



2019 U.S. WaterSense Market Penetration

A GMP Research Industry Report
commissioned by Plumbing Manufacturers International (PMI)



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Executive summary

This study was commissioned by Plumbing Manufacturers International (PMI) and is a follow on to the initial market penetration study completed on WaterSense market penetration in May 2015 to determine how the market has evolved.

Products captured in this study include tank-type residential toilets, bathroom sink faucets, showerheads, flushometer-valve toilets and flushing urinals.

In 2015 we identified WaterSense-certified tank-type toilets had a 7.0% market penetration. WaterSense-certified bathroom sink faucets had a 25.4% market penetration and WaterSense-certified showerheads had a 28.7% market penetration. Flushometer-valve toilets and flushing urinals were not part of the research scope in 2015.

WaterSense market penetration is defined by the total number of WaterSense-certified products installed divided by the total number of installed products of that specific product type:

$$\text{total installed WaterSense products} \div \text{total installed products} = \text{WaterSense market penetration rate in \%}$$

According to this study, WaterSense-certified tank-type toilets have a 16.8% market penetration. WaterSense-certified bathroom sink faucets have a 40.1% market penetration, and WaterSense-certified showerheads have a 45.4% market penetration. Flushometer-valve toilets and flushing urinals were introduced much later into the WaterSense program (flushing urinals in 2010 and flushometer-valve toilets in 2016) and consequently have low single digit market penetration rates.

The key driver for high WaterSense market penetration is the replacement market. Plumbing fixtures have very long replacement cycles. Residential tank-type toilets are replaced in average every 30 years. Flushometer-valve toilets and flushing urinals are replaced in average every 35.9 years. Homeowners and commercial property managers are sometimes reluctant to replace a product unless it is defective, or they are undergoing a major remodel of the bathroom.

According to the leading manufacturers of plumbing fixtures and fittings, the National Association of Home Builders (NAHB) and the International Association of Certified Home Inspectors (InterNACHI), bathroom sink faucets are replaced on average every 15 years, while showerheads are replaced every 12 years.

As bathroom sink faucets and showerheads are replaced more frequently, the market penetration of WaterSense products is higher than for plumbing fixtures such as tank-type toilets, flushometer-valve toilets or flushing urinals.

Within the next 15 years, most bathroom sink faucets and showerheads installed in the United States will be WaterSense-certified or meet the WaterSense program. Within the next 30 years, most residential tank-type toilets will be WaterSense-certified or meet the WaterSense program. Within the next 40 years, most flushometer-valve toilets and flushing urinals will be WaterSense-certified or meet the WaterSense program.

Mount Pleasant, June 2019

About Plumbing Manufacturers International (PMI)

Plumbing Manufacturers International (PMI) is the trade association of plumbing product manufacturers that produce more than 90 percent of the United States' plumbing products, represent more than 150 iconic brands, and develop safe, reliable and innovative water-efficient plumbing technologies. PMI members contribute more than 464,000 jobs and \$85.5 billion in economic impact to America's economy.

With a vision of safe, responsible plumbing – always, PMI advocates for plumbing product performance contributing to water efficiency and savings, sustainability, public health and safety, consumer satisfaction, and a clean environment. PMI members manufacture water-efficient toilets, urinals, faucets, showerheads and other products at more than 70 locations across the country and market them online and in home improvement stores, hardware stores and showrooms in all 50 states. PMI member products include potable water supply system components, plumbing fixtures and fittings, flushing devices, sanitary drainage system components, and plumbing appliances.

PMI provides early warning notice on critical industry issues, serves as an educational forum for collecting and exchanging industry information, and works to enhance the plumbing manufacturing industry's growth and expansion. In addition, PMI serves as a coordinating and decision-making body for dealing with industry issues. PMI works closely with government agencies at all levels – federal, state and local – and is active in many industry arenas. PMI staff members sit on a variety of key industry committees, helping to develop and maintain codes and standards.

For more information on PMI, contact the organization at:

Plumbing Manufacturers International

1750 Tysons Blvd., Ste. 1500

McLean, Va., 22102

Phone: [847-481-5500](tel:847-481-5500)

www.safeplumbing.org

About GMP Research

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GMP Research works with a network of affiliated partners throughout the world. Our clients are the leaders of their industry and are at the forefront of technology and design.

Our mission is to supply our clients with the best market intelligence. We go to great lengths to research the subject matter at hand, and then spend an equal amount of time validating the data, to ensure our clients are receiving the best possible market intelligence.

For more information on GMP Research Inc, contact the company at

GMP Research Inc.

2999 River Vista Way

Mount Pleasant, SC 29466

Phone: 843-884-9567

www.gmpresearch.com



Why do a market penetration study for WaterSense products?

Water is a finite resource – even though about 70 percent of the Earth’s surface is covered by water, less than 1 percent is available for human use. Despite the water supply and infrastructure challenges faced by many communities across the U.S., each American uses an average of 88 gallons of water each day at home. Water managers in at least 40 states expect local, statewide, or regional water shortages to occur over the next several years.

The average family spends more than \$1,000 per year in water costs but can save more than \$380 annually from retrofitting with WaterSense-labeled fixtures and Energy Star-certified appliances.

A first study on WaterSense market penetration was completed in May 2015. For consistency purposes, we have used the same methodology to examine how the market has evolved.

What is WaterSense?

WaterSense is a voluntary partnership program sponsored by the U.S. Environmental Protection Agency (EPA). It is both a label for qualified water-efficient products and a resource to help homeowners and business owners save water.

The WaterSense label makes it easy to find water-efficient products, water-efficient homes and programs that meet the EPA’s criteria for efficiency and performance. WaterSense products and services are certified to use at least 20 percent less water, save energy, and perform as well as or better than non-WaterSense products.

The WaterSense website states they partner with manufacturers, retailers, distributors, homebuilders, irrigation professionals and utilities to bring WaterSense products to the market.

The following comments were taken from the WaterSense website and give an understanding of the importance of the WaterSense program:

- Bathrooms are the largest use of water in the home, using more than 50 percent of all indoor water.
- Approximately 5 to 10 percent of U.S. homes have easy-to-fix leaks that drip away 90 gallons a day or more.
- Residential outdoor water usage across the U.S. accounts for nearly 9 billion gallons of water each day, mainly for landscape irrigation.
- On average, a urinal in a public place gets flushed 18 times per day.
- Heating water is typically the second largest use of energy in a home (after space heating and cooling).

What are the benefits of WaterSense?

According to WaterSense, the average family can save 13,000 gallons of water and \$130 in water costs per year by replacing all old, inefficient toilets in their home with WaterSense-labeled models.

If all U.S. households replaced their inefficient toilets, this would represent water savings of approximately 520 billion gallons of water – roughly the amount of water that flows over Niagara Falls in about 12 days.

Replacing old, inefficient bathroom faucets and aerators with WaterSense-labeled models can save the average family \$250 in water and electricity costs over the faucets' lifetime.

Replacing showerheads with WaterSense-labeled models can reduce the average family's water and electricity costs by \$70 and can save the average family more than 2,700 gallons of water per year, equal to the amount of water needed to wash 88 loads of laundry.

Replacing inefficient flushometer-valve toilets and flushing urinals would result in water savings of more than \$500 million annually.

The U.S. Census Bureau reports there are 137.4 million homes and 11.8 million commercial non-residential facilities in the United States. If every home and commercial non-residential facility were equipped with WaterSense products, we would see an annual water savings of \$ 26.445 billion.

WaterSense action	Total annual savings in billion U.S. \$
Replacing inefficient residential tank-type toilets	\$19.236 billion
Replacing inefficient bathroom sink faucets	\$ 1.300 billion
Replacing inefficient residential showerheads	\$ 5.400 billion
Replacing inefficient flushing urinals and flushometer-valve toilets	\$ 0.509 billion
Total annual savings	\$26.445 billion

Source: U.S. Environmental Protection Agency, U.S. Census, GMP Research estimates

When was WaterSense launched? Which plumbing products are included?

WaterSense was launched in June 2006. Products included in the WaterSense program are residential toilets, bathroom faucets and accessories, showerheads, flushing urinals, flushometer-valve toilets and landscaping irrigation products.

Tank-type high efficiency toilets

WaterSense released its initial Tank-Type High-Efficiency Toilet Specification in January 2007 and issued the first revision to the specification in May 2011. Since that time, the American Society of Mechanical Engineers (ASME) and Canadian Standards Association (CSA) have revised ASME A112.19.2/CSA B45.1 Ceramic Plumbing Fixtures to include the waste media extraction test, fill valve integrity test, and tank trim adjustability test protocols established in the WaterSense Specification for Tank-Type Toilets.



The WaterSense specification establishes a maximum effective flush requiring 1.28 gallons per flush (GPF) or less for all residential toilets.

- Single flush toilets must use 1.28 GPF or less
- Dual flush toilets must have an effective flush volume that does not exceed 1.28 GPF which is the average flush volume of two reduced flushes and one full flush

Bathroom sink faucets and accessories

WaterSense-labeled bathroom sink faucets and accessories use a maximum of 1.5 gallons per minute. WaterSense-labeled bathroom sink faucets and accessories were introduced in 2007.



Showerheads

Water-saving showerheads that earn the WaterSense label must demonstrate that they use no more than 2.0 GPM. The WaterSense label also ensures that these products provide a satisfactory shower that is equal to or better than with conventional showerheads on the market. WaterSense-certified products were introduced in 2010.



Flushing urinals

WaterSense-labeled flushing urinals use no more than 0.5 GPF and comply with existing standards for flushing urinals. To ensure adequate performance, urinals must also be independently certified to ensure that they flush effectively and have properly functioning drain traps before they can earn the WaterSense label. WaterSense-certified urinals were introduced in 2010.

Flushometer-valve toilets

WaterSense-labeled flushometer-valve toilets, whether single- or dual-flush, use no more than 1.28 GPF, which is a 20 percent savings over the federal standard of 1.6 GPF. WaterSense has also included a minimum flush volume of 1.0 GPF to ensure plumbing systems have adequate flow to function effectively. WaterSense-certified flushometer-valve toilets were introduced in 2016.

A full list of WaterSense-labeled products can be found at <https://www.epa.gov/watersense/product-search>.



Research methodology

During the months of May and June 2019, GMP Research reviewed the penetration rate of residential and commercial WaterSense-certified products among the installed base of bathroom fixtures in homes and non-residential commercial properties in the United States.

According to the U.S. Census Bureau, there are 137.4 million existing homes and 11.8 million commercial non-residential facilities in the United States. We reviewed the number of homes by state and examined when they were constructed. For the commercial non-residential facilities, we examined the number of hotels and motels, office buildings, retail and wholesale operations, health care facilities, day care centers, schools, universities, churches and places of worship, public safety facilities, leisure and entertainment facilities, airports and other passenger terminals, communication facilities, and manufacturing facilities.

We reviewed OSHA regulations to determine the number of commercial toilets and urinals installed per commercial property.

To determine the number of installed residential tank-type toilets, bathroom sink faucets and showerheads, we first examined how many bathrooms the average U.S. home has. We reviewed the characteristics of new housing completed provided by the U.S. Census.

The Census Bureau provides data on homes with 1-1/2 baths or less, 2 baths, 2-1/2 baths and 3 baths or more. We supplemented this information by reviewing home descriptions of 1.135 million single family and 0.271 million multi-family homes currently for sale in all price ranges on Zillow.com and sorted the homes by the number of bathrooms (1, 1-1/2, 2, 3, 4, 5, 6 and 7 or more bathrooms).

In a next step, we reviewed home floorplans to determine the average number of toilets, bathroom sink faucets and showerheads per bathroom.

We reviewed when federal legislation was enacted, determining when low flow and WaterSense products became available. For each product examined, we reviewed the WaterSense accomplishment scorecard (https://www.epa.gov/sites/production/files/2018-06/documents/ws-aboutus-2017-accomplishments_0.pdf), which gave an indication of the number of certified products that were available in a given year.

We worked closely with John Koeller of Koeller & Company of Yorba Linda, CA, to review our assumptions and to ensure they were in line with general industry views. John Koeller is a registered professional engineer with extensive experience in water-efficient technologies and products. Widely recognized as a water efficiency specialist, Koeller is a consultant to numerous water providers, green-building organizations, and private-sector firms. He is co-developer of Maximum Performance (MaP) testing for toilet fixtures (www.map-testing.com).

We interviewed the leading suppliers of plumbing fixtures and fittings and reviewed the websites of various plumbing manufacturers, wholesalers and retailers to determine the level of WaterSense-certified products available for purchase.

PMI provided us with a summary of current U.S. Plumbing Provisions by state/municipality. This list highlighted the effective date when these plumbing provisions went into effect and which products were covered. We used this information to determine when WaterSense products were required in these municipalities/states and to calculate the market penetration in these areas.

Every year GMP Research publishes the U.S. Kitchen + Bath Industry report. This is a detailed industry report card on the kitchen + bath industry, which provides market information by plumbing fixture and fitting. We referred to these studies to determine how many of the tank-type toilets, bathroom sink faucets, showerheads, flushometer-valve toilets and flushing urinals were sold during the investigation period.

This led to a detailed assessment of the market penetration of WaterSense-certified products installed in each of the 50 U.S. states and cumulatively in the United States. While the study is based on certain product life expectancy assumptions, GMP Research interviewed several of the leading plumbing fixture and fittings manufacturers, and reviewed guidelines published by the National Association of Home Builders and International Association of Certified Home Inspectors (InterNACHI) to get as accurate a read as possible of the type of plumbing fixtures and fittings that are installed in the United States.

