

Using Low-Flow Plumbing Fixtures to Obtain LEED Credits

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A wave of new low-flow plumbing fixtures and technologies is hitting the market. The last time so much activity in the plumbing industry occurred was the introduction of the Energy Policy Act of 1992 that mandated the use of water-conserving plumbing fixtures.

When they were introduced in the early 1990s, low-flow fixtures had many problems; however, manufacturers have improved quality to minimize adverse effects, and the public has grown more accepting of these products. The latest generation of fixtures is unique because it was not created in response to a federal mandate as in the early 1990s. Rather, manufacturers are responding to owners' and designers' interest in voluntary programs such as the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) rating system.

Why Low Flow?

The demand for low-flow fixtures is growing even in areas of the country that have an abundance of fresh water. Many building owners and users have realized that issues such as overcrowding and urban sprawl are endangering natural resources.

Open, environmentally sustainable spaces are being replaced with buildings and pavement, as well as the large water and sewer systems that follow such development. The large amounts of water used for potable water systems and discharge from facilities' sewer systems compromise the natural environment.

Other issues in established urban areas also promote water-efficient facilities. While they may be located in parts of the country with an abundance of fresh water, many urban areas have outdated water distribution systems and combined storm and sanitary sewer systems. Reducing demand on these water distribution systems will reduce the amount of flow in these undersized combination systems. Using less water will diminish the necessity for expensive municipal projects to maintain or replace these old systems,

especially in high-density urban areas where upgrades to the existing municipal systems are not feasible.

A growing number of owners and users is looking for ways to reduce buildings' effects on the environment and to respect and replicate the way the Earth's biosphere cleans air and water. *Sustainable construction* is the term that describes this development method; when applied to plumbing, it could be called *plumbing biospherics*. Efficient plumbing systems reduce the amount of potable water used and the waste produced in a facility. Low-flow plumbing fixtures are an important part of such systems.

This growing interest in the sustainable building industry and LEED-type guidelines promoting water efficiency has prompted manufacturers to invest large amounts of capital in researching, developing, and manufacturing low-flow plumbing fixtures. Plumbing engineers need to be cognizant of the rating systems and the new fixtures made for this market.

Dual-Flush Water Closets

A new concept in the United States that has been popular for a few years in other parts of the world is the dual-flush water closet, which has two flush controls. To flush solids, the user pushes one button for a full 1.6-gallon

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flush. To flush liquids, the user pushes the other button for a partial flush (0.8 gallon, 0.6 gallon, or some other amount less than 1.6 gallon) that clears the trap.

As a water closet usually is used to flush more liquids than solids, this fixture can reduce the amount of water used by a facility without compromising the ability to flush solids. Another advantage is that the costs to purchase, install, and maintain the fixture are

similar to a 1.6-gallon-per-flush water closet.

Using dual-flush units can help a facility obtain the LEED water-efficiency credit, particularly in the women's toilets. The LEED for New Construction (LEED-NC) credit is based on a calculation using fixtures from the 1992 Energy Act, which requires 1.6-gpf water closets and 1-gpf urinals. The usage factor is based on each building occupant using a fixture four times a day. Male occupants will use a water closet one time a day and a urinal three times a day, while female occupants will use a water closet four times a day.¹ Thus, the advantage of a dual-flush unit used in the female toilet room is that the LEED calculation will be based on each female occupant using a full 1.6-gallon flush one time a day and the low-flow flush three times a day. In many cases this fixture can help obtain the required 20 percent reduced potable water use for a facility.

Dual-flush fixtures also are visual reinforcements that the owner is making a commitment to reduce the facility's water and sewage demand. Owners of LEED-certified buildings like having such items that they can highlight and demonstrate to potential tenants and the public.

Designers should be aware of some issues with the dual-flush water closet before specifying the fixture. Dual-flush flush meter water closets are not yet on the market. Flush meter manufacturers can manufacture a dual-flush meter valve for a water closet, but bowl manufacturers have not developed a dual-flush bowl. As a result, designers only have the option to specify and install tank-type dual-flush water closets.

