the first major step in mandating high-efficiency toilets (HETs) and urinals (HEUs) in the U.S. and provided that California would no longer allow Federal standard 1.6 gpf toilets and 1.0 gpf urinals to be sold or installed in the state beginning on January 1, 2014. Instead, the California thresholds became:

Water closets (toilets)	1.28 gpf
Urinals	0.5 gpf[8]

With AB715 as a template, other major jurisdictions followed with similar legislation. Those include Texas, Georgia and, most recently, Colorado. New York City and Miami-Dade and Broward County in Florida also adopted high-efficiency thresholds as well.

Currently, 29.7 percent of the U.S. population is subject to these more stringent requirements for indoor plumbing fixtures (toilets and urinals). In some cases, lower thresholds for fixture fittings are mandated as well (e.g., for faucets, pre-rinse spray valves, and showerheads). The following table illustrates which jurisdictions are mandating specific fixture requirements for HETs and HEUs.

Table 2. Regulatory Coverage

HETs and HEUs	
Jurisdiction	**Population 2014 & 2015**
California	39,144,818
Texas	27,469,114
Georgia	10,214,860
Colorado	5,456,574
New York, NY	8,491,079
Miami-Dade, FL	2,662,874
Broward County, FL	1,869,235
Santa Fe, NM	67,947
Total pop of jurisdictions with HET-HEU requirement	95,376,501
Total U.S.	321,418,820
% with HET-HEU req'm't	29.67%

[7] U.S. Department of Energy, 10 CFR Part 430, Docket No. EERE-2010-BT-STD-WAV-0045, *Energy Efficiency Program for Consumer Products: Waiver of Federal Preemption of State Regulations Concerning the Water Use or Water Efficiency of Showerheads, Faucets, Water Closets, and Urinals.*

[8] This was later changed in 2015 by the California Energy Commission to 0.125 gpf

As a result of the individual states and municipalities adopting these high-efficiency water use thresholds, an 'uneven playing field' currently exists within GBI, since there are no prerequisites requiring HETs and HEUs. In the long term, this is detrimental to green building standards and model codes, to manufacturers and their distribution structure, and, ultimately, to consumers and businesses, who would otherwise benefit from the efficiencies and improved performance of the new high-efficiency products.

HEUs have existed in the marketplace since the early 1990s, while HETs were introduced in the U.S. in 1999. Both are mature product categories that outperform their predecessors and have been widely accepted in those regions where they are readily available.

Status of Green Building Codes, Standards and Rating Systems

A proliferation of green building codes, standards, and rating systems exists in the U.S., many of which are of local origin. A comparison of the plumbing fixture provisions is shown in **Table 3** on the following page. Each of these seven programs undergoes periodic revision on a sustaining or scheduled basis. Consequently, each may change somewhat in 2016, since a new WaterSense® specification for flushometer valve/bowl combination toilets was released by the U.S. EPA on December 17, 2015. With one exception, GBI,[9] we expect the green codes and green building standards shown in the table will continue to mandate at least a WaterSense certification and listing for toilet and urinal fixtures in 2016, thereby creating a 'level playing field' within each green document. GBI, being a favored rating system for Federal facilities, lacks such uniformity. That is, plumbing provisions for HETs and HEUs (and other plumbing installations) should be uniform regardless of any special initiatives by some jurisdictions as displayed in **Table 2**.

Impacts on Product Manufacturers

As noted earlier, nearly 30 percent of the U.S. (by population) is already subject to plumbing fixture mandates for HETs and HEUs. Others jurisdictions are considering identical requirements. Until there is uniformity of requirements across the entire country (through either Federal or states' actions), manufacturers are required to maintain two sets of production lines and two sets of product SKUs. With a lack of uniformity, their regional distributors are thus burdened with stocking fixture models of both types, i.e., products compliant exclusively with the Federal standard and products compliant with local or regional requirements. This is costly and benefits neither the manufacturers, their customers, nor the progress toward 'green' construction.