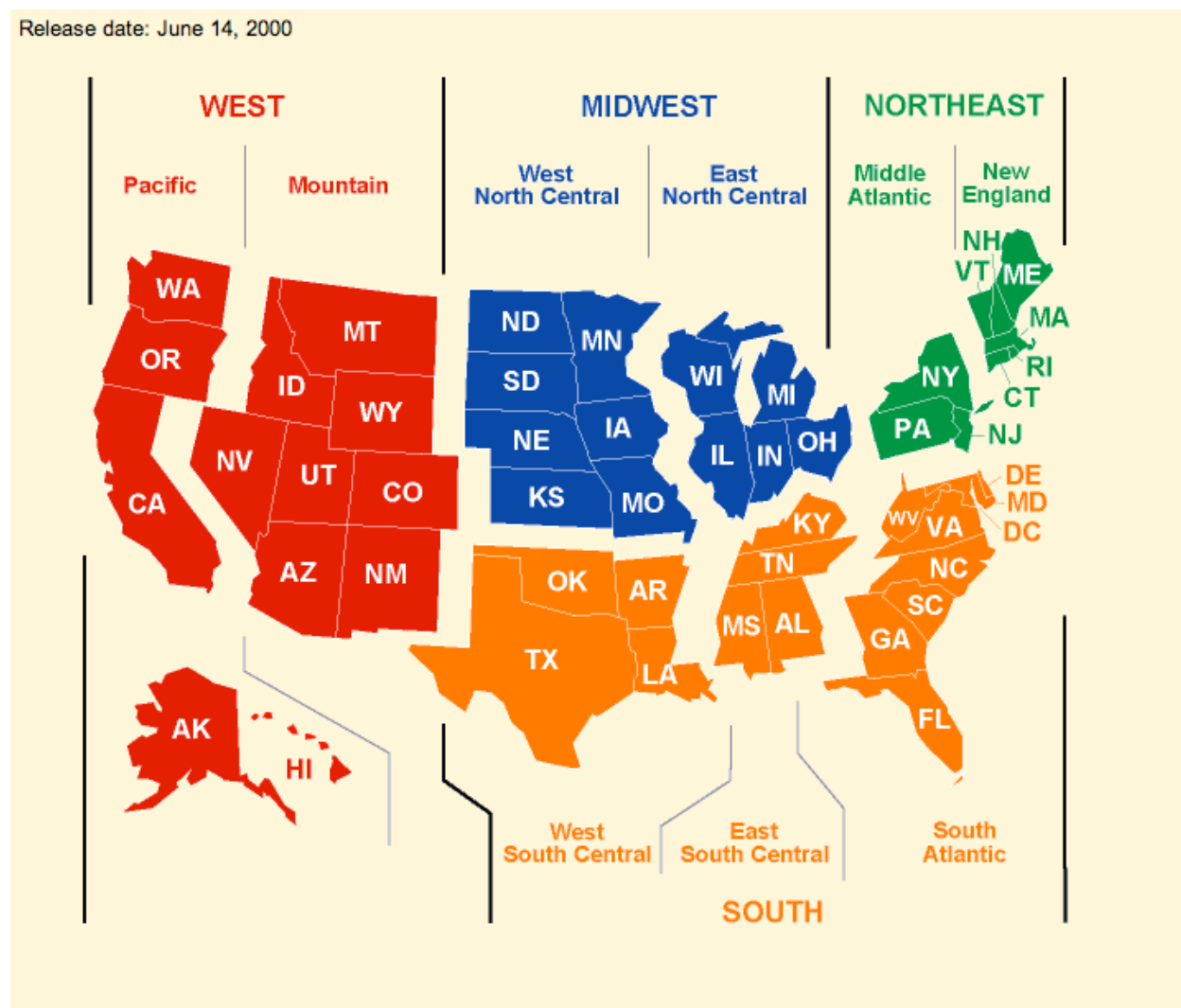
It is important to note that we define WaterSense market penetration as a percentage of all installed products.

- The market penetration rate of WaterSense tank-type high efficiency toilets is therefore the number of WaterSense-certified tank-type toilets installed divided by the total number of tank-type residential toilets in the United States (regardless of flushing criteria).
- The market penetration rate of WaterSense bathroom sink faucets is the number of WaterSense-certified bathroom sink faucets installed divided by the total number of installed bathroom sink faucets.
- The market penetration rate of WaterSense showerheads is the number of WaterSense-certified showerheads installed divided by the total number of installed showerheads.
- The market penetration rate of WaterSense flushometer-valve toilets is the number of WaterSense-certified flushometer-valve toilets installed divided by the total number of installed flushometer-valve toilets.
- The market penetration rate of WaterSense flushing urinals is the number of WaterSense-certified flushing urinals installed divided by the total number of installed urinals.

U.S. Census regions

The U.S. Census Bureau segments the country into nine U.S. Census regions. We followed this approach to determine the regional market penetration of WaterSense products:

Release date: June 14, 2000



Source: U.S. Census Bureau

Residential WaterSense products

To determine the market penetration of residential WaterSense products, we first need to determine the installed base of the target residential products. This is achieved by examining the number of existing homes in the United States. Next, we need to determine how many bathrooms per home exist to identify the number of toilets, bathroom sink faucets and showerheads per bathroom are installed.

- a) The U.S. Census provides information on the characteristics of homes completed from 1973 to present for both single family and multi-family homes. Based on the U.S. Census data, we completed an analysis of the number of bathrooms per completed home for every year from 1973 to present.

For single family homes, census data was available for 1-1/2 or less bathrooms, 2 bathrooms, 2-1/2 bathrooms and 3 bathrooms or more. For multi-family homes, Census data was available for 1 bathroom, 1-1/2 bathrooms and 2 or more bathrooms.

To get a finer estimate of the number of bathrooms per home, we examined the characteristics of 1.135 million single family homes and 0.271 million multi-family homes in all nine U.S. Census regions currently for sale by number of bathrooms, number of rooms and price point. We used this information to fine tune the 1 and 1-1/2 bathroom category and the 3+ bathroom category for single family homes and for 2+ bathrooms for multi-family homes.

- b) In a third step, we calculated the number of toilets, bathroom sink faucets and showerheads per single family and multi-family homes to arrive at the total installed base of products in the U.S.
- c) U.S. Census provided housing starts per state by housing type from 1939 to present.
- d) For residential tank-type toilets, we assumed a replacement cycle of 30 years. For bathroom sink faucets we assumed a replacement cycle of 15 years. For showerheads we assumed a replacement cycle of 12 years. This is based on data from the NAHB/Bank of America Study of Life Expectancy of Home Components, InterNACHI's standard estimated life expectancy for homes and input from manufacturers.

a) Existing homes in the U.S. by number of bathrooms per home

	Existing homes with one bathroom	Existing homes with 1-1/2 bathrooms	Existing homes with two or 2-1/2 bathrooms	Existing homes with three bathrooms	Existing homes with four bathrooms	Existing homes with five bathrooms	Existing homes with six bathrooms	Existing homes with more than 6 bathrooms	Average
Single family homes	27.1%	11.8%	35.0%	5.9%	6.3%	5.8%	4.6%	3.5%	2.5 bathroom per home
Multi-family homes	47.0%	10.1%	9.5%	9.4%	9.2%	8.2%	3.8%	2.8%	2.3 bathrooms per home

Source: U.S. Census Bureau Characteristics of New Homes Completed 1973-present, GMP Research analysis of 1.135 million and 0.271 million multi-family homes currently for sale in the United States, 2019 U.S. Kitchen + Bath Industry Report, 2018 GMP Research study on the RV and mobile home market

b) Average number of toilets, bathroom sink faucets and showerheads per bathroom

	Average number of toilets per bathroom	Average number of sink faucets per bathroom	Average number of showerheads per bathroom
Products per bathroom	1.0	1.46	0.93




Source: U.S. Census Bureau Characteristics of New Homes Completed 1973-present, GMP Research analysis of 1.135 million single family and 0.271 million multi-family homes currently for sale in the United States, 2019 U.S. Kitchen + Bath Industry Report, 2018 GMP Research study on the RV and mobile home market

c) Total existing homes, bathrooms, installed toilets, bathroom sink faucets and showerheads

	Total number of existing homes	Number of bathrooms	Number of installed toilets	Number of installed bathroom sink faucets	Number of installed showerheads
	Million units	Million units	Million units	Million units	Million units
Single family homes	92.790	231.975	231.975	338.684	215.737
Multi-family homes	44.617	102.619	102.619	149.824	95.436
Total installed base	137.407	334.594	334.594	488.508	311.173







Source: U.S. Census Bureau Characteristics of New Homes Completed 1973-present, GMP Research analysis of 1.135 million and 0.271 million multi-family homes currently for sale in the United States, 2019 U.S. Kitchen + Bath Industry Report, 2018 GMP Research study on the RV and mobile home market

d) 2019 U.S. existing home inventory by type of home, U.S. Census region and by state

Census region	State	Total existing homes								
			Single Family	Duplex	3 or 4 units	5 to 9 units	10 to 19 units	20 or more units	Mobile home	Boat, RV, Van
USA	USA	137,407,308	92,789,782	4,914,617	5,990,555	6,424,836	6,065,580	12,593,793	8,500,432	127,713
New England	CT	1,517,495	983,758	119,504	132,115	80,228	52,840	137,718	11,234	98
	MA	2,894,590	1,660,911	287,664	315,792	168,362	120,201	316,227	24,452	981
	ME	742,644	542,841	32,540	40,354	26,866	11,598	26,704	61,456	285
	NH	634,689	442,805	33,034	36,650	28,110	17,695	44,853	31,123	419
	RI	468,266	272,371	54,576	56,054	21,729	18,432	39,961	4,905	238
	VT	335,248	232,849	21,447	19,952	17,496	6,538	13,981	22,664	321
Middle Atlantic	NJ	3,615,891	2,286,170	338,282	238,440	168,054	168,772	383,252	32,601	320
	NY	8,327,621	3,917,640	848,967	574,232	430,141	351,697	2,009,212	193,493	2,239
	PA	5,694,402	4,303,251	248,439	225,305	180,953	147,157	358,682	228,843	1,772
South Atlantic	DC	314,843	116,774	9,412	19,932	22,674	26,974	118,528	485	64
	DE	432,853	321,466	7,605	9,450	16,309	26,927	19,603	31,086	407
	FL	9,441,585	5,728,688	197,887	374,130	460,321	534,477	1,291,572	841,439	13,071
	GA	4,282,254	3,021,894	91,124	127,997	198,552	190,908	272,298	376,636	2,845
	MD	2,449,123	1,781,539	35,560	51,684	130,110	192,247	220,923	36,318	742
	NC	4,622,656	3,220,365	92,756	130,588	188,327	191,787	207,588	587,857	3,388
	SC	2,284,820	1,497,253	43,463	70,377	96,995	75,961	122,507	375,996	2,268
	VA	3,512,917	2,549,764	53,602	95,855	170,365	198,295	262,067	181,909	1,060
	WV	892,240	646,833	19,699	26,410	25,517	14,678	24,427	134,178	498
	AL	2,258,669	1,565,024	51,442	67,368	97,107	78,662	90,580	305,749	2,737
East South Central	KY	1,984,235	1,383,423	66,135	87,231	83,807	65,932	64,115	231,981	1,611
	MS	1,323,754	921,423	32,196	39,698	52,464	34,988	32,060	209,273	1,652
	TN	2,958,799	2,109,694	81,170	95,049	141,497	120,188	135,829	272,708	2,664
	AR	1,370,109	977,060	40,078	45,766	48,876	53,308	35,708	167,714	1,599
West South Central	LA	2,061,582	1,400,672	85,737	84,349	65,886	57,253	94,150	271,171	2,364
	OK	1,734,074	1,293,394	33,753	45,371	66,271	60,510	66,093	165,848	2,834
	TX	10,933,375	7,394,305	206,625	348,816	519,410	689,692	959,301	795,075	20,151
	IL	5,359,416	3,463,847	302,686	347,719	338,175	200,939	572,846	131,258	1,946
East North Central	IN	2,885,342	2,215,331	73,367	99,374	128,198	104,851	126,752	136,756	713
	MI	4,595,274	3,536,356	107,770	118,485	196,420	159,995	236,214	238,789	1,245
	OH	5,201,701	3,798,575	220,911	229,039	245,072	208,027	297,891	200,183	2,003
	WI	2,695,303	1,905,393	169,684	103,038	131,333	95,580	198,445	90,931	899
West North Central	IA	1,397,739	1,087,859	31,487	45,907	48,117	53,936	79,499	50,464	470
	KS	1,273,776	986,121	32,095	46,613	48,115	44,136	61,014	55,117	565
	MN	2,437,726	1,812,073	49,496	52,937	55,051	87,233	300,890	79,269	777
	MO	2,792,445	2,060,417	94,730	129,174	102,717	100,843	132,051	169,846	2,667
	ND	374,591	233,619	8,479	14,168	12,934	22,447	55,564	27,234	146
	NE	837,540	641,008	15,989	23,176	36,108	36,827	58,170	26,010	252
	SD	392,650	277,941	7,996	14,128	16,224	17,571	25,889	32,717	184
	AZ	2,999,185	2,085,747	39,482	98,192	121,005	130,585	210,979	300,378	12,817
Mountain	CO	2,385,495	1,671,624	42,249	73,355	111,073	132,664	258,111	94,905	1,514
	ID	721,818	559,580	14,993	30,957	18,485	15,151	28,190	53,556	906
	MT	510,408	375,062	14,132	21,386	16,036	11,130	17,092	54,696	874
	NM	937,976	629,008	17,641	36,862	27,601	23,044	37,827	163,897	2,096
	NV	1,249,733	806,457	14,674	80,171	108,726	62,385	112,210	63,237	1,873
	UT	1,084,685	808,706	29,814	50,477	38,457	44,083	75,530	36,944	674
	WY	276,733	196,004	6,724	11,115	10,050	6,765	7,173	38,674	228
Pacific	AK	316,968	223,887	17,076	22,198	13,478	9,002	15,917	14,685	725
	CA	14,177,270	9,210,270	342,567	770,463	844,841	735,724	1,738,818	519,658	14,929
	HI	542,955	336,324	10,568	21,532	36,860	29,323	106,799	1,099	450
	OR	1,768,582	1,211,751	46,578	77,305	75,894	66,943	149,903	135,265	4,943
	WA	3,103,263	2,084,655	70,732	113,819	137,439	158,679	342,080	188,670	7,189

