

Development of the Ecological Bathroom Ideas

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Abstract. Shaping the ecological bathroom includes various activities allowing optimal usable, health and aesthetic conditions to reside and perform specific actions by users with minimum interference in the environment and low use of natural resources. The main objective of these activities is to create a harmonious compounds in the system: user - bathroom - the environment. The basic features of ecological bathrooms and its ecological equipment include efficiency and savings of water, energy and materials. Equally important is the friendly treatment of the environment and the maintenance of healthy and hygienic conditions of use of the bathroom.

Bathroom industry, taking care of the environment, is offering more and more products that prevent waste of natural resources and control their consumption. As a result of work on ever new, sometimes surprising, possibilities of their optimal use, numerous projects appear in response to needs for solutions that are economical in operation and at the same time comfortable to use.

Keywords: Ecological bathroom · Eco friendly bathroom · Sustainable bathroom · Modern bathroom design trends · Hygienic and sanitary facilities · Technological development · Modern technology · Ergonomics

1 Introduction

Nowadays, having to deal with health and hygiene conscious society, and when the innovations in the bathroom relate primarily to its aesthetic and technological side, the problem of natural resources turns out to be extremely important. Despite this ecological imperative, the quest for total comfort of use of hygienic and sanitary zone and experience in this area greatest pleasure still continues. Hedonistic lifestyle of many people is associated with the desire to achieve well-being, from enjoying the aromatherapy baths, and ending with the luxury brands of bathroom facilities, signed with the names of well-known designers. Paradoxically, the user, on the one hand, being aware of the opportunities of bathroom facilities and encouraged by manufacturers offers, at the same time realizes that his worldly pleasures take place at the expense of diminishing natural resources. Water as a natural resource and an essential element of the bath becomes a luxury. We can look for the good balance, for example, by saving water at home activities during the day, for the evening bath in a bathtub full of water, but such behavior is not entirely consistent with contemporary trends directed towards the comfort of using the bathroom and the whole apartment [12].

The basic principle is verification of the current water consumption and awareness of the need of water-saving. It turns out that the installed water meters are the most effective elements causing rational use of water. Measurements affect the need to search for solutions directed towards the reduction of water bills. The second step is identification of areas for the application of improvements and obtainment savings. The implementation of appropriate solutions for water management should be proceeding.

Saving water is just one of the activities associated with the formation of the ecological bathroom and its ecological equipment. Saving energy and materials is also an important issue. This ecological attitude is intended to provide a healthy and hygienic conditions of use of the bathroom with due respect for the natural environment, minimum interference in the ecosystem and low utilization of natural resources. Friendly treatment of the natural environment and creation of harmonious relationships in the system: user - bathroom - the environment are key activities associated with the formation of the ecological, environmentally sustainable bathroom.

2 Daily Habits

Reasonable use of the water is one of the main rules. Precise observation of water usage can show that even simple changes in daily habits are sufficient to significantly reduce the consumption of water in every home. Brushing teeth, washing hands, or shaving, are examples of activities that, despite appearances, require use of the large amounts of water. Therefore, should not be done as continuous use of flowing stream of water - close the tap while brushing teeth or shaving foam overlap. For example, rinsing teeth after brushing using a cup instead of under running water is a consumption of 0.5 liters of water instead of 16. You can also replace a full bath, with a content of about 100–150 liters of water, on a more economical shower and save at least one third of the amount of water [11].

3 The Quality and Condition of the Bathroom Installations and Equipment

You should also pay attention to the quality and condition of installation and fittings of the bathrooms, especially the faucets and taps. Leaky valve and tap, from which drips one drop per second causes a waste of 16.8 liters of water a day - that's more than half a liter per hour, and each year about 4.7 cubic meters, or 4 700 liters. The tap, from which leaking 2 mm water stream leads to loss of water in an amount of 277 ml per minute and 146 cubic meters per year (146 000 liters). Therefore, both the competent installation and proper maintenance of fittings can be very important. Quality control, verification of the guarantee and certificates required by building regulations and authorizing the sale of faucets are also recommended. They are evidence of the use in the production of faucets materials that guarantee safety of the use. Also, the quality of toilet flushing devices is an important issue. Leaky toilet cistern wastes up to 32 liters of water per day. Water saving flush systems with dual flushing and start/stop flushing can help save about 1.5–2 liters of water with every flushing [9, 11].

