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Water demand management overview

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Abstract:

This article provides an overview of water demand management, highlighting its importance in optimizing water usage, reducing waste, and ensuring the sustainability of water resources. Water demand management involves implementing various strategies, including water conservation, leakage reduction, demand-based pricing, public awareness, water recycling, rainwater harvesting, and efficient agricultural practices. The article explores the application of demand management in different sectors, such as households, irrigation, and industries. It emphasizes the need for accurate data, decision-making processes, and regulatory measures to effectively manage water demand.

The benefits of water demand management include economic advantages, environmental protection, climate change adaptation, and enhanced water security. The article also acknowledges the challenges in implementing demand management, particularly in underdeveloped regions, and suggests the integration of both water supply and demand management approaches. Finally, it discusses the projected increase in urban population and the significance of water demand management in addressing water scarcity issues and ensuring the adequacy of water supply infrastructure for growing urban areas.

Keywords:Water management, Water demand, Water supply, Water demand management, Water use,

1.Introduction

Water demand management doesn't only refer to the implementation of policies or measures which serve to control or influence the amount of water used. Water Demand Management (WDM) requires a holistic approach that recognizes the complexity of the inter-relationships among all the factors affecting water demand. It calls for the creation of an enabling environment based on an adequate set of mutually supportive policies and a comprehensive legal framework with a coherent set of incentives and regulatory measures to support these policies.

Until relatively recently problems with water supply-demand balance were typically addressed through "supply augmentation", that is to say, building more dams, water treatment stations, etc. As long as water resources were considered abundant and the needs of the natural environment were ignored this reliance on the "engineering paradigm" made sense(1). Moreover, water utilities and governments have long preferred large capital projects to the less profitable and more difficult challenges of improving system efficiency (e.g. leakage reduction) and demand management. Water demand management came into vogue in the 1990s and 2000s at the same moment dams and similar supply augmentation schemes went out of fashion because they were increasingly seen as overly expensive, damaging to the environment, and socially unjust.

Now, in the 2020s, it is accurate to say that demand management is the dominant approach in the richer countries of North America and Europe, but is also becoming more popular in less affluent countries and regions.

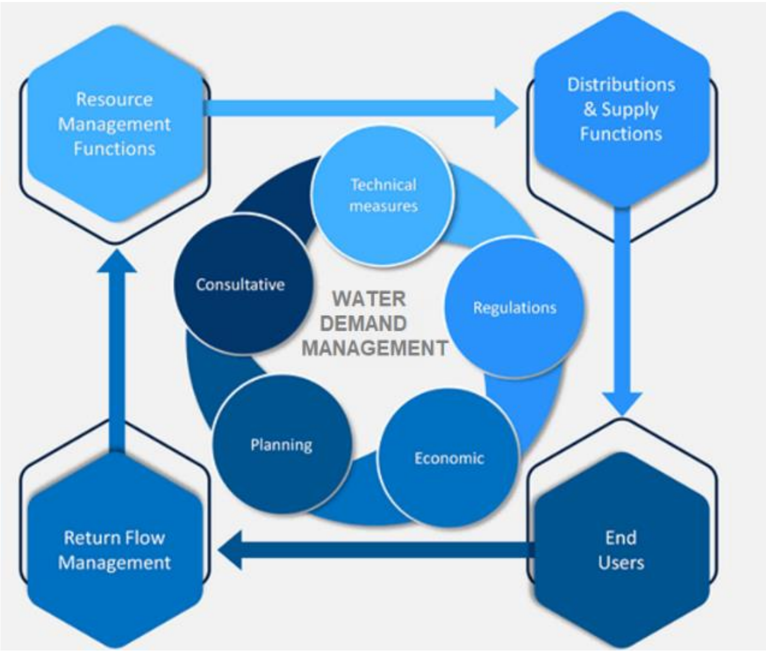

Figure 1.Water Demand Management

2.Definitions

At its heart, demand management is about forecasting demand for goods and services and planning how that demand will be met. In many applications, demand management is also increasingly about reducing or moderating demand (e.g. water, energy, acute clinical health services, etc.). In energy demand management, for example, the offer of cheaper off-peak energy tariffs is a common method for shifting energy demand away from peak periods and towards periods when there is surplus energy available.