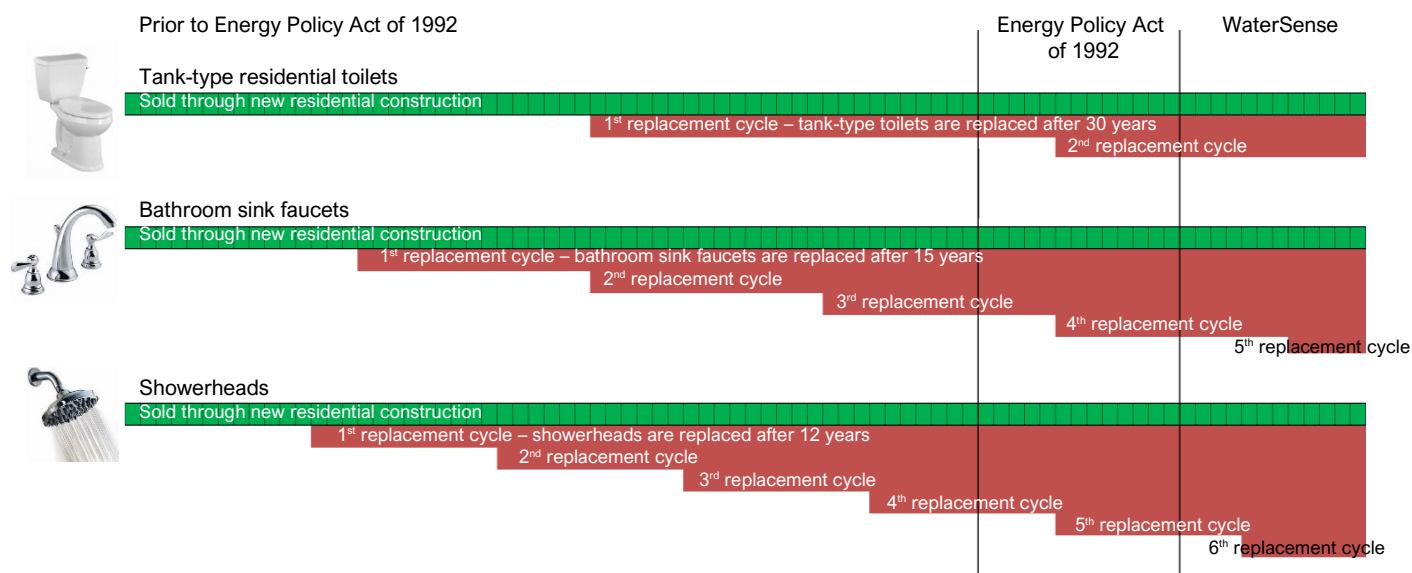
Source: U.S. Census Bureau

Total installed residential plumbing products by state and region

U.S. Census Region	State	Total existing homes						
			Existing single family homes	Existing multi-family homes	Total existing bathrooms	Total installed residential toilets	Total installed bathroom sink faucets	Total installed showerheads
USA	USA	137,407,308	92,789,782	44,617,526	334,594,765	334,576,763	488,508,357	311,173,131
New England	CT	1,517,495	983,758	533,737	3,686,990	3,686,623	5,383,006	3,428,901
	MA	2,894,590	1,660,911	1,233,679	6,989,739	6,989,043	10,205,019	6,500,457
	ME	742,644	542,841	199,803	1,816,649	1,816,468	2,652,308	1,689,484
	NH	634,689	442,805	191,884	1,548,346	1,548,192	2,260,585	1,439,962
	RI	468,266	272,371	195,895	1,131,486	1,131,373	1,651,970	1,052,282
Middle Atlantic	VT	335,248	232,849	102,399	817,640	817,559	1,193,755	760,405
	NJ	3,615,891	2,286,170	1,329,721	8,773,783	8,772,946	12,809,724	8,159,618
	NY	8,327,621	3,917,640	4,409,981	19,937,056	19,935,156	29,108,102	18,541,462
	PA	5,694,402	4,303,251	1,391,151	13,957,775	13,956,444	20,378,351	12,980,731
South Atlantic	DC	314,843	116,774	198,069	747,494	747,404	1,091,341	695,169
	DE	432,853	321,466	111,387	1,059,855	1,059,766	1,547,388	985,665
	FL	9,441,585	5,728,688	3,712,897	22,861,383	22,859,451	33,377,619	21,261,086
	GA	4,282,254	3,021,894	1,260,360	10,453,563	10,452,680	15,262,202	9,721,814
	MD	2,449,123	1,781,539	667,584	5,989,291	5,988,785	8,744,364	5,670,040
	NC	4,622,656	3,220,365	1,402,291	11,276,182	11,275,229	16,463,225	10,486,849
	SC	2,284,820	1,497,253	787,567	5,554,537	5,554,067	8,109,623	5,165,719
	VA	3,512,917	2,549,764	963,153	8,589,662	8,588,936	12,540,906	7,988,386
	WV	892,240	646,833	245,407	2,181,519	2,181,334	3,185,017	2,028,812
	AL	2,258,669	1,565,024	693,645	5,507,944	5,507,785	8,041,598	5,122,387
East South Central	KY	1,984,235	1,383,423	600,812	4,840,425	4,840,286	7,067,021	4,501,595
	MS	1,323,754	921,423	402,331	3,228,919	3,228,826	4,714,221	3,002,894
	TN	2,958,799	2,109,694	849,105	7,227,177	7,226,969	10,551,678	6,721,274
West South Central	AR	1,370,109	977,060	393,049	3,346,663	3,346,570	4,886,128	3,112,396
	LA	2,061,582	1,400,672	660,910	5,021,773	5,021,634	7,331,789	4,670,249
	OK	1,734,074	1,293,394	440,680	4,247,049	4,246,931	6,200,692	3,949,756
East North Central	TX	10,933,375	7,394,305	3,539,070	26,625,624	26,624,887	38,873,410	24,761,830
	IL	5,359,416	3,463,847	1,895,569	13,019,426	13,018,986	19,008,362	12,108,066
	IN	2,885,342	2,215,331	670,011	7,079,353	7,079,114	10,335,855	6,583,798
	MI	4,595,274	3,536,356	1,058,918	11,276,401	11,276,020	16,463,546	10,487,053
	OH	5,201,701	3,798,575	1,403,126	12,723,627	12,723,197	18,576,496	11,832,973
West North Central	WI	2,695,303	1,905,393	789,910	6,580,276	6,580,054	9,607,202	6,119,656
	IA	1,397,739	1,087,859	309,880	3,432,372	3,432,268	5,011,262	3,192,105
	KS	1,273,776	986,121	287,655	3,126,909	3,126,815	4,565,287	2,908,025
	MN	2,437,726	1,812,073	625,653	5,969,184	5,969,004	8,715,009	5,551,341
	MO	2,792,445	2,060,417	732,028	6,834,707	6,834,500	9,978,672	6,356,277
	ND	374,591	233,619	140,972	908,283	908,256	1,326,093	844,703
	NE	837,540	641,008	196,532	2,054,544	2,054,482	2,999,634	1,910,726
Mountain	SD	392,650	277,941	114,709	958,683	958,654	1,399,677	891,575
	AZ	2,999,185	2,085,747	913,438	7,315,275	7,315,087	10,680,301	6,803,206
	CO	2,385,495	1,671,624	713,871	5,820,963	5,820,814	8,498,606	5,413,496
	ID	721,818	559,580	162,238	1,772,097	1,772,052	2,587,262	1,648,051
	MT	510,408	375,062	135,346	1,248,951	1,248,919	1,823,468	1,161,524
	NM	937,976	629,008	308,968	2,283,146	2,283,087	3,333,394	2,123,326
	NV	1,249,733	806,457	443,276	3,035,677	3,035,600	4,432,089	2,823,180
	UT	1,084,685	808,706	275,979	2,656,517	2,656,448	3,878,514	2,470,561
	WY	276,733	196,004	80,729	675,687	675,670	986,503	628,389
Pacific	AK	316,968	223,887	93,081	773,804	773,776	1,129,754	719,638
	CA	14,177,270	9,210,270	4,967,000	34,449,775	34,448,513	50,296,672	32,038,291
	HI	542,955	336,324	206,631	1,316,061	1,316,012	1,921,449	1,223,937
	OR	1,768,582	1,211,751	556,831	4,310,089	4,309,931	6,292,730	4,008,383
	WA	3,103,263	2,084,655	1,018,608	7,554,436	7,554,160	11,029,476	7,025,625

Source: U.S. Census Bureau + GMP Research field input

Estimated replacement cycles for tank-type toilets, bathroom sink faucets and showerheads



Source: NAHB/Bank of America Study of Life Expectancy of Home Components, InterNACHI's standard estimated life expectancy for homes and from input from manufacturers of toilets, faucets and showerheads, Koeller & Company, GMP Research interviews with leading plumbing manufacturers.

To determine the average replacement cycle of the examined plumbing fixtures and fittings, we spoke with the manufacturers of the products and reviewed product replacement studies completed by the National Association of Home Builders (NAHB) and the International Association of Certified Home Inspectors (InterNACHI):

- A residential tank-type toilet has an average life expectancy of 30 years
- Bathroom sink faucets have an average life expectancy of 15 years
- Showerheads have an average life expectancy of 12 years

By 2018, the homeowner of a house built in 1939 will have experienced two replacement cycles for the toilets based on the life expectancy of the product (1st replacement in 1969; 2nd replacement in 1999).

The same homeowner would have experienced five replacement cycles for the bathroom sink faucets (1954, 1969, 1984, 1999, and 2014).

The homeowner would have experienced six replacement cycles for the showerheads (1951, 1963, 1975, 1987, 1999, and 2011).

Note: Several of the utilities offering rebates for water conserving toilets refer to a 25 year replacement cycle for residential tank-type toilets. In the 2015 market penetration study, based on input from the leading manufacturers, we used a 30 year replacement cycle for residential tank-type toilets. For consistency purposes, and to better evaluate how the market has evolved, we have chosen to use a 30-year replacement cycle for tank-type toilets. If a 25 year replacement cycle were used, this would marginally increase the market penetration of WaterSense products.

Determining the market penetration of WaterSense products

According to the EPA WaterSense website, WaterSense-labeled tank-type residential toilets and bathroom sink faucets were introduced to the market in 2007. WaterSense-labeled showerheads were introduced in 2010.

Tank-type residential toilets



Toilets are by far the main source of water use in the home, accounting for nearly 30 percent of an average home's indoor water consumption.

Recent advancements have allowed toilets to use 1.28 gallons per flush or less while still providing equal or superior performance. This is 20 percent less water than the current federal standard of 1.6 gallons per flush. The WaterSense label is used on toilets that are independently certified to meet rigorous criteria for both performance and efficiency. Only water-saving toilets that complete the certification process can earn the WaterSense label.

GMP Research estimates there are currently 334.577 million residential toilets installed in the 137.407 million homes in the United States, assuming there is one toilet installed in every residential bathroom.

During the period of 2007-2018, a total of 118.126 million toilets were sold, or roughly 10.1 million toilets per year. These toilets are sold into the new residential construction market, hospitality (hotel/motel) market, and to homeowners who are replacing older toilets in their homes.

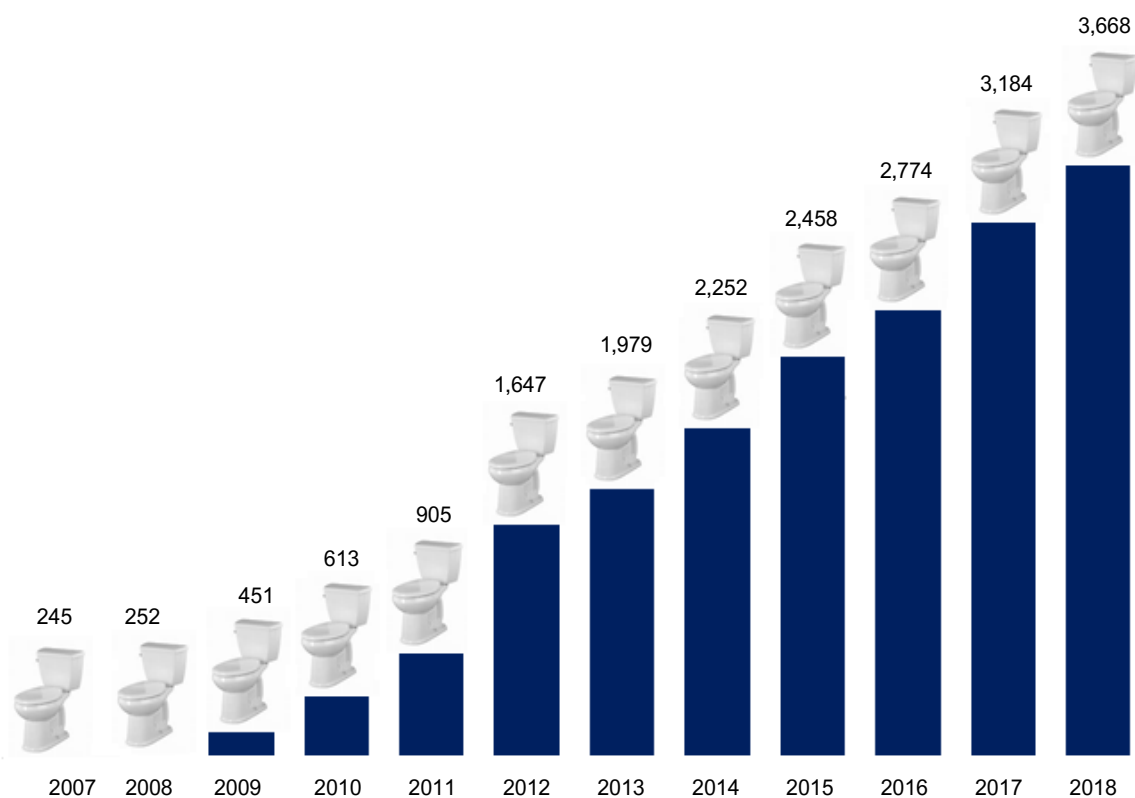
Toilets used in guest rooms of hotels are considered residential toilets and are included in these calculations. Toilets used in public restrooms are considered commercial toilets and are not included in these market estimates.