4 Water Recycling and Reuse

Possibility of recycling and reuse wastewater, is an effective way to reduce water consumption in the household. Increasingly effective systems allow, for example, through proper filtration, use the waste water from the bathtubs and shower cabins for flushing the toilet bowls. In a domestic installation, users have opportunity of recycling and reuse consumed water, the so-called “grey water” or process water. Properly designed and installed system is needed for this purpose. Waste water is collected from bathtubs, shower trays and washbasins. Waste water is collected from bathtubs, shower trays and basins, and then is passed through a natural filter system (sand and gravel) and biological and mechanical filter systems. Purified water is stored in underground tanks and used for flushing the toilet, cleaning or watering the garden. In the single-family house also rainwater can be used. It is suitable for irrigating the garden, flushing the toilets, washing the car, and even doing the laundry [11, 13].

5 Modern Devices Limiting the Consumption of Water and Energy

Modern equipment limiting water and energy consumption can also help in saving and at the same time in environmental protection. Bathroom industry, taking care of the environment and implementing ecological programs, is offering more and more products that prevent waste of natural resources and control their consumption. Solutions as a result of work on their optimal use are becoming increasingly frequent. They do not reduce the comfort of using the bathroom, on the contrary, they contribute to improving quality and standard of this place. Among them you can find economical energy-efficient washing machines, which have special functions of washing and consume less water with less clothes, environmentally friendly faucets with special solutions allowing to avoid water waste while providing the comfort of their use and a modern, efficient flushing device and ecological bathing facilities. Other ecological solutions include waterless urinals and dry toilets. Energy efficient hand dryers and energy-efficient lighting, such as LED type are further examples of environmentally friendly solutions.

5.1 Ecological Bathroom Fittings and Fixtures

Faucets are elements of bathroom facilities that can help you save water. Ecological solutions that are used in them do not allow for the water losses and provide comfort of use. Single-lever mixer taps and thermostatic faucets provide control and regulation of the stream intensity and the temperature of the flowing water. Therefore setting of the optimal parameters is fast and prevents wasting even a drop of water. One handle is easier to open the outflow of water for children and the elderly. In this way, you can easily adjust the intensity and temperature of the water, while holding in your other hand another thing such as a toothbrush. This solution helps to save water that would be consumed during long lasting regulation of the pressure or temperature with double

handle faucets. Electronically controlled touchless faucets running only when your hand or other object comes within range of the sensors are another way to control the amount of water consumed. The water flow stops automatically after removal of the hands - so there is no risk that a child or elderly person forgets to close the tap, pouring in an uncontrolled manner many liters of precious water. Also, bathroom faucets operated electronically - via the remote control are effective in saving water. With their help, you can set both the required water temperature and a suitable size of water flow: 2, 5 or 13 liters/min, and by pressing the corresponding button save setpoints. Touchless faucets and taps with the remote control may limit water consumption by even more than 50 %. Faucets fitted with a stop the flow of water so-called eco-button are also effective solution. It is usually located on the back or on the side of the tap. In order to obtain the maximum flow of water out of the spout (13–14 liters per minute), button must be pressed. After closing tap the button automatically returns to its previous position, and after re-opening tap, water flows already in the amount of 5–7 liters per minute. In this way, the water flow is reduced by approximately 50 %. Also the faucet with a special water-saving head, which is equipped with the lock - brake is offered by manufacturers of sanitary fittings. Strong resistance is felt at the time of lifting up the faucet holder - from the tap flows 5–7 liters of water. Maximum outflow in an amount of about 13 liters/min is achieved only after overcoming this resistance. Water consumption using the water-saving head can be reduced by up to half. Another proposal is to use the aerator - an element in the form of special fine-mesh sprinkler, which is fastened at the end of the spout in order to aerate the water flowing stream. Despite this reduction in the intensity of the stream, it seems that the same amount of water flows from the tap, because it is enriched with thousands of air bubbles. Such a change does not reduce the effectiveness of cleaning, and reduces water consumption by about 15 % in the case of using the traditional aerator. The eco-aerator, designed specifically for effective water saving, can reduce the outflow from the spout even by 40–60 %. Also, shower head and hand shower may have a special construction to minimize water consumption. As a result, the strength of the water stream and enjoyment of the shower does not change, and water consumption is reduced by 50 % [7, 9].