The Energy vs. Water Efficiency Conundrum

Many codes and standards provide flexibility in achieving energy efficiency goals because there are often multiple paths to achieving efficiency. Water use, on the other hand, is quite different than energy use. For example, while there are many ways to efficiently light an interior space (LEDs, fluorescents, supplemental daylighting, etc.), there is only one practical way to remove human waste from a building and that is by way of a toilet and drain system.

Another reason water use is fundamentally different than energy use indoors is that energy is consumed, water is not. Energy is typically converted to either light or heat and is essentially lost. Once it's used, Energy's waste product has relatively little value. Indoor water, on the other hand, is not consumed, it merely changes form through use and can be recovered for reuse.

[9] 2015, Green Building Initiative, *BSR/GBI 01-201X: Green Building Assessment for Commercial Buildings, Public Comment Draft 1*, August 31.

TABLE 3. National Green Building Standards, Codes, and Rating Systems: Comparison of Plumbing Fixture Water Efficiency Provisions – Maximum Water Consumption

PLUMBING: TOILETS & URINALS	ASHRAE SS189.1 (v.2-2011, updated with addendum v-2014)	ASHRAE S191P (Public review draft v.1, July 2012)	IAPMO WE-Stand: Water Efficiency & Sanitation (2015 public review draft)	Green Globes – Green Bldg Initiative (April 2010)	LEED V.4 (July 2014)	IAPMO Green Plumbing & Mech Code Supplement (2015 version)	IgCC Green Code (2015 version)
	ANSI Standards				Non-ANSI Documents		
Residential toilets OR "private" setting in commercial – FLUSHOMETER TYPE **(gals per flush)**	HET: 1.28g	HET: 1.28g	HET: 1.28g	*No individual maximums specified.* *Federal maximums apply: 1.6 gpf for toilets; 1.0 gpf for urinals*	*No individual maximums specified, except requires WaterSense products where available.* *Mandatory to reduce aggregate water consumption by at least 20% from calculated "baseline"*	HET: 1.28g	HET: 1.28g
Residential toilets – TANK TYPE **(gallons per flush)**	HET: 1.28g + WaterSense	HET: 1.28g + WaterSense	HET: 1.28g + WaterSense			HET: 1.28g + WaterSense	HET: 1.28g + WaterSense
Commercial toilets – "public" setting and NON-REMOTE **(gallons/flush)**	HET: 1.28g Tank-type must comply with WaterSense	HET: 1.28g Tank-type must comply with WaterSense	HET: 1.28g			HET: 1.28g	HET: 1.28g
Commercial toilets "public" setting and REMOTE[10] **(gallons/flush)**			1.6g[2]			1.6g[2]	1.6g[11]
Flushing urinals (gallons per flush)	HEU: 0.5g + WaterSense	HEU: 0.5g + WaterSense	HEU: 0.5g + WaterSense			HEU: 0.5g + WaterSense	HEU: 0.5g + WaterSense
Non-water urinals	Permitted	Permitted	Permitted; requires upstream discharges to drain from other fixtures or fittings			Permitted; requires upstream discharges to drain from other fixtures or fittings	

[10] 'Remote' definition: toilet is located 30 feet or more upstream of other drainline connections or fixtures AND where that connection is served by less than 1.5 drainage fixture units.

[11] 1.6 g permitted only when toilet location meets code definition of 'remote'.

For these reasons, energy efficiency and water efficiency must be handled differently in codes and standards. While flexibility is typically provided for energy efficiency, clearer mandates are needed to achieve desired water efficiency outcomes.