Availability of WaterSense-certified toilets

Based on information from the U.S. Environmental Protection Agency, from John Koeller & Company, from Gauley Associates, and from the manufacturers of residential toilets, we see the following availability of certified WaterSense toilets since inception of the WaterSense program.

The leading suppliers of residential tank-type toilets indicated that in 2007 roughly 25% of the toilets for sale were WaterSense-certified. At the end of 2018, roughly 75% of the tank-type toilets offered for sale were WaterSense-certified (76.8%). A list of the WaterSense-certified tank-type toilets can be found at <https://www.epa.gov/watersense/product-search>.

Number of certified WaterSense toilet models available for purchase



Source: <https://www.epa.gov/watersense/accomplishments-and-history>

Assumptions to determine the market penetration of WaterSense-certified tank-type toilets


- There is one toilet installed per residential bathroom
- Residential tank-type toilets are replaced every 30 years
- All toilets installed prior to 1992 used 3.5 gallons or more per flush. Toilets installed from 1992 to 2007 used 1.6 gallons per flush. By January 1, 1994, all replacement residential toilets installed needed to comply with the energy Policy Act of 1992. By January 1, 1997, all newly installed commercial toilets needed to comply with the Energy Policy Act.
- WaterSense-certified toilets were introduced to the marketplace in 2007. In 2007, 25% of the toilets offered for sale were WaterSense-certified or met the WaterSense specification. In 2018, 76.8% of the toilets offered for sale were WaterSense-certified or met the WaterSense specification.
- Municipalities/states requiring toilets of 1.28 gpf or less are listed below:

State/County/Municipality	Effective date	Maximum allowed flushing performance in gallons per flush	Applies to new construction only	Applies to new construction and replacement
Miami-Dade County, FL	1/1/2009	1.28 gpf	•	
State of Georgia	7/1/2012	1.28 gpf		•
Broward County, FL	6/1/2012	1.28 gpf	•	
New York City, NY	7/1/2012	1.28 gpf		•
State of Texas	1/1/2014	1.28 gpf		•
Greater Chicago, IL	11/18/2014	1.28 gpf	•	
Washington, DC	3/28/2014	1.28 gpf	•	
State of California	1/1/2014	1.28 gpf		•
State of Colorado	9/1/2016	1.28 gpf		•
Scottsdale, AZ	1/1/2017	1.28 gpf	•	
State of Oregon	10/1/2017	1.28 gpf	•	
State of New York – except NYC	10/31/2017	1.3 gpf	•	

Source: PMI summary of current U.S. Plumbing Provisions

WaterSense-certified tank-type toilet market penetration

According to our research, there are 334.577 million residential toilets installed in the United States. During 2007-2018, a total of 118.126 million tank-type toilets were sold and installed in homes throughout the United States. Based on our research, 56.212 million WaterSense toilets or those which met the WaterSense specification of not flushing more than 1.28 gallons per flush were sold. This represents 16.8% of all residential toilet installations.

Maximum flushing performance	Million installed residential tank-type toilets	% of total
1.28 gpf or less 	56.212	16.8%
1.6 gpf	216.137	64.6%
3.5 gpf	52.893	15.8%
5.0 gpf or more	9.335	2.8%
Million installed residential tank-type toilets	334.577	100.0%

Source: U.S. Census + GMP Research field interviews + PMI summary of current U.S. plumbing provisions



U.S. Census Region	State	Total number of toilets installed in all homes	Total WaterSense toilets installed	WaterSense market penetration	1.6 gpf in % of total	3.5 gpf or more in % of total
USA	USA	334,773,222	56,212,198	16.8%	65.5%	17.7%
New England	CT	3,700,911	573,388	15.5%	68.0%	16.5%
	MA	7,049,856	920,293	13.1%	75.3%	11.6%
	ME	1,824,379	240,678	13.2%	69.0%	17.8%
	NH	1,553,166	254,652	16.4%	59.8%	23.8%
	RI	1,143,837	147,719	12.9%	68.5%	18.6%
	VT	819,797	107,369	13.1%	69.0%	17.9%
Middle Atlantic	NJ	8,800,251	1,430,861	16.3%	64.5%	19.2%
	NY ¹	20,190,580	3,412,900	16.9%	64.5%	18.6%
	PA	13,922,069	1,858,144	13.3%	68.5%	18.2%
South Atlantic	DC ²	754,981	110,906	14.7%	65.6%	19.7%
	DE	1,061,712	179,839	16.9%	66.1%	17.0%
	FL ³	22,879,484	4,067,787	17.8%	63.5%	18.7%
	GA ⁴	10,471,896	2,565,135	24.5%	57.0%	18.5%
	MD	5,984,197	944,112	15.8%	68.0%	16.2%
	NC	11,312,937	1,793,494	15.9%	67.0%	17.1%
	SC	5,602,712	909,938	16.2%	68.7%	15.1%
	VA	8,595,719	1,378,147	16.0%	66.8%	17.2%
	WV	2,182,412	286,478	13.1%	67.0%	19.9%
East South Central	AL	5,516,352	813,836	14.8%	64.8%	20.4%
	KY	4,837,302	663,756	13.7%	66.2%	20.1%
	MS	3,235,295	444,824	13.7%	66.7%	19.6%
	TN	7,218,671	1,120,737	15.5%	64.0%	20.5%
West South Central	AR	3,337,407	477,601	14.3%	67.0%	18.7%
	LA	5,036,969	764,690	15.2%	64.7%	20.1%
	OK	4,232,638	636,309	15.0%	64.4%	20.6%
	TX ⁵	26,522,714	6,840,050	25.8%	55.0%	19.2%
East North Central	IL ⁶	13,038,956	1,702,057	13.1%	68.0%	18.9%
	IN	7,049,271	907,545	12.9%	67.6%	19.5%
	MI	11,232,329	1,565,477	13.9%	66.5%	19.6%
	OH	12,672,646	1,650,419	13.0%	68.4%	18.6%
	WI	6,653,833	781,988	11.8%	69.0%	19.2%
West North Central	IA	3,407,892	406,973	11.9%	68.5%	19.6%
	KS	3,103,341	450,515	14.5%	66.0%	19.5%
	MN	5,947,901	855,702	14.4%	66.0%	19.6%
	MO	6,810,447	946,240	13.9%	66.2%	19.9%
	ND	904,764	154,395	17.1%	62.0%	20.9%
	NE	2,043,721	260,763	12.8%	68.1%	19.1%
	SD	956,147	135,268	14.1%	66.1%	19.8%
Mountain	AZ ⁷	7,335,651	1,222,328	16.7%	64.1%	19.2%
	CO ⁸	5,812,107	1,116,440	19.2%	62.0%	18.8%
	ID	1,772,191	261,527	14.8%	65.6%	19.6%
	MT	1,240,092	183,019	14.8%	65.0%	20.2%
	NV	3,043,633	371,557	12.2%	68.2%	19.6%
	NM	2,299,329	448,158	19.5%	57.1%	23.4%
	UT	2,653,861	438,544	16.5%	63.4%	20.1%
	WY	677,699	100,866	14.9%	61.5%	23.6%
Pacific	AK	765,908	127,109	16.6%	62.5%	20.9%
	CA ⁹	34,403,742	7,212,207	21.0%	62.1%	16.9%
	HI	1,311,809	192,952	14.7%	66.1%	19.2%
	OR ¹⁰	4,303,036	612,085	14.2%	66.8%	19.0%
	WA	7,544,672	1,164,421	15.4%	64.5%	20.1%

Notes	State / county	Effective	Construction application
1	New York New York City	10/31/2017 7/1/2012	New construction All sales
2	Washington DC	3/28/2014	New construction
3	Miami-Dade, FL Broward County, FL	1/1/2009 6/1/2012	New construction New construction
4	Georgia	7/1/2012	All sales
5	Texas	1/1/2014	All sales

Notes	State/county	Effective	Construction application
6	Chicago, IL	11/18/2014	New construction
7	Scottsdale, AZ	1/1/2017	New construction
8	Colorado	9/1/2016	All sales
9	California	1/1/2014	All sales
10	Oregon	10/1/2017	New construction

Observations concerning WaterSense tank-type toilet market penetration

WaterSense was introduced to the marketplace in June 2006. The first series of products were introduced in 2007.

By August 2006, the construction boom had noticeably cooled in all regions of the United States. At the end of 2006, more than 1.25 million homes were in foreclosure. One in 92 homes in the United States were in some stage of foreclosure.

Realtytrac.com – a wholly owned subsidiary of Attom Data Solutions LLC - is the leading authority on reporting foreclosure market information in the United States. In February 2007, more than 25 sub-prime lenders declared bankruptcy or put themselves up for sale. By August 2007, many mortgage lenders stopped offering home equity loans. By the end of 2007, a total of 2.2 million foreclosures were filed on 1.3 million properties, with more than 1% of all households in the U.S. in some stage of foreclosure.

The National Association of Realtors announced 2007 had the largest drop in existing home sales over the last 25 years. According to senior research economists, the collapse of the subprime mortgage market set in motion a chain reaction of economic and financial adversity and created depression-like conditions in the housing market.

Dropping valuations of mortgage backed securities caused by the skyrocketing default and foreclosure rates forced margin calls by the largest Wall Street banks. Rumors of major bank failings caused worldwide fear of a total financial collapse.

The Great Recession began in December 2007 and lasted until June 2009, making it the longest recession since World War II. According to senior economic and policy advisors of the Federal Reserve Bank, real gross domestic product (GDP) fell 4.3 percent from its peak in Q4 2007 to its trough in Q2 2009. The U.S. Bureau of Labor Statistics reported the unemployment rate, which was 5 percent in December 2007, rose to 9.5 percent in June 2009, and peaked at 10 percent in October 2009.

According to data from the U.S. Census Bureau, home prices fell approximately 30 percent, on average, from their mid-2006 peak to mid-2009. The Federal Reserve Bank indicated the S&P 500 index fell 57 percent from its October 2007 peak to its trough in March 2009. The net worth of U.S. households and nonprofit organizations fell from a peak of approximately \$69 trillion in 2007 to a trough of \$55 trillion in 2009.

Because of the financial turmoil impacting everything, homeowners were putting off the purchases of new homes and delaying any type of remodeling project, unless it was essential. In addition, consumers were cautious about the new high efficiency toilets, and did not believe these products would perform as proclaimed by the manufacturers.

As a result of these extraneous effects, our research indicates WaterSense products gained little initial traction in the marketplace. By the end of 2014, our analysis indicated 7% of the installed tank-type toilets were WaterSense-certified or complied with the WaterSense specification.

At that time, we wrote WaterSense market penetration will increase over time, as new construction continues to expand, and more homeowners were again investing in remodeling activities.

At the end of 2014, the manufacturers of tank-type toilets indicated 30% of toilets offered for sale were WaterSense-certified or met the WaterSense specification. By the end of 2018 they indicated 76.8% of the toilets offered for sale were WaterSense-certified.

Over the last 10 years, both new residential construction and residential remodeling expenditures have been expanding year over year. By 2018 remodeling accounted for 80% of all tank-type toilets while 20% were sold into new residential and light commercial construction.

Based on the proven performance of the new 1.28 gpf toilets, builders and consumers have embraced the technology. With over 3,668 models of WaterSense-certified toilets to choose from, the market penetration of these toilets was inevitably going to increase.

WaterSense-certified tank-type toilets will continue to gain market share over an extended period. With an average replacement cycle of 30 years, we can safely project WaterSense tank-type toilets will have a significant market share within the next 30 years.

Focus needs to be on motivating the homeowners to swap out their existing toilets. Consumers are reluctant to replace toilets. They perceive it as a cumbersome and messy task, that requires the services of a plumber. They are only interested in replacing a toilet if it is broken or is not working properly or because they do not like the style of the toilet.

Bathroom sink faucets



WaterSense-labeled bathroom sink faucets and accessories that use a maximum of 1.5 gallons per minute can reduce a sink's water flow by 30 percent or more from the standard flow of 2.2 gallons per minute without sacrificing performance. We could save billions of gallons nationwide each year by retrofitting bathroom sink faucets with models that have earned the WaterSense label.