5.2 Ecological Flushing Devices

The toilet bowls designed for efficient flushing are now the new standard. The amount of water needed to flush the toilet bowl depends on its shape. Older models of toilet bowls with the so-called ledge (obsolescent) require a larger amount of flushing water - usually around 9 liters. For flushing new model of toilet bowl 6 liters of water is usually sufficient. In modern flush tanks, the amount of water, that flushes the toilet bowl, can be adjusted. In most containers, it is in the range of 6 to 9 liters. The flush mechanism is equipped with a dual button. Pressing the first button releases 6–9 liters of water (and causes complete emptying of the reservoir), pressing the second button releases only 3 liters (limited but efficient flushing). The buttons are usually marked (for example, the first - a large drop, the second - a small drop), or one which empties the entire tank is larger. The use of the toilet bowl with a flush tank equipped with a dual flush button

(3 or 6 liters of water) compared with the bowl with a conventional system allows to save 22 m³ of water per year for a family of 4 people. The single button with “stop” function that allows - by pressing again - to stop the flow of water at any time, is a slightly different, but also environmentally friendly alternative. Modern non-contact flush devices respond to the presence of at least 6 s the user in the impact zone of photocell. Automatic water flow occurs within 3 s after leaving the zone by the user. In case of necessity of additional flushing, this is possible with the help of manually operated button. The flushing installation with the use of waste water from the bathtub and the shower cabin is now becoming more and more frequently used solution [3, 8, 10, 13].

5.3 Ecological Bathing Facilities

The bath in the tub, although pleasant, is not a pro-ecological. Filling the bathtub requires about 180 liters of water, while each minute of the shower is the consumption of about 10 liters of water. For persons, who in addition to water, save time, the choice seems obvious. However, if you wish to take a long baths, both tub and shower are a problem from an ecological point of view. High-tech shower cabins, such as hygienic capsule designed by Fabio Lenci, are programmed in such a way that the water consumption during washing is low as possible. It can be a water saving system, similar to that used on the spaceships, in the form of three separate functions. The first function, used to wet the entire body with a consumption of only three liters of water, the second function, atomizing water, that helps to soap and rinse the body with two liters of water, and the third function using a further three liters for the final rinse. Additional water filtration methods allow the water reuse. The toilet set integrated with the cabin is equipped with special system that separates excrement and urine, and which allows to use of less contaminated wastewater [4, 5].

5.4 Ecological Toilets and Urinals

The present ecological sanitation methods help to save water, energy and reuse of human waste. The waterless toilet systems do not require any water to function. They utilize a natural biological processes to break down human waste into dehydrated odorless compost - as material. They not only save water, but they are also entirely isolated from the surrounding environment and cannot contaminate underground water resources.

Given that 40 % of the water consumed in the household is used for flushing the toilet bowl, the solutions in the form of toilets without flushing seem to be a very ecological proposals. The so-called composting toilets, separating toilets or a so-called dry toilets are suitable for use, among others, in the residential buildings, especially toilets which have a central composting module, which can collect waste from many toilet in the building [2].