Because dual-flush technology is relatively new in the United States, another issue is that most dual-flush water closets have been manufactured only for the residential market. For the light commercial market, the number of fixtures currently equipped with elongated

bowls or Americans With Disabilities Act-height bowls is very limited. However, manufacturers have indicated that this is about to change.

In the meantime, pressure-assisted dual-flush water closets that use the municipal water pressure to assist in flushing are available. The pressure-assisted technology is very reliable and appropriate for particular applications. Some owners of hotels and resorts that use only the pressure-assisted fixtures will be interested in trying out the dual-flush options.

Some owners are concerned about the ability of these fixtures to effectively flush solids. Much like the conventional single-flush water closets, some products work very well while others are lacking. However, problems with the product most likely are not due to the dual-flush technology; rather, they probably are associated with the design of the trap and the flushing process.

Low-Flow Water Closets

Another new product is the low-flow water closet, which uses less than 1.6 gpf, reducing both potable water use and wastewater. To the untrained eye, these fixtures appear and operate similarly to the 1.6-gpf fixtures, and users may never know they are low flow.

These fixtures are installed and maintained just like 1.6-gpf fixtures. At one time, non-mainstream or foreign manufacturers were the only makers of these fixtures. As a result, some owners were concerned that their maintenance staffs would be unable to find parts or service the fixtures. However, many fixtures now are available from mainstream manufacturers and are supported by large supply houses. You also can find dual-flush and low-flow water closets with the tank installed inside the wall. These installations offer the convenience of a wall-mounted fixture and conceal the flush tank and valves.

Using these low-flow water closets along with other low-flow fixtures can help obtain water-efficiency LEED credits with minimal installation issues or added cost.

Low-Flow Showerheads

The 2.5-gallons-per-minute showerhead has been the standard fixture in the United States since the 1992 Energy

Act. Some users complain that this is not enough water; thus, shower systems that use several showerheads, and as a result use much more than 2.5 gpm, are becoming more popular. Some people in the green construction movement have compared these types of showers to large sport utility vehicles that use so much gas.

Many of these systems have been installed in residential bathroom redesigns that include expensive finishes. The problem arises when the homeowner cannot use the fixture because typical residential water heaters do not supply enough hot water to support it.

While these systems may be appropriate in some applications, they usually are not used in sustainable facilities. One type of system available for green construction recirculates the water in complete shower systems much like a whirlpool tub recirculates water.

A low-flow showerhead is another option; however, the user will know this is a reduced-flow fixture and will approach the shower differently than a standard shower. While most sustainable practices require little or no compromises in user comfort or convenience, the same cannot be said for a reduced-flow shower system.

For instance, when a dual-flush water closet is installed, users quickly can learn how to operate the fixture. If the fixture is installed and operates properly, the user makes little if any sacrifices. The use of a water-free urinal is similar in that it has little effect on the user if the fixture operates properly. As a result, if used in appropriate facilities, these low-flow fixtures can be installed with little risk of increased user complaints.

Low-flow shower systems are different. When using low-flow showerheads, users may need to alter their normal showering routines. For example, because of the decreased water flow, a few more seconds may be needed to rinse hair after shampooing. To fully appreciate low-flow shower systems, users must buy into the sustainable practices concept. If this buy in does

not occur, users may not accept the fixture.

For example, a new college dormitory marketed as a sustainable building that uses less energy and water, and as a result creates less waste, will attract motivated users who already have

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bought into the concept. On the other hand, it is not unusual for universities to install vandal-resistant fixtures in dormitories because students will either remove the flow restrictor from the showerhead or disable the showerhead and complain to the staff to replace it. However, with the proper approach these fixtures have been used very successfully with few complaints.

The plumbing design team should be aware of these issues before recommending the installation of a low-flow showerhead. If the users will not buy into the sustainable concept, the use of the low-flow showers may not be appropriate for the particular project. On the other hand, the design team should be aware that low-flow showerheads might be expected if the owner and users are motivated to follow sustainable practices.