All products bearing the WaterSense label complete an independent certification process to ensure they meet EPA criteria. Bathroom sink faucets and faucet accessories—products that can be attached easily to existing bathroom sink faucets to save water—that obtain the WaterSense label have demonstrated both water efficiency and the ability to provide ample flow.

According to the WaterSense website, replacing old, inefficient bathroom sink faucets and aerators with WaterSense-labeled models can save the average family 700 gallons of water per year, equal to the amount of water needed to take 40 showers. As these water savings reduce demands on water heaters, households will also save enough energy to run a hairdryer 10 minutes a day for a year.

GMP Research estimates there are 488.508 million residential bathroom sink faucets installed in the United States, assuming there are 1.46 bathroom sink faucets per residential bathroom. In addition to the existing stock, approximately 22 million new bathroom sink faucets are sold every year into the new residential and light commercial construction market and to homeowners who are replacing existing older bathroom sink faucets.

Bathroom sink faucets sold into the guest rooms of hotels are considered residential faucets and are included in these calculations. Faucets used in public restrooms are considered commercial faucets and are excluded from this exercise.

All bathroom sink faucets installed prior to 1992 had flow rates in excess of 2.2 gallons per minute (gpm). All bathroom sink faucets installed from 1992-2006 had flow rates of 2.2 gallons per minute, as stipulated by the Energy Policy Act of 1992.

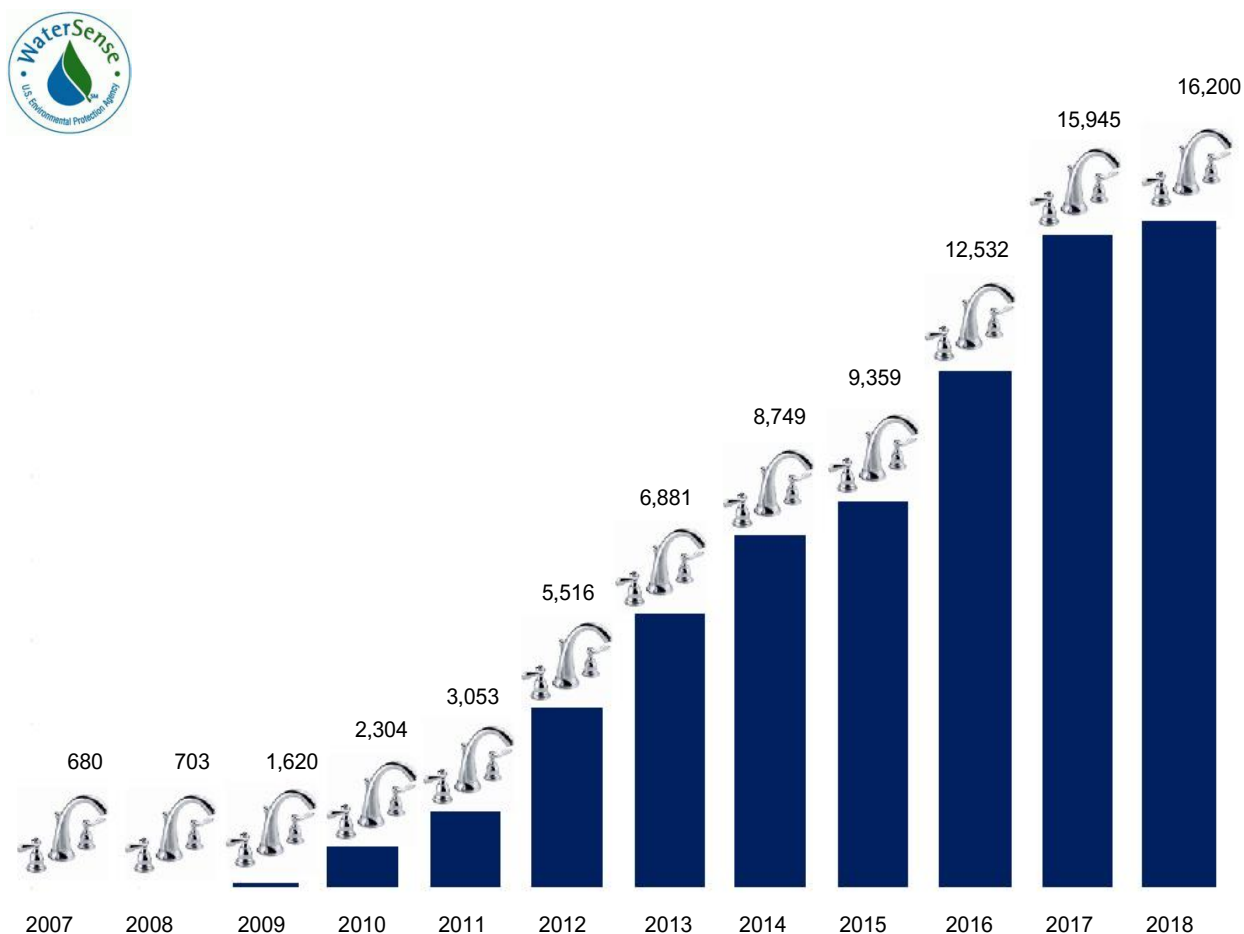
WaterSense bathroom sink faucets were introduced to the marketplace in 2007. From 2007-2018, a total of 242.5 million bathroom sink faucets were sold in the United States. Of these 242.5 million bathroom sink faucets, 195.672 million were WaterSense-certified or met the WaterSense specification.

Availability of WaterSense-certified bathroom sink faucets

Based on information from the U.S. Environmental Protection Agency, and from the manufacturers of bathroom sink faucets, the following illustrates the availability of certified WaterSense bathroom sink faucets since inception of the WaterSense program.

In 2015, the manufacturers indicated 98% of the bathroom sink faucets were either WaterSense-certified or met the requirements of the WaterSense specification. At the end of 2018, according to input from the manufacturers, 99.0% of the bathroom sink faucets for sale were either WaterSense-certified or met the requirements of the WaterSense program. A list of WaterSense-certified bathroom sink faucets can be found at <https://www.epa.gov/watersense/product-search>.

Number of certified WaterSense bathroom sink faucet models available for purchase



Source: <https://www.epa.gov/watersense/accomplishments-and-history>

Assumptions to determine the market penetration of WaterSense bathroom sink faucets


- There are 1.46 bathroom sink faucets installed per residential bathroom
- Residential bathroom sink faucets are replaced every 15 years
- All bathroom sink faucets installed prior to 1992 had flow rates in excess of 2.2 gallons per minute (gpm). All bathroom sink faucets installed from 1992-2006 had flow rates of 2.2 gallons per minute, as stipulated by the Energy Policy Act of 1992
- WaterSense-certified bathroom sink faucets were introduced to the marketplace in 2007
- In 2007, 25% of the bathroom sink faucets offered for sale were WaterSense-certified or met the requirements of the WaterSense specification. In 2018, 99% of the bathroom sink faucets offered for sale were WaterSense-certified or met the requirements of the WaterSense specification
- Municipalities/states requiring faucets with flow rates of 1.5 gpm or less listed below:

State/County/Municipality	Effective date	Maximum allowed flow performance in gallons per minute	Applies to new construction only	Applies to new construction and replacement
Miami-Dade County, FL	1/1/2009	1.5 gpm	•	
State of Georgia	7/1/2012	1.5 gpm		•
Broward County, FL	6/1/2012	1.5 gpm	•	
New York City, NY	7/1/2012	1.5 gpm		•
Greater Chicago, IL	11/18/2014	1.5 gpm	•	
Washington, DC	3/28/2014	1.5 gpm	•	
State of California	1/1/2016	Product manufactured on or after 9/1/2015 to 7/1/2016 was 1.5 gpm and after 7/1/2016 is 1.2 gpm		•
State of Colorado	9/1/2016	1.5 gpm		•
Scottsdale, AZ	1/1/2017	1.5 gpm	•	
State of New York – except NYC	10/31/2017	1.5 gpm	•	

Source: PMI summary of Current U.S. Plumbing Provisions

WaterSense-certified bathroom sink faucet market penetration

- According to our research, there are 488.508 million residential bathroom sink faucets installed in the United States
- During 2007-2018, a total of 242.5 million residential bathroom sink faucets were sold and installed in homes throughout the United States
- Of the 242.5 million bathroom sink faucets, 195.672 million were WaterSense-certified or met the WaterSense program:

Maximum flow performance in gallons per minute	Million installed bathroom sink faucets	% of total
1.5 gpm or less 	195.672	40.1%
2.2 gpm or more	292.836	59.9%
Million installed bathroom sink faucets	488.508	100.0%

Source: U.S. Census + GMP Research field interviews + PMI summary of current U.S. plumbing provisions



Census Region	State	Total number of bathroom sink faucets installed	Total WaterSense bathroom sink faucets installed	WaterSense market penetration	2.2 gallons per minute or more
USA	USA	488.508	195.672	40.1%	59.9%
New England	CT	5.383	1.189	22.09%	77.9%
	MA	10.205	2.770	27.14%	72.9%
	ME	2.652	0.996	37.55%	62.4%
	NH	2.261	0.848	37.51%	62.5%
	RI	1.652	0.376	22.76%	77.2%
	VT	1.194	0.298	24.96%	75.0%
Middle Atlantic	NJ	12.810	3.746	29.24%	70.8%
	NY ¹	29.108	7.772	26.70%	73.3%
	PA	20.378	5.397	26.48%	73.5%
South Atlantic	DC ²	1.091	0.285	26.11%	73.9%
	DE	1.547	0.679	43.88%	56.1%
	FL ³	33.378	17.846	53.47%	46.5%
	GA ⁴	15.262	8.214	53.82%	46.2%
	MD	8.744	2.824	32.30%	67.7%
	NC	16.463	7.759	47.13%	52.9%
	SC	8.110	3.920	48.34%	51.7%
	VA	12.541	5.133	40.93%	59.1%
	WV	3.185	0.846	26.56%	73.4%
East South Central	AL	8.042	3.151	39.18%	60.8%
	KY	7.067	2.395	33.89%	66.1%
	MS	4.714	1.811	38.42%	61.6%
	TN	10.552	4.005	37.95%	62.0%
West South Central	AR	4.886	1.969	40.30%	59.7%
	LA	7.332	2.840	38.74%	61.3%
	OK	6.201	2.247	36.23%	63.8%
	TX	38.873	18.840	48.47%	51.5%
East North Central	IL ⁵	19.008	5.690	29.93%	70.1%
	IN	10.336	3.438	33.26%	66.7%
	MI	16.464	4.496	27.31%	72.7%
	OH	18.576	5.164	27.80%	72.2%
	WI	9.607	3.469	36.11%	63.9%
West North Central	IA	5.011	1.628	32.49%	67.5%
	KS	4.565	1.420	31.10%	68.9%
	MN	8.715	3.268	37.50%	62.5%
	MO	9.979	3.579	35.87%	64.1%
	ND	1.326	0.566	42.68%	57.3%
	NE	3.000	1.014	33.80%	66.2%
	SD	1.400	0.634	45.30%	54.7%
Mountain	AZ ⁶	10.680	6.144	57.53%	42.5%
	CO ⁷	8.499	4.666	54.90%	45.1%
	ID	2.587	0.454	17.56%	82.4%
	MT	1.823	0.845	46.35%	53.6%
	NM	3.333	0.596	13.45%	86.6%
	NV	4.432	1.500	44.99%	55.0%
	UT	3.879	1.707	44.00%	56.0%
	WY	0.987	0.394	39.94%	60.1%
Pacific	AK	1.130	0.368	32.57%	67.4%
	CA ⁸	50.297	26.195	52.08%	47.9%
	HI	1.921	0.789	41.06%	58.9%
	OR	6.293	2.673	42.48%	57.5%
	WA	11.029	6.821	61.84%	38.2%

Notes	State / county	Effective	Construction application
1	New York New York City	10/31/2017 7/1/2012	New construction All sales
2	Washington DC	3/28/2014	New construction
3	Miami-Dade, FL Broward County, FL	1/1/2019 6/1/2012	New construction New construction
4	Georgia	7/1/2012	All sales

Notes	State/county	Effective	Construction application
5	Chicago, IL	11/18/2014	New construction
6	Scottsdale, AZ	1/1/2017	New construction
7	Colorado	9/1/2016	All sales
8	California	1/1/2016	All sales

Observations concerning WaterSense bathroom sink faucet market penetration

Bathroom sink faucets are replaced much more often than tank-type toilets. Consumers do not perceive a bathroom sink faucet replacement to be cumbersome or messy. While they may engage a plumber to do the replacement, more often they will either do it themselves (DIY) or hire a handyman to swap out the faucet.

Swapping out an aerator to achieve a higher water efficiency is a very easy and affordable task. A quick search at www.homedepot.com revealed 98.5% of the aerators cost less than \$20, with 70% costing less than \$10.

Swapping out the existing aerator for a water efficient aerator is the most cost effective way to significantly boost the water savings of the bathroom sink faucet.

According to input from the manufacturers, by the end of 2018, almost all the faucets for sale are either WaterSense-certified or meet the WaterSense specification (99% of all bathroom sink faucets are either WaterSense or meet the WaterSense specification).

When a homeowner replaces an existing bathroom sink faucet, they will, with 99% certainty, be replacing it with a WaterSense-certified bathroom sink faucet, or one that meets the WaterSense specification.

When a builder installs bathroom sink faucets into new homes being built, with a 99% certainty, these products will be WaterSense-certified, or will meet the WaterSense specification.