In addition to waterless toilets we have waterless urinals. Waterless urinal known today does not use a single drop of water. This is due to the use of a replaceable cartridge filled with a special biodegradable substance which transmits urine into the

drain, but on the other hand blocks the release of odors outside without the need of flushing. Operation consists of replacing the cartridge - on average every 4–6 months, depending on frequency of use. However, the price of the cartridge is considerably less than the amount saved on the water consumption. Waterless urinals allow for a significant reduction in operating costs. They do not require flushing, and consequently reduce the amount of wastewater compared to traditional urinals. This ecological device, saving water and environment, is willingly used in public buildings. No water consumption saves on water and wastewater, so provides economic advantages, but it also gives the environment protection, so provides ecological benefits. Some waterless urinals have the potential to get extra points for LEED and BREEAM - certification for “green buildings” [1].

6 Peculiar Ideas of Ecological Bathroom and Its Equipment

There are also some strange ideas and concepts in the form of various solutions related to the unlimited possibilities of use bathtubs and shower cabins, born under the inspiration of the modern, multi-function devices, which, although based on advanced technologies, however, are not always equipped with water saving systems and their use requires large amounts of this precious natural resource. They were processed under the influence of certain philosophies of life, desire for contact with nature and its contemplation, and at the same time the need to protect natural resources, especially water. Many interesting projects were created as a result of this. It is to be hoped that they will get the chance for realization.

Several designers, drawing on the experience of countries facing water scarcity, have presented a number of unusual and unconventional proposals. The bathtub “*Ben Hur*” and the shower “*True Trunk*” are French examples. “*Ben Hur*” is a large bathtub on wheels equipped with a set of accessories that can be used not only for bathing and washing. Person taking a bath does not need to break away from their daily activities, such as laundry, cleaning, cooking, or working at a desk etc. The wheels allow for easy movement around the house. Thanks to them, the person can also go to the garden. Sunshade which is part of the bathtub equipment effectively protects against the sun. The user can take a bath in the presence of other people, treating this action as an element of social life [12].

Unknown eclectic group of designers, writers and artists from Marseille, Les Pas Perdus, with roots in Mauritius, has approached to the subject of bath with wealth of experience from the Third World, combining them with the “visual euphoria.” The use of recycled materials returning to favor in the form of secondary raw materials, and artistic installations and structures realized with them, are the result of the search of unlimited possibilities. Plastic cover creates a shower cabin, and a barrel full of water mounted on a tree trunk, allows you to see the level of the water for use. This simple, realized according to the principle of “do-it-yourself”, shower is designed to provide the unusual sensations in contact with nature treated as a valuable natural goodness. Projects “*X-les Bain*” designed by Olivier Peyricot, are another bathing inventions, which give water equal status with human. “*Roombath*” is an example of the bath architecture, which is closed within a large plastic bathtub warm and nice to touch

giving shelter from the surrounding world. The users, sitting on small chairs in its interior, can use a small, water-filled bowls to wash up. Transparent plastic hose enables precise control of water stream. Portable mattress designed for relaxation and accessories for massage and personal care are additional bathtub equipment. This form of bath refers to the rituals that are part of Muslim or Japanese bathing culture. The bathtub is a health and rest center, with a small amount of precious water. “*Wombath*”, flexible, latex bathtub in the shade of human skin, is referring to the womb of a pregnant woman. It has been shaped in such a way that allows the user bathing in a fetal position, so that even a small amount of water reaches up to his shoulder. This position relating to the first moments in the womb, promotes relaxation, meditation and even allows napping during the bath. Flexible but durable material “softens” the light and dampens the sounds reaching into the interior, providing total peace of mind and undisturbed relaxation for user. “*Washchair*” like a tub of our ancestors, can be used for bathing and washing clothes. It is made of soft polyurethane. Its shape, high back and rounded edges resembles nineteenth-century tub, designed for hygiene in a sitting position, and as it allows for a comfortable bath in the “cosy chair”. Textured back provides a shoulder massage, and, if necessary, can become functional tare for washing. By maintaining the central parts of the body in a small amount of warm water, “*Washchair*” is another example of its ecological use [6, 12].

