FACT SHEET

Reusing and recycling water

Key point

- ***Reusing water by matching the quantity and quality of water with intended purposes can reduce the withdrawal of freshwater and reduce wastewater.***

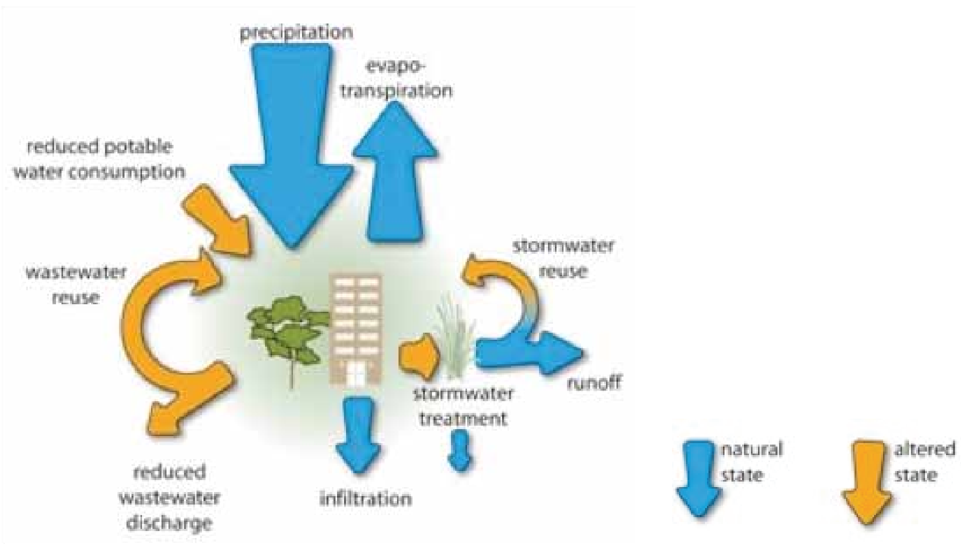
Reuse and recycling explained

The water cycle refers to the continuous movement of water on, above and below the Earth's surface.[1] The water cycle is a crucial function of the ecosystem; in the natural hydrological cycle, the Earth reclaims water over a long period of time. Promoting a water cycling system in an urban setting refers to harmonizing human activities with several processes of the natural water cycle, including efficient water reuse.

How it works

Water reuse can do two things: 1) minimize freshwater demand and 2) reduce wastewater treatment needs. As a result, water reuse minimizes new water extraction and wastewater effluent, thus enabling the continuous cycle of water in an urban setting. By minimizing new water inflow and wastewater effluent, water reuse makes the urban water cycle more compact and sustainable. Figure 1 shows how water reuse manipulates the directions of unfavourable water flows and creates a cycle of water in urban setting.

Figure 1: Sustainable urban water cycle through water reuse



Source: Healthy Waterways website,"What is water sensitive urban design?"(2011).Available from http://waterbydesign.com.au/whatiswsud/(accessed 2 February 2012).

The basic principle of water reuse is to reduce the inefficient mismatch between available water resources and the specific purposes of water use. Although freshwater sources are becoming scarce, it is also true that precious

[1] US Geological Survey website "Water Cycle" (27 December 2011). Available from http://ga.water.usgs.gov/edu/watercycle.html(accessed 2 February 2012).

freshwater is inefficiently used for non-potable purposes, such as irrigation. A 1958 UN Economic and Social Council resolution stated, "No higher quality of water, unless there is surplus of it, should be used for a purpose that can tolerate a lower grade."[2] To avoid the inefficient use of precious water sources, an eco-efficient water system allocates water types to appropriate purposes.

The sources and uses of reclaimed water are dependent on contexts. Thus treatment technologies need to be selected in relation to the sources and purposes of use. Examples of treatment technologies include membranes, wet lands, sand filters and waste-stabilizing ponds. The purposes of use also vary, depending on the quality of reclaimed water and local needs. While a potable use of reclaimed water is practised in some cities, non-potable uses, such as irrigation, toilet flushing and fire fighting, are more common. Context-specific matching of water sources, technologies and specific uses are critical elements of a water reuse policy.

Strengths in reusing and recycling water

- **Economic:** Developing new freshwater sources requires capture, conveyance and piping costs. Wastewater treatment and discharge are also an economic burden for public authorities. In particular, energy is a hidden cost in freshwater provision and wastewater treatment. Water reuse can cut this cost; household and community water reuse significantly reduces energy costs for water transmission.
- **Urban water cycle and ecosystem maintenance:** Water reuse reduces unnecessary new freshwater extraction and wastewater generation by correcting unfavourable water flows and promoting a sustainable cycle of water in an urban setting.
- **Environmental resilience:** A resilient water system helps communities cope with environmental shocks, such as water scarcity, floods and drought. Reclaimed water can be a dependable alternative source of water and improve water security in the face of climatic variability.

Challenges to reusing and recycling water

- **Public acceptance barriers regarding health issues:** The most critical hurdle for water reuse is fears and uncertainties about the health risks, which can severely affect public acceptance. This then impedes the implementing of policies. Unfavourable and uncoordinated regulatory framework can increase such fears and uncertainties.
- **Technical barriers:** Wastewater treatment for reuse requires such technologies as a membrane and a wetland. Insufficient technical capacity can hinder the installation and maintenance of the wastewater treatment systems. Although high-tech treatment generally produces high-quality reclaimed water, it is not easily a viable option in developing countries.
- **Financial barriers:** Initial costs to install wastewater treatment technologies can be expensive, thus making a reuse system unaffordable for households. The unfavourable pricing of freshwater can be a significant hurdle to promote water reuse. If freshwater pricing is too low, it does not drive people to reuse water.