During the last study conducted in May of 2015, we identified that 25.4% of the installed bathroom sink faucets were WaterSense-certified or met the WaterSense specification. At that time, manufacturers had indicated 98% of all bathroom sink faucets available for purchase were WaterSense-certified or met the WaterSense specification.

In the last WaterSense market penetration study, we stated the market penetration of the bathroom sink faucets would steadily increase due to the high availability of the products, new home construction demand and homeowners replacing their current bathroom sink faucets as they reached their typical end of life.

And that is exactly what we are seeing in this study.

The market penetration nationwide of WaterSense bathroom sink faucets grew from 25.4% to 40.1%. As the products are replaced every 15 years, we can safely state, within the next 15 years, WaterSense will enjoy a much higher overall market penetration than we are seeing today.

59.9% of the bathroom sink faucets are still using 2.2 gallons per minute or more. To increase the water efficiency, focus needs to be on getting the homeowner to replace the existing water guzzling faucets, or at a minimum to replace the current aerator with one that meets the WaterSense program.



Showerheads

Showering is one of the leading uses of water inside the home, representing approximately 17 percent of annual residential indoor water use in the United States. This translates into more than 1.2 trillion gallons of water consumed each year.

The WaterSense program released its final specification for showerheads on March 4, 2010 to further improve upon the nation's water and energy efficiency by raising consumer awareness and promoting the use of more efficient showerheads.

There are 137.4 million existing homes in the United States. To determine the average number of bathrooms per home, we reviewed 1.135 million single family and 0.271 million multi-family homes listed on Zillow.com. Based on this analysis, we have seen the average single family home has 2.5 bathrooms and the average multi-family home has 2.3 bathrooms per dwelling, resulting in 334.594 million bathrooms.

Not every bathroom has a shower. Guest bathrooms typically have a toilet and a washbasin, while full bathrooms are equipped with a toilet, 1 or 2 bathroom sinks, a tub or a shower enclosure. In some cases, there is both a tub and a separate shower enclosure.

Bathtubs – unless it is a freestanding soaker tub or whirlpool bath - are frequently equipped with a tub/shower mixer, allowing the homeowner to use the fixture for bathing and for showering. Based on our analysis of homes, we estimate there are 311.173 million showering environments in the United States – each equipped with 1 showerhead.

Total existing homes, bathrooms, installed toilets, lavatory faucets and showerheads

Type of home	Total number of existing homes million units	Number of bathrooms million units	Number of installed toilets million units	Number of installed sink faucets million units	Number of installed showerheads million units
Single family homes	92.790	231.975	231.975	338.684	215.737
Multi-family homes	44.617	102.619	102.619	149.824	95.436
Total installed base	137.407	334.594	334.594	488.508	311.173

Source: U.S. Census Bureau Characteristics of New Homes Completed 1973-present, GMP Research analysis of 1.135 million single family and 0.271 million multi-family homes currently for sale in the United States, 2019 U.S. Kitchen + Bath Industry Report, 2018 GMP Research study on the RV and mobile home market

Showerheads are frequently replaced by the homeowner. This can be because of mineral deposit buildup causing clogs or reducing water pressure. It can be because the showerhead has become defective and is either rusty or is leaking. It can also be the homeowner wishes to replace an older showerhead because it does not match newer bathroom décor – especially after a remodel. And it can be because homeowners realize their showerhead is inefficient and replacing it can lower their water utility costs.

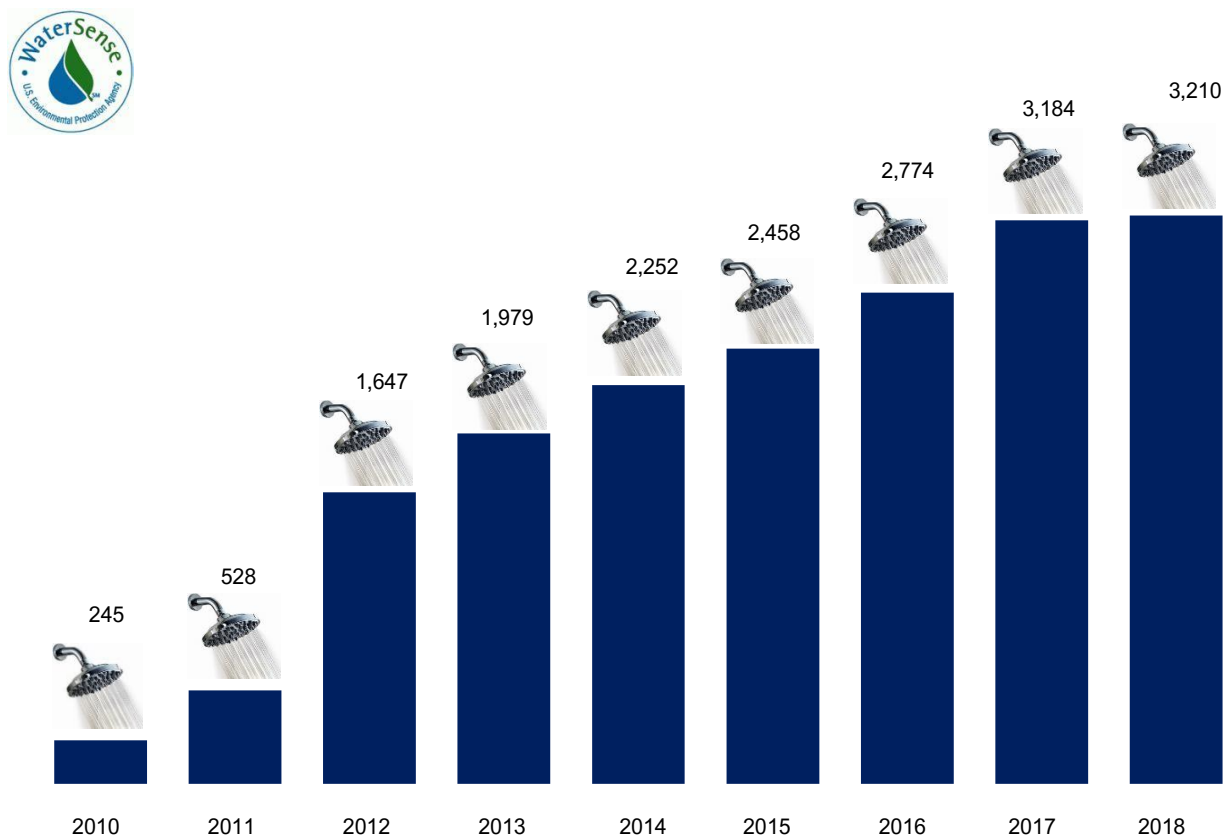
Based on input from manufacturers, we believe a showerhead is replaced in average every 12 years.

Availability of WaterSense-certified showerheads

Based on information from the U.S. Environmental Protection Agency, and from the manufacturers of showerheads, we see the following availability of certified WaterSense showerheads since inception of the WaterSense program.

In 2015, the manufacturers indicated 60% of the showerheads were either WaterSense-certified or met the requirements of the WaterSense specification. At the end of 2018, according to input from the manufacturers, 67.5% of the showerheads were either WaterSense-certified or met the requirements of the WaterSense program. A list of WaterSense-certified showerheads can be found at <https://www.epa.gov/watersense/product-search>.

Number of certified WaterSense showerhead models available for purchase



Source: <https://www.epa.gov/watersense/accomplishments-and-history>

Assumptions to determine the market penetration of WaterSense-certified showerheads


- There are 0.93 showerheads installed per residential bathroom
- Residential showerheads are replaced every 12 years
- All showerheads installed prior to 1992 had flow rates in excess of 2.5 gallons per minute (gpm). All showerheads installed from 1992-2006 had flow rates of 2.5 gallons per minute, as stipulated by the Energy Policy Act of 1992
- WaterSense-certified showerheads were introduced to the marketplace in 2010
- In 2010, 40% of the showerheads offered for sale were WaterSense-certified or met the requirements of the WaterSense specification. In 2018, 67.5% of the showerheads offered for sale were WaterSense-certified or met the requirements of the WaterSense specification.
- Municipalities/states requiring showerheads with flow rates of 2.0 gpm or less listed below:

State/County/Municipality	Effective date	Maximum allowed flow performance in gallons per minute	Applies to new construction only	Applies to new construction and replacement
Miami-Dade County, FL	1/1/2009	1.5 gpm or WS certified	•	
Broward County, FL	6/1/2012	2.0 gpm	•	
New York City, NY	7/1/2012	2.0 gpm		•
Greater Chicago, IL	11/18/2014	2.0 gpm	•	
Washington, DC	3/28/2014	2.0 gpm	•	
State of California	1/1/2016	Product manufactured on or after 7/1/2016 to 7/1/2018 was 2.0 gpm and after 7/1/2018 is 1.8 gpm	•	
State of Colorado	9/1/2016	2.0 gpm		•
Scottsdale, AZ	1/1/2017	2.0 gpm	•	
State of Oregon	10/1/2017	2.0 gpm	•	
State of New York – except NYC	10/31/2017	2.0 gpm	•	

Source: PMI summary of current U.S. Plumbing Provisions

WaterSense-certified showerhead market penetration

- According to our research, there are 311.173 million residential showerheads installed in the USA
- During 2010-2018, a total of 141.136 million showerheads were sold, which were either WaterSense-certified or met the WaterSense specification

Maximum flow performance In gallons per minute	Million installed showerheads	% of total
2.0 gpm or less 	141.136	45.4%
2.5 gpm or more	170.037	54.6%
Million installed residential showerheads	311.173	100.0%

Source: U.S. Census + GMP Research field interviews + PMI summary of current U.S. plumbing provisions



Census Region	State	Total number of showerheads installed	Total WaterSense showerheads installed	WaterSense market penetration	2.5 gallons per minute or more
USA	USA	311.173	141.136	45.36%	54.6%
New England	CT	3.429	0.789	23.00%	77.0%
	MA	6.500	1.940	29.85%	70.2%
	ME	1.689	0.720	42.60%	57.4%
	NH	1.440	0.615	42.70%	57.3%
	RI	1.052	0.253	24.04%	76.0%
	VT	0.760	0.209	27.50%	72.5%
Middle Atlantic	NJ	8.160	2.709	33.20%	66.8%
	NY ¹	18.541	5.618	30.30%	69.7%
	PA	12.981	3.764	29.00%	71.0%
South Atlantic	DC ²	0.695	0.207	29.80%	70.2%
	DE	0.986	0.484	49.10%	50.9%
	FL ³	21.261	12.884	60.60%	39.4%
	GA	9.722	5.950	61.20%	38.8%
	MD	5.570	1.981	35.56%	64.4%
	NC	10.487	5.537	52.80%	47.2%
	SC	5.166	2.746	53.15%	46.9%
	VA	7.988	3.619	45.30%	54.7%
	WV	2.029	0.590	29.10%	70.9%
East South Central	AL	5.122	2.228	43.50%	56.5%
	KY	4.502	1.702	37.80%	62.2%
	MS	3.003	1.150	38.30%	61.7%
	TN	6.721	2.890	43.00%	57.0%
West South Central	AR	3.112	1.217	39.10%	60.9%
	LA	4.670	1.959	41.95%	58.1%
	OK	3.950	1.572	39.80%	60.2%
	TX	24.762	13.594	54.90%	45.1%
East North Central	IL ⁴	12.108	4.105	33.90%	66.1%
	IN	6.584	2.410	36.60%	63.4%
	MI	10.487	3.157	30.10%	69.9%
	OH	11.833	3.616	30.56%	69.4%
	WI	6.120	2.469	40.35%	59.7%
West South Central	IA	3.192	1.117	35.00%	65.0%
	KS	2.908	1.006	34.60%	65.4%
	MN	5.551	2.348	42.30%	57.7%
	MO	6.356	2.492	39.20%	60.8%
	ND	0.845	0.403	47.70%	52.3%
	NE	1.911	0.710	37.15%	62.9%
	SD	0.892	0.453	50.80%	49.2%
Mountain	AZ ⁵	6.803	4.436	65.20%	34.8%
	CO ⁶	5.413	3.367	62.20%	37.8%
	ID	1.648	1.023	62.10%	37.9%
	MT	1.162	0.594	51.15%	48.9%
	NM	2.823	1.390	49.25%	50.8%
	NV	2.123	1.094	51.50%	48.5%
	UT	2.471	1.233	49.90%	50.1%
	WY	0.628	0.280	44.60%	55.4%
Pacific	AK	0.720	0.261	36.30%	63.7%
	CA ⁷	32.038	18.903	59.00%	41.0%
	HI	1.224	0.551	45.05%	55.0%
	OR ⁸	4.008	1.936	48.30%	51.7%
	WA	7.026	4.855	69.10%	30.9%

Notes	State / county	Effective	Construction application
1	New York New York City	10/31/2017 7/1/2012	New construction All sales
2	Washington DC	3/28/2014	New construction
3	Miami-Dade, FL Broward County, FL	1/1/2019 6/1/2012	New construction New construction
4	Chicago	11/18/2014	New construction

Notes	State/county	Effective	Construction application
5	Scottsdale, AZ	1/1/2017	New construction
6	Colorado	9/1/2016	All sales
7	California	1/1/2016	All sales
8	Oregon	10/1/2017	New construction

Observations concerning WaterSense showerhead market penetration

Showerheads are frequently replaced by the homeowner. This can be because of mineral deposit buildup causing clogs or reducing water pressure. It can be because the showerhead has become defective and is either rusty or is leaking. It can also be the homeowner wishes to replace an older showerhead because it does not match newer bathroom décor – especially after a remodel. And it can be because homeowners realize their showerhead is inefficient and replacing it can lower their water utility costs.