“*Four Seasons*” is a project of a luxurious spa bath. Its bottom is covered with a synthetic grass and flooded only a small amount of water. The grass is intended to stimulate blood circulation of user. The bathtub cover has openings which can be filled with vegetation corresponding to the current season. It may resemble a pond or a small lake. In order to enhance the sensations associated with the passing seasons, you can use the cherry blossom-scented bathing salt in the spring and in the summer seaweed and algae that may turn bathtub into the sea beach. Herbs in the autumn and eucalyptus oil or extract from spruce and juniper in winter, can be very helpful in the treatment of colds, and in addition the bath becomes a soothing, regenerating and uniting with nature experience [6, 12].

Aside from a number of changes “in the bathtub”, seen as a sign of luxury in areas of water scarcity, shower as a more economical solution when it comes to about the bath, were also not left out. But although its use was always associated with time saving and water saving, today the term “quick shower” is already outdated. Currently in the cabin, you can spend even more time than in the bathtub. Therefore just as relaxing bath in the tub showering should become an experience similarly pleasant, with the participation of music therapy and aromatherapy, that also does not waste precious water resource. In this case, the water can be, for example, an element of fun recalling childhood memories. “*Popshower*”, a form of shower that offers the benefits of thalassotherapy while having fun is exactly such a solution. Various shower heads arranged in the wall and floor of the suitably shaped cabin provide a different types of water stream. It can take the form of a rushing waterfall, a gentle sprinkler grass or a light sea breeze. Each of the water outlets is closed with a rubber stopper with a suitable handle for easy release of the plug and trouble-free start of each shower forms [6, 12].

7 Summary

User of contemporary bathroom is motivated both by ecological and economic considerations, so he would like to use water and energy wisely, reasonably and sparingly, but at the same time without sacrifice and without giving up the pleasures that provide modern bathroom facilities. Therefore, the society, which on the one hand wants to care about health, hygiene, appearance and well-being, on the other hand, is aware of the problem of natural resources, is looking for functional, comfortable to use, and at the same time economical in operation, solutions. Developing bathroom industry, taking care of the needs both of users as well as the environment, is offering more and more products that provide a high quality of use, while preventing the waste of valuable resources and control their consumption. Many interesting ideas, concepts and finished products resulting from the development of new, sometimes unexpected, possibilities of optimal use of natural resources are a response to the needs of users. The solutions discussed in this article are only examples of far-reaching and multifaceted environmentally friendly actions of designers and manufacturers that significantly contribute to development of the ecological bathrooms.

References

1. Bezwodny pisuar – co to właściwie jest? <http://blog.ekoforte.com>
2. Ekotoaleta kompostująca. <http://www.ekogazeta.com.pl>
3. Filipkowski, K.: Podtynkowe systemy splukujące, Lazienka, Publikator, Białystok (8/2000)
4. Kubasik, A.: Kapsuła kosmicznej higieny, Lazienka, Publikator, Białystok (5/2001)
5. Kubasik, A.: Mobilne konfiguracje, Lazienka, Publikator, Białystok (9/2002)
6. Morozzi, C.: Linee d'acqua. Cultura del bagno e del corpo, Miller Freeman I Mostra Convegno Expocomfort, Mediolan (2000)
7. Oras – nowe standardy, Lazienka, Publikator, Białystok (9/2000)
8. Oszczędne splukiwanie. <http://www.kolo.com.pl>
9. Oszczędzanie wody w kuchni i łazience. <http://www.muratordom.pl>
10. Oszczędzanie wody w toalecie. <http://www.muratordom.pl>
11. Szkoła oszczędzania. <http://www.archipelag.pl>
12. White, L.: Kąpielowe paradoksy, Lazienka, Publikator, Białystok (8/2000)
13. Woda i ścieki. <http://www.life.epce.org.pl>