Implementing strategies

Develop a favourable regulatory framework to overcome health risks and secure public acceptance: An extensive public awareness campaign will minimize the health risks of water reuse and make the practice socially acceptable. It requires cross-sector collaboration and harmony with agricultural and health policies. Raising public awareness and thus public comfort is the make-or-break necessity.

Match technologies with local contexts and purposes of water reuse: To determine the level of technology to use, the quality and quantity of wastewater needs to be balanced against the purposes for reusing. Building up capacities, from national government down to communities is necessary for installing and maintaining the treatment technologies.

[2] United Nations Economic and Social Commission for Asia and the Pacific, *Genetic Guideline to an Eco-efficient Approach to Water Infrastructure Development* (Bangkok. UNESCAP and KOICA, 2011).

Offer favourable financial support: To overcome financial constraints, cooperation with the private sector is necessary: financial support, such as subsidies, microfinance and leasing, supports the distributed application of water reuse systems. With initial installation costs relatively high, community ownership may be a viable option. Additionally, policymakers will need to set a price for freshwater and wastewater treatment at a level that promotes water reuse.

Maintain a good overview of the whole system: Because the basic principle of water reuse is to overcome an inefficient mismatch of water sources and uses, a careful balancing act is required to match available water sources with specific needs and with the appropriate quality and technology. Policymakers need to look at the whole water system. And they need to see that water reuse is critical to integrating and optimizing a water system; it affects both the inflow of freshwater and the wastewater effluent in the urban water cycle.

Examples

***Greywater*[3] *reuse with planted filter (wetland), Kathmandu Valley, Nepal*[4]:** In the Kathmandu valley, household wastewater ran into and polluted the rivers due to the inadequate reach of the centralized wastewater treatment system. There was a significant deficit in water demand[5] due to the use of freshwater for non-potable purposes, such as irrigation, washing cars and flushing toilets. To overcome the problem, a wetland system (planted filter) was tested to prove the efficiency of greywater reuse (wastewater generated from such domestic activities as laundry, dishwashing and bathing). The project led to a savings of 500 litres of potable water a day per household and US$40 reduction in household expenditure for the year. Based on this calculation, the initial cost of the system could be paid back within ten years. The project proved that the system contributes to relieving water demand deficit, particularly in regions where urban space for planted filters was available and could cover the initial costs.

***Turning used water into safe potable water, NEWater in Singapore*[6]:** Singapore has significantly depended on imported water from Malaysia for decades. But when one of its water treaties with Malaysia expired in 2011 and water demands were expected to rise to 400 million gallons a day by 2012 (from 300million in 2008), the Government began looking for other options. It latched onto recycling to build more resilient water security in an eco-efficient manner. NEWater is the brand name for reclaimed water produced by Singapore's Public Utilities Board. More specifically, it is treated wastewater (sewage) that has been purified using dual-membrane (via microfiltration and reverse osmosis) and ultraviolet technologies, in addition to conventional water treatment processes. The quality of NEWater consistently exceeds the requirements set by the US Environmental Protection Agency and the World Health Organization guidelines and is cleaner than the other sources of Singapore's water.[7] There are 5 NEWater plants in Singapore that now meet 30 per cent of Singapore's total water demand. By 2060, NEWater is projected to provide half of Singapore's water demand.[8]

Further reading

Urban Water CycleProcesses And Interactions: Technical Documents, IHP-VI Technical Document in Hydrology No. 78, by J. Marsalek and others (Paris, UNESCO, 2006). Available from www.infoandina.org/system/files/recursos/urban_water_cycle.pdf.

Genetic Guideline to an Eco-Efficient Approach to Water Infrastructure Development (UNESCAP and KOICA, 2011).

[3] Greywater is household wastewater from domestic activity, such as laundry, dishwashing and bathing.

[4] A. Morel and S. *Diener Greywater Management In Low And Middle-Income Countries, Review of Different Treatment Systems for Households or Neighbourhoods*, Sandec Report No. 14/06 (Dubendorf, Switzerland, Swiss Federal Institute of Aquatic Science and Technology, 2006). Available from www.susana.org/lang-en/library?view=ccbktypeitem&type=2&id=947 (accessed 22 February 2012).

[5] According to A. Morel and S. Diener, the water demand in Kathmandu is about 150 million litres per day, with 90 million litres available.

[6] Cezar Tigno, *Country Water Action: Singapore NEWater: From Sewage to Safe* (Manila, Asian Development Bank, 2008). Available from www.adb.org/Water/Actions/sin/NEWater-Sewage-Safe.asp (accessed 2 February 2012).

[7] Singapore, Public Utilities Board website "Membrane Technology" (28 December 2011). Available from www.pub.gov.sg/research/Key_Projects/Pages/MembraneTechnology.aspx (accessed 2 February 2012).

[8] Singapore, Public Utilities Board website "NEWater"(28 December 2011). Available from www.pub.gov.sg/about/historyfuture/Pages/NEWater.aspx (accessed 2 February 2012).