As WaterSense showerheads were first introduced in 2010 – 3 years after WaterSense tank-type toilets and WaterSense bathroom sink faucets - one would assume the market penetration rate for showerheads would be lower. But because the showerhead is replaced more often than both the bathroom sink faucet and the tank-type toilet, this works as an accelerating factor. As more products are swapped out, the probability increases that it is replaced with a WaterSense-certified product.

In 2015, we reported the market penetration for WaterSense showerheads stood at 28.7%. At the end of 2018, our research indicates 45.4% of the installed showerheads were WaterSense-certified or met the WaterSense specification.

We can safely assume, by 2030, most of the showerheads will be WaterSense-certified or will be products that meet the WaterSense specification.



Flushing urinals and flushometer-valve toilets

Flushing urinals and flushometer-valve toilets are installed in non-residential commercial buildings. The non-residential commercial market is not a homogeneous market. It is a compilation of multiple industries, each with their own market dynamics.

Non-residential commercial construction markets

Non-residential commercial market	Examples of buildings	2018 Market Size in Million U.S. \$
Lodging	Hotels, motels, resorts, and casinos	\$32,744
Office buildings	Single + multi-level office buildings, high rises and skyscrapers	\$74,096
Commercial	Retail and wholesale operations	\$89,225
Health care	Hospitals, clinics, physician offices, dentist offices, medical laboratories, nursing homes	\$42,186
Education	Daycares, kindergartens, primary/middle school, high schools, junior colleges, universities, vocational schools	\$96,780
Religious	Churches and other places of worship	\$3,083
Public safety	Police departments, fire stations, Coast Guard	\$9,139
Amusement + recreations	Cinemas, museums, theatres, amusement parks	\$26,863
Transportation	Airports and other types of passenger terminals	\$52,495
Communication	Telephone, internet, cell towers, data centers	\$25,390
Manufacturing	Places of production	\$68,091

Source: U.S. Census

Existing non-residential commercial inventory in the United States

Based on U.S. Census data coupled with our own research, we believe there are 11.8 million commercial facilities in the United States.

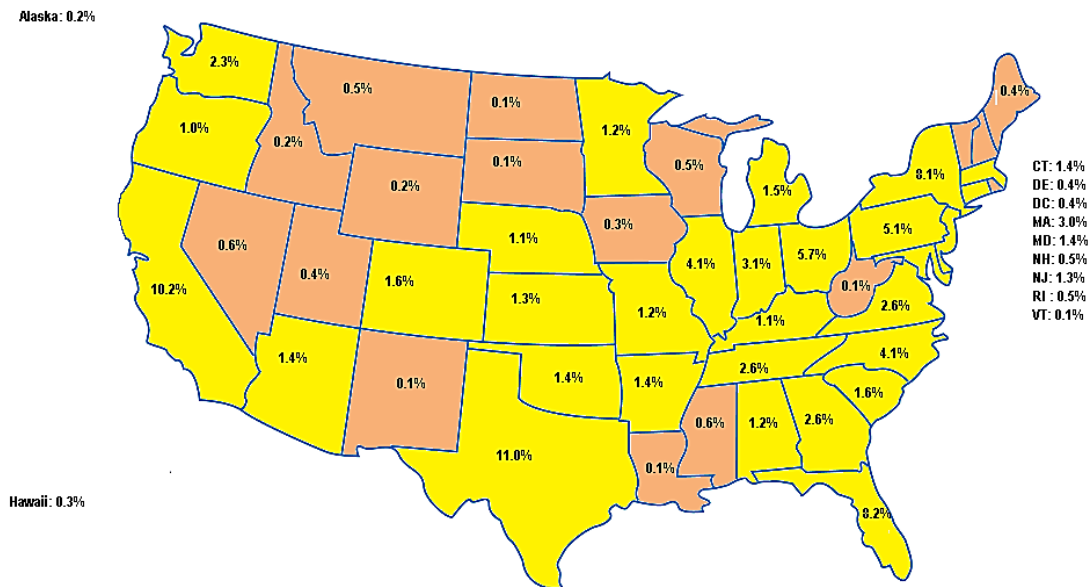
The following table gives an overview of the non-residential construction expenditures in million U.S. \$ from 2013-2018 with forecasts to 2022.

Non-residential buildings	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Lodging	13,484	16,783	21,908	26,969	28,672	32,744	31,845	30,236	30,663	31,539
Office buildings	37,979	46,582	55,521	67,616	66,850	74,096	78,307	75,606	73,980	75,867
Commercial	53,159	62,841	65,899	78,151	87,733	89,225	93,163	90,782	89,552	92,231
Health care	40,689	38,647	39,147	40,157	41,916	42,186	43,270	43,989	45,060	46,740
Education	79,060	79,681	84,771	90,348	91,213	96,780	102,640	106,057	110,801	114,994
Religious	3,590	3,386	3,577	3,721	3,366	3,083	2,975	2,837	2,853	2,931
Public safety	9,506	9,437	8,484	8,023	8,290	9,139	9,850	10,288	10,553	11,066
Amusement + recreation	15,207	16,773	20,258	23,155	24,851	26,863	27,980	27,229	25,641	26,780
Transportation	39,459	42,043	44,843	43,274	45,173	52,495	56,754	61,113	66,182	70,573
Communication	17,783	17,298	21,696	22,178	24,831	25,390	26,415	26,965	27,719	28,827
Manufacturing	50,548	58,648	79,930	76,380	66,448	68,091	72,091	70,977	68,461	70,564
Total	360,464	392,074	446,034	479,972	489,343	520,093	545,291	545,979	551,463	572,130

Source: Federal Reserve Bank of St. Louis, FMI

The U.S. non-residential commercial building floor space is estimated at 128.5 billion square feet and represents approximately 20% of the 642.5 billion global commercial floor space. In the last three years, roughly 1 billion square feet of new inventory was delivered. By 2025, we believe the U.S. commercial building floor space will increase by another 166.4 billion square feet, while the global commercial floor space will experience an increase of an additional 409.02 billion square feet.

The following map gives an overview where the commercial non-residential floor space is concentrated. States highlighted in yellow are home to at least 1% of the national commercial non-residential floor space.



Source: U.S. Bureau of Economic Analysis

Determining the number of installed flushing urinals and flushometer-valve toilets

- The number of restrooms in a workplace is a requirement that is set forth by OSHA. For 15 employees, 1 restroom room is needed. For 150 employees, six restrooms are needed. If there are more than 150 employees, then there must be one restroom for every 40 people.
- U.S. Census provides accurate figures concerning the number of commercial establishments, while the Bureau of Labor Statistics provides the total number of people employed in the various fields.
- The Commercial Buildings Energy Consumption Survey provides insight to the types of buildings, the square footage, and the number of floors.
- The Federal Aviation Authority has a detailed website covering all the public and private airports in the United States.
- The CIA World Factbook/USA provides additional information on non-residential commercial facilities.
- Using all these information sources, we put together the following table, which gives an overview of the commercial non-residential properties in the United States and an estimate of the number of commercial toilets and flushing urinals installed:

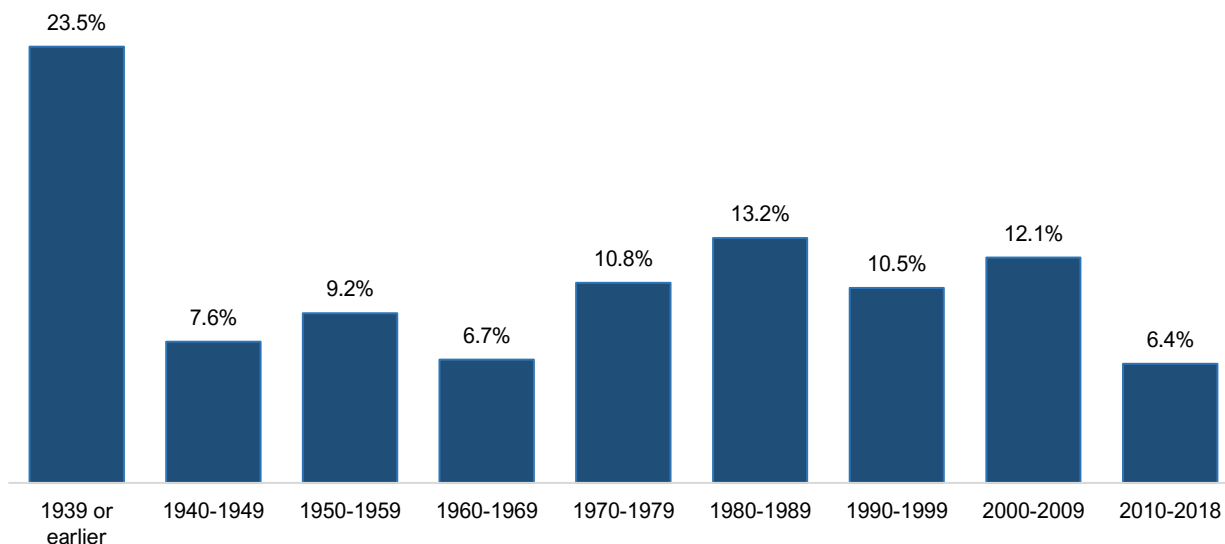
Non-residential commercial facilities and the installed base of flushing urinals and commercial toilets

Non-residential commercial facilities	Number of facilities	Number of Restrooms	Number of women's bathrooms	Number of men's bathroom	Toilets per women's bathroom	Toilets per men's bathroom	Flushing urinals per men's bathroom	Toilets installed in women's bathroom	Toilets installed in men's bathroom	Flushing urinals installed in men's bathroom
International airport	221	78	47	31	8	6	12	83,096	41,106	82,212
Major airport hub	1994	38	21	17	7	6	10	293,118	203,388	338,980
Regional airport hub	2661	6	4	3	6	5	10	57,478	39,915	79,830
Small public airport	1090	4	2	2	5	3	6	10,900	6,540	13,080
Sport stadiums	2617	17	10	7	9	6	12	235,530	109,914	219,828
Office buildings	6,100,000	5	3	2	3	2	3	54,900,000	24,400,000	36,600,000
Shopping centers	115,857	14	8	6	5	4	8	4,634,280	2,780,568	5,561,136
Gas stations	126,000	2	1	1	1	1	1	126,000	126,000	88,200
Wholesale operations	412,526	4	2	2	1	1	2	825,052	825,052	1,320,912
Retail operations	827,239	3	2.0	1.0	2	2	2	3,308,956	1,654,478	1,654,478
Educational buildings on university campus	106,000	5	3	2	3	2	3	954,000	318,000	636,000
Public or private elementary and middle schools	139,874	6	3	3	3	2	4	1,258,866	839,244	1,678,488
Public or private high schools	37,100	6	3	3	3	2	2	333,900	222,600	222,600
Junior colleges	1,013	6	3	3	3	2	2	9,117	6,078	6,078
Business/office management schools	7,783	4	2	2	2	2	1	31,132	31,132	15,566
Vocational schools	8,167	4	2	2	2	2	1	32,668	32,668	16,334
Other schools	50,886	6	3	3	3	3	1	457,974	457,974	152,658
Hospitals (community hospitals, federal hospitals, non-federal psychiatric hospitals, other hospitals)	6,210	10	5	5	5	2	3	155,250	62,100	93,150
Regulated long-term care service providers (nursing homes)	65,600	4	2	2	5	2	3	656,000	262,400	393,600
Offices of physicians, dentists, and other health practitioners	501,594	2	1	1	1	1	0	501,594	501,594	-
Outpatient care facilities	40,589	2	1	1	2	1	1	81,178	40,589	40,589
Medical and diagnostic laboratories	4,652	2	1	1	2	1	1	9,304	4,652	4,652
Home health care services	32,464	2	1	1	2	1	1	64,928	32,464	32,464
Other health care	239,410	4	2	2	2	1	1	957,640	478,820	478,820
Museums	7,655	6	3	3	5	4	1	114,825	91,860	22,965
Cinemas	40,313	4	2	2	5	4	1	403,130	322,504	80,626
Other amusement + entertainment	89,242	4	2	2	5	4	1	892,420	713,936	178,484
Hotels / Motels	54,882	4	2	2	1	1	3	109,764	109,764	164,646
Restaurants (independent, chain and fast food)	691,273	2	1	1	1	1	2	691,273	691,273	1,382,546
Drinking places + bars	43,985	2	1	1	1	1	1	43,985	43,985	43,985
Manufacturing establishments	291,543	4	2	2	3	2	1	1,749,258	1,166,172	583,086
Mining, quarrying and oil/gas extraction establishments	22,594	2	1	1	1	1	0	22,594	22,594	-
Construction companies	683,352	6	3	3	1	1	0	2,050,056	2,050,056	-
Government owned buildings	112,113	10	5	5	4	3	1	2,242,260	1,681,695	560,565
Utility buildings	18,160	2	1	1	2	1	1	36,320	18,160	18,160
EDP and data processing sites	146,407	4	2	2	2	1	1	585,628	292,814	292,814
Other	754,229	4	2	2	2	1	1	3,016,916	1,508,458	1,508,458
Total	11,787,295	4.53	2.57	1.96	2.70	1.83	2.37	81,936,390	42,190,547	54,565,990

1) Note: According to the Federal Aviation Authority, there are 8,292 private airports. These are not included in the above figures.