Finally, we must recognize that every one of these indoor high-efficiency water fixtures saves energy. The amount of energy it takes to extract, treat, and move water to the building is very significant, not to mention any energy costs incurred by the building owner in additional booster pump and heating costs to raise it several stories or degrees for use. A 2005 report[12] estimated that approximately 13 percent of the country's energy use was water-related. The amount of energy resources in water varies with the region and with the nature of the energy and water resources portfolio. In California, for example, 19 percent of the state's electrical energy output goes to providing water for its population.[13]

Use of Alternate Water Sources

Some may contend there is no need to limit water use if alternate water sources are used, but that is an invalid assertion. Alternate sources do reduce dependence upon potable supplies, but non-potable water is no less valuable. In fact, this water is the most costly to produce, due to the additional treatment (additional energy use) and distribution required (extra infrastructure) by the water utility and the building owner. All water is inherently of high value and may ultimately be reclaimed after reaching the sanitary sewer system. Using a non-potable water source is not a justification for using more water. In fact, it's one of the best reasons for using high-efficiency fixtures and appliances.

Water from all sources needs to be used efficiently. The water efficiency community does not discriminate based upon the quality or source of the water (i.e. salt water, rainwater, graywater, etc.) and neither should regulation, codes, or building standards.

Solving the Building Type/Function Issue

Sometimes there are concerns raised regarding reduced flow fixtures in certain special applications or building types. For example, in healthcare settings, a certain type of or flow rate for a lavatory faucet might be required in a given circumstance. In most cases, the codes (plumbing and health codes) directly address these circumstances. For green specifications, the best way to consider these circumstances is to clarify that the maximum points or credits are awarded when all the locations *eligible* (or permitted) for such high-efficiency fixtures have them at the site. In this way, for example, a business center with leased suites can participate and comply, even if that facility happens to include a surgery center. This is analogous to what the codes provide.

By structuring green building standards to require water efficient options *where applicable*, the greatest savings potentials are realized while assuring no customer types are excluding from participating.

Conclusions & Recommendation

Where feasible, uniformity or a 'level playing field' for plumbing fixtures is essential within each of the green codes and standards related to building projects. Such uniformity is not necessarily feasible in the provisions related to outdoor installations, due largely to climate and other differences across the country. For example, the uniform provisions may not necessarily be feasible for landscape irrigation,

[12] River Network (2009) The Carbon Footprint of Water, http://www.rivernetwork.org/resource-library/carbon-footprint-water
[13] 2005 California Energy Commission's Integrated Energy Policy Report, http://www.energy.ca.gov/2005_energypolicy

heating and cooling systems, and vegetated roofs. On the other hand, indoor provisions for plumbing fixtures can be uniformly applied throughout the U.S., since the indoor conditions and user demands are largely the same everywhere for new buildings. As such, AWE urges jurisdictions and standards developers to implement uniform plumbing water efficiency provisions within their codes and standards for the following reasons:

- Points are not 'earned' by a building design merely for meeting the minimum code requirements of a state or local jurisdiction.
- Compliance with green provisions can be readily compared against the same yardstick across the entire U.S.
- Manufacturers, distributors, and others are not required to produce multiple product models to accommodate the requirements of different jurisdictions and standards.
- Users and owners benefit from the superior performance of high-efficiency fixture models.

Furthermore…

- Unlike energy, water is not consumed. Whereas there may be multiple ways to light a building, there is only one way to flush waste.
- All water is valuable regardless of the source and ultimately is "borrowed, not owned". Reducing sanitary fixture water use makes sense.
- By developing standards where high-efficiency fixtures are required wherever they are *permitted* within a given facility, consistency with code requirements is guaranteed and the opportunities are granted to all customer classes to choose compliance with the specification.

Therefore, we recommend that green rating systems and green ANSI standards under development today incorporate U.S. EPA WaterSense specifications as a minimum requirement for all covered products, including water closets (toilets), urinals, showerheads, pre-rinse spray valves, and residential lavatory faucets.

About the Alliance for Water Efficiency

The Alliance for Water Efficiency (AWE) is a broad-based non-profit organization headquartered in Chicago, Illinois. Its mission is to promote the efficient and sustainable use of water, by bringing together a diverse range of stakeholders throughout North America to advocate for water use efficiency and conservation. AWE activities include developing a comprehensive web-based clearinghouse of information, participating in standards and codes processes, developing green building recommendations for water use, working with EPA on the WaterSense® product labeling program, and conducting water efficiency training and education program. Learn more here—http://www.a4we.org.