Another issue with low-flow showers is mixing valves that are designed for non-scald capabilities at 2.5 gpm. While flowing at lower rates has not been an issue with the performance of the 2.5-gpm mixing valves, manufacturers are looking at creating mixing valves rated for the low-flow showerheads.

Plumbing system designers also should be aware of the length and size of hot water piping from the hot water source or main to the showerhead. In theory, removing a 2.5-gpm showerhead and replacing it with a low-flow showerhead can reduce the flow of water in a line by a minimum of one-third. The end result is that it will take one-third more time to get the hot water to the fixture. Potable water is wasted when the user has to wait for the hot water to reach the fixture. While it does not directly count toward LEED

credits, reducing the length of piping from the hot water source to the fixture is one way to reduce the amount of water used in a facility.

When designing a system with many showers, such as a hotel or dormitory, the designer must decide if the supply piping and water heater system should be sized for the low-flow heads or the standard heads. Until the low-flow showerheads are common, the designer may choose to size the piping and the water heating system based on 2.5-gpm showerheads, because the facility owner may decide to change the low-flow showerheads to the 2.5-gpm showerheads in the future.

Maintaining LEED Certification

The LEED rating system is a voluntary set of guidelines. It is not enforced by law as the Energy Policy Act of 1992.

Currently most references to LEED certification are to LEED for New Construction, or LEED-NC. To obtain LEED-NC certification, the owner must register the facility with the USGBC. The USGBC will send the design and construction team a package of materials to be filled out and submitted at the end of construction. For example, to obtain the LEED credit for reducing potable water use, the team will need to submit three items. The first item is a calculation showing that, by using low-flow fixtures, the facility uses at least 20 percent less water than the baseline calculation for the facility using 1992 Energy Policy Act fixtures. The second item is documentation that the fixtures installed are low flow. The third item is a report from the commissioning agent verifying

that low-flow fixtures were installed in the facility. The new versions of LEED-NC also require a letter signed by the mechanical, electrical, and plumbing engineer or responsible party declaring that the project uses less water.

If the credits are approved, the USGBC will send a plaque to the building owner that shows the facility was LEED-NC certified at the time construction was complete. Any subsequent actions taken by the users after occupying the facility, such as removing low-flow showerheads and installing 2.5-gpm showerheads as in the example of a university dormitory, do not take the LEED-NC certification away from the building.

The USGBC realized that LEED-NC does not guarantee that a building will continue to run as a high-efficient facility in the years after construction. Systems can deteriorate over time, and the building can be operated in a way that does not take advantage of the sustainable systems. In response, the USGBC introduced LEED for Existing Buildings (LEED-EB).

LEED-EB is a set of standards that helps building owners monitor the operation of sustainable systems in their facilities. Building owners can keep records on the facility's efficiency and resubmit to the USGBC every five years to maintain LEED-EB certification. USGBC predicts that this product eventually will be used in more facilities than LEED-NC.

In the case of low-flow showerheads, LEED-EB brings another element to the sustainable facility. For a building to retain the LEED-EB certification, users

must buy into the sustainable facility concept because they will have to make minor adjustments in their showering habits as previously noted. Actions such as replacing showerheads *do* affect LEED-EB certification.

Water-free Products

Water-free urinals were discussed in detail in the March/April 2005 issue; however, it is important to mention that water-free urinals can help in obtaining LEED's water-efficiency credit.

Because of these fixtures' popularity, mainstream manufacturers are introducing more and more water-free products. Expect to see these fixtures heavily promoted in the near future. As with any new product, designers need to be aware that these fixtures, even though they are popular, might not be the best application for every project.

If the sustainable construction trend continues, more fixtures will become available that use even less water than low-flow fixtures. One example is the water closet that uses no water. What is a water closet with no water? Owners of traditional office buildings are looking at the advantages of composting toilets. Is there a future for a landscaping/plumbing professional to design composting toilet systems? These questions will be answered in future columns. The industry is growing and changing every day, and plumbing engineers need to keep ahead of the curve. ■

References

1. *LEED-NC Version 2.0 Rating System: Water Use Reduction 3.1 and 3.2.* USGBC. June 2001.

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