Sources: U.S. Census Bureau Number of Establishments, Federal Aviation Authority, ICS Research and CoStar Realty U.S. shopping centers, Commercial Buildings Energy Consumption Survey (CBECS), U.S. Department of Education, American Hospital Association, U.S. Department of Health and Human Services, American Hotel and Lodging Association, American Restaurant Association, Federal Real Property Public Data Set of the GSA, National Association of Manufacturers (NAM), GMP Research field input

Age of U.S. non-residential commercial buildings



Source: U.S. Census, American Fact Finder CB1600A11, Enhanced Commercial Property Database, GMP Research interviews with leading plumbing fixture manufacturers

Average age of non-residential commercial buildings by building type

Non-residential commercial building type	Average age of building	Typical toilet replacement time frame	Typical flushing urinal replacement time frame
Lodging	43.5 years	15 years	15 years
Office buildings	49 years	30 years	30 years
Commercial	61 years	40 years	40 years
Health care	45 years	35 years	35 years
Education	63 years	40 years	40 years
Religious	50 years	50 years	50 years
Public Safety	48 years	40 years	40 years
Amusement + recreation	51 years	35 years	35 years
Transportations	33 years	30 years	30 years
Communications	12 years	30 years	30 years
Manufacturing	50 years	50 years	50 years

Source: U.S. Census, American Fact Finder CB1600A11, Enhanced Commercial Property Database, GMP Research interviews with leading plumbing fixture manufacturers

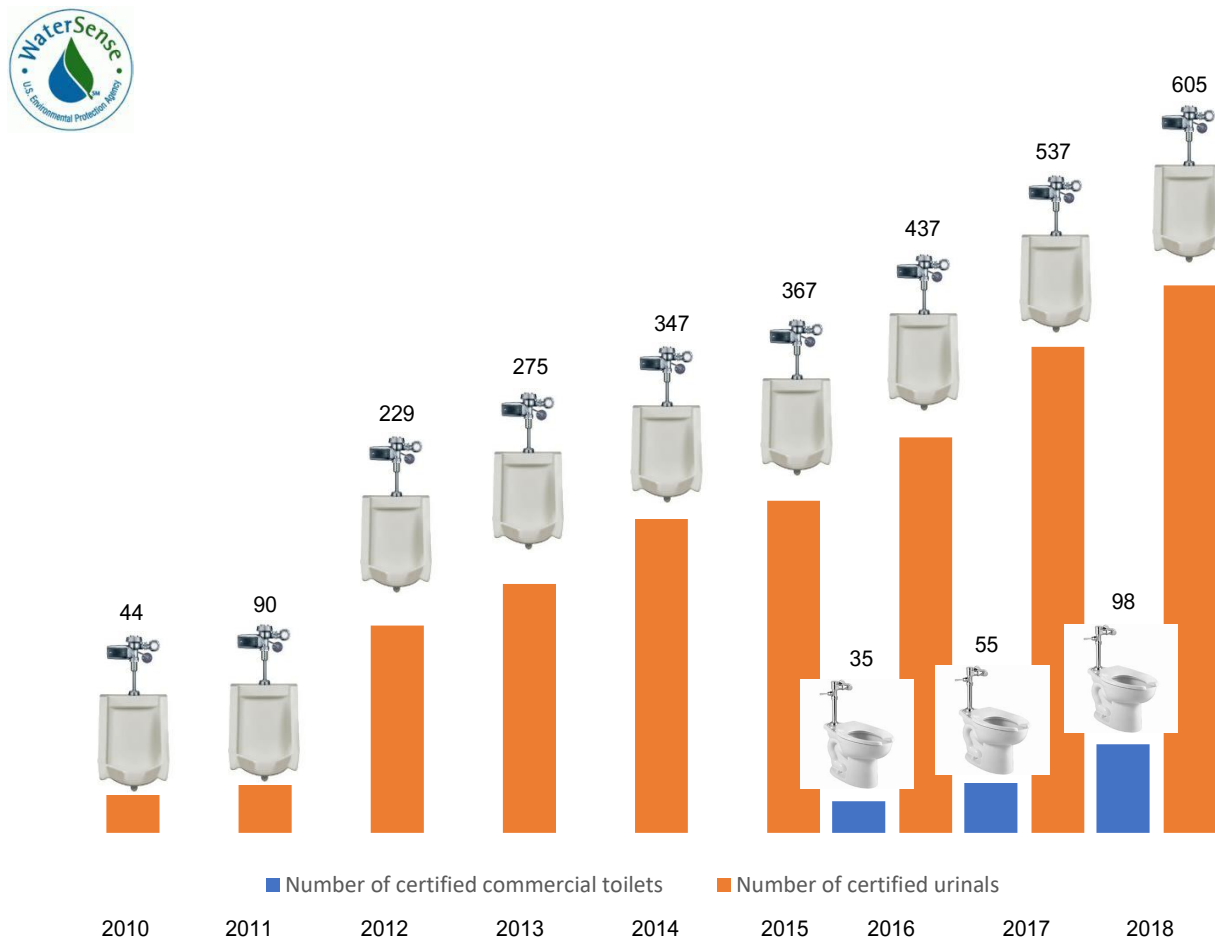
Note: Commercial toilets are frequently replaced well before they are "worn out" or inoperable. In some cases, for tank-type toilets in heavy use commercial areas (e.g., a gas station, theater, etc.) the economic lifetime may be reduced to 20 years or less, just because of physical wear and tear from abuse. For flushometer-valve toilets, replacement is not as frequent, as retrofitting the flushometer valve is often the preferred choice, rather than replacing the entire toilet and flushometer valve.

Many water utilities offering rebate programs geared toward replacing commercial toilets, generally use a 30 year replacement cycle as basis for their rebate program. They typically do not distinguish among toilets used in the various commercial/institutional buildings, because there are too many variables at play.

Availability of WaterSense-certified flushing urinals and flushometer-valve toilets

The WaterSense website indicates, WaterSense-certified flushing urinals were introduced to the market in 2010. WaterSense-certified flushometer-valve toilets were introduced in 2016. A list of WaterSense-certified flushing urinals and flushometer-valve toilets can be found at <https://www.epa.gov/watersense/product-search>.

Number of certified WaterSense flushing urinals and flushometer-valve toilets available for purchase



Source: <https://www.epa.gov/watersense/accomplishments-and-history>

According to input from the plumbing fixture and fitting manufacturers, 39.2% of the flushing urinals were WaterSense-certified, while 56.8% of the flushometer-valve toilets available for purchase were WaterSense-certified products.

WaterSense-certified flushing urinal market penetration

According to our research, there are some 54.5 million installed flushing urinals in non-residential commercial buildings. Every year roughly 400,000 - 450,000 flushing urinals are sold into new commercial construction and as replacement units for older fixtures.

The Energy Policy Act of 1992 established the maximum flush volume for all flushing urinals manufactured in the United States after January 1, 1994, at 1.0 gallons per flush (gpf).

Since the federal standards were enacted, manufacturers have developed flushing urinals that use significantly less water than the standard 1.0 gpf fixtures. These high-efficiency fixtures can save at least 0.5 gallons of water per flush compared to standard 1.0 gpf fixtures.

Since 2010 roughly 3.1 million flushing urinals have been sold. According to the WaterSense flushing urinal roll-out, we estimate approximately 1.0 million WaterSense urinals have been installed. With 54.5 million installed flushing urinals, WaterSense market penetration stands at 1.8% nationwide.

In the WaterSense® Specification for Flushing Urinals Supporting Statement from 2009, WaterSense estimates there are 12 million flushing urinals currently in use in the United States.

<https://www.epa.gov/sites/production/files/2017-01/documents/ws-products-support-statement-urinals.pdf>.

This is based on a 2005 report published by D&R International titled “Plumbing Fixtures Market Overview: Water Savings Potential for Residential and Commercial Toilet and Urinals”.

We do not agree with that assessment, and believe the figures listed on page 40 of this report reflect the installed base of flushing urinals in the United States.

If the WaterSense Specification for Flushing Urinals Supporting Statement is correct, then by 2018, there would be 12 million existing flushing urinals + 3.1 million new flushing urinals = a total installed base of 15.1 million flushing urinals. With a total installed base of 15.1 million flushing urinals, and roughly 1.0 million WaterSense-certified flushing urinals installed, then the WaterSense market penetration for flushing urinals would be 6.6% nationwide.

WaterSense-certified flushometer-valve toilet market penetration

According to our research, there are some 124.127 million toilets installed in commercial non-residential buildings. Not all these toilets will be equipped with a flushometer valve. We believe some 20% of the toilets will be either equipped with a pressure-assist tank or are gravity-fed tank-type toilets. This would indicate there are 99.302 million installed wall- and floor-mounted flushometer-valve toilets in the United States.

WaterSense-certified flushometer-valve toilets entered the market in 2016. According to the manufacturers, roughly 56.8% of the flushometer-valve toilets currently for sale are WaterSense-certified.

Since 2016, roughly 4.0 million wall-hung and floor-mount flushometer-valve toilets have been sold. According to the WaterSense flushometer-valve toilet roll-out, we estimate 2.0 million are WaterSense-certified or meet the WaterSense specification.

According to our research, there are 99.302 million flushometer-valve toilets installed in non-residential commercial buildings. With 2.0 million WaterSense-certified flushometer-valve toilets sold, this would indicate the market penetration for WaterSense flushometer-valve toilets is 2.0% nationwide.

In the WaterSense Specification for Flushometer-Valve Water Closets Supporting Statement, WaterSense states there are approximately 27 million flushometer-valve toilets currently in use in the United States. <https://www.epa.gov/watersense/watersense-specification-flushometer-valve-water-closets-supporting-statement>.

This is based on the 2005 study by D&R International titled “Plumbing Fixtures Market Overview: Water Savings Potential for Residential and Commercial Toilets and Urinals”.

We do not agree with that assessment, and believe the figures listed on page 40 of this report reflect the installed base of flushometer-valve toilets in the United States.

If the 27 million flushometer-valve toilet numbers were correct, that would imply that the current installed base would be 27,000,000 + 4.0 million newly sold flushometer-valve toilets since 2015 = 31.0 million installed flushometer-valve toilets.

With 2.0 million WaterSense-certified flushometer-valve toilets sold and a total installed base of 31 million flushometer-valve toilets, then the market penetration for WaterSense-certified flushometer-valve toilets would be 6.5% nationwide.

Observations concerning WaterSense flushing urinals and flushometer-valve toilets

WaterSense flushing urinals were introduced to the market in 2010. WaterSense flushometer-valve toilets were introduced in 2016.

According to the manufacturers, 39.2% of the available flushing urinals are WaterSense-certified or meet the WaterSense specification. 56.8% of the available flushometer-valve toilets are WaterSense-certified or meet the WaterSense specification.

Both WaterSense flushing urinals and flushometer-valve toilets have low single digit market penetration nationwide. As with the residential tank-type toilet, the time of replacement for commercial plumbing fixtures is the main driver of market penetration.

The commercial building inventory in the United States is well advanced in years, as can be seen from the following table. Commercial toilets are frequently replaced well before they are “worn out” or inoperable. In some cases, for tank-type toilets in heavy use commercial areas (e.g., a gas station, theater, etc.) the economic lifetime may be reduced to 20 years or less, just because of physical wear and tear from abuse. For flushometer-valve toilets, replacement is not as frequent, as retrofitting the flushometer valve is often the preferred choice, rather than replacing the entire toilet and flushometer valve.

Public restrooms with low traffic volume will have fixtures and fittings in good functioning order. These products are typically only replaced if they are defective, or if the building is being remodeled.

With an average replacement happening 35.9 years after initial installation, it will take roughly 40 years before WaterSense-certified flushing urinals or flushometer-valve toilets gain any serious market penetration.

Non-residential commercial building type	Average age of building	Typical flushometer-valve toilet replacement time frame	Typical flushing urinal replacement time frame
Lodging	43.5 years	15 years	15 years
Office buildings	49 years	30 years	30 years
Commercial	61 years	40 years	40 years
Health care	45 years	35 years	35 years
Education	63 years	40 years	40 years
Religious	50 years	50 years	50 years
Public safety	48 years	40 years	40 years
Amusement + recreation	51 years	35 years	35 years
Transportation	33 years	30 years	30 years
Communications	12 years	30 years	30 years
Manufacturing	50 years	50 years	50 years

Conclusions and final thoughts

Products captured in this study included tank-type residential toilets, bathroom sink faucets, showerheads, flushing urinals and flushometer-valve toilets.

WaterSense market penetration is defined by the total number of WaterSense-certified products installed divided by the total number of installed products of that specific product type.

WaterSense Products	2015 market penetration	2019 market penetration
Tank-type residential toilets	7.0%	16.8%
Bathroom sink faucets	25.4%	40.1%
Showerheads	28.7%	45.4%
Flushing urinals	Not included	1.8%
Flushometer-valve toilets	Not included	2.0%

Source: GMP Research estimates

Based on the data reviewed, we believe the key driver for high WaterSense market penetration is the replacement market. Plumbing fixtures have very long replacement cycles. Homeowners and commercial property owners are reluctant to replace a plumbing fixture unless it is either broken or is being replaced as part of a major remodeling project.

Bathroom sink faucets and showerheads are easier to replace and are often completed by the homeowner or a handyman. WaterSense-certified showerheads were introduced a few years after the bathroom sink faucets. As showerheads are replaced more often than bathroom sink faucets, the market penetration for the WaterSense-certified showerheads is higher and will continue to outpace the other products.

Within the next 15 years, most bathroom sink faucets and showerheads installed in the United States will be WaterSense-certified or meet the WaterSense program. Within the next 30 years, most residential tank-type toilets will be WaterSense-certified or meet the WaterSense program. Within the next 40 years, most flushometer-valve toilets and flushing urinals will be WaterSense-certified or meet the WaterSense program.

Mount Pleasant, June 2019