Water demand management depends on a better understanding of exactly how much water different users are using for different purposes (the quantitative challenge) and on users' decision-making processes (the qualitative challenge). With these sorts of data it is possible to create policies, at a utility-scale (usually a city-region) or national scale (government), to promote reductions in user demand. If skillfully done, such policies can address supply-demand imbalances by reducing demand to available supply, though the risk of negative impacts on utilities, consumers and the environment are all too real. There are three basic approaches to water demand management policy and one key challenge, all of which are discussed below with reference to the key sectors where water demand management is practiced: domestic, agricultural and industrial.

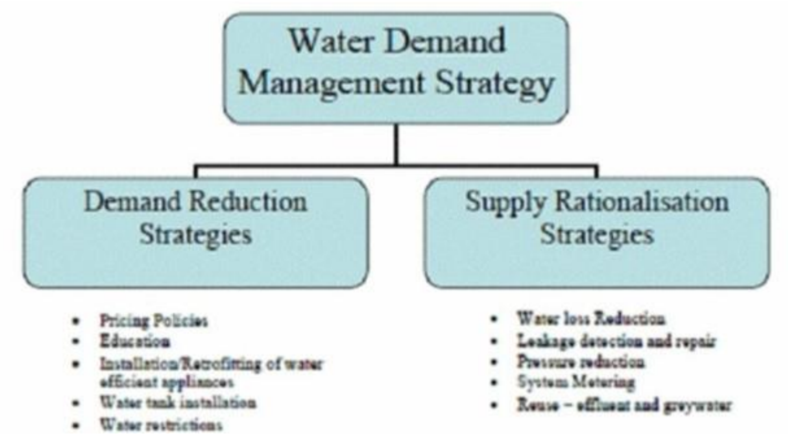

Figure 2.Water demand management strategy [10].

Water demand management refers to a set of strategies and measures aimed at optimizing water usage, reducing water waste, and ensuring the sustainability of water resources. It involves implementing practices and policies that promote efficient water use, conservation, and the equitable distribution of water among various sectors and users.

The goal of water demand management is to meet current and future water needs while minimizing the negative environmental, economic, and social impacts associated with excessive water consumption.

3.Water Demand Management Strategies

Water demand management typically involves a combination of technical, regulatory, and educational approaches. Some common strategies include:

- ***Water Conservation:*** Encouraging individuals, households, businesses, and industries to use water more efficiently by adopting technologies and practices that reduce water consumption, such as low-flow fixtures, water-efficient appliances, and irrigation systems.
- ***Leakage Reduction:*** Identifying and repairing leaks in water supply systems to minimize water losses and improve overall system efficiency.
- *Demand-based Pricing:* Implementing pricing structures that reflect the true value of water and encourage responsible use. This can involve tiered pricing, where higher volumes of water usage are charged at higher rates, or seasonal pricing to incentivize water conservation during periods of high demand.
- ***Public Awareness*** *and Education:* Raising awareness about the importance of water conservation and providing information on efficient water use practices through public campaigns, educational programs, and outreach initiatives.
- ***Water Recycling and Reuse:*** Promoting the use of treated wastewater for non-potable purposes such as landscape irrigation, industrial processes, and toilet flushing, reducing the demand for freshwater sources.
- ***Rainwater Harvesting****:* Capturing and storing rainwater for later use, particularly in areas with limited water resources, to supplement traditional water supplies.
- ***Efficient Agricultural Practices:*** Encouraging farmers to adopt irrigation methods that minimize water loss, such as drip irrigation and precision farming techniques, and promoting the use of drought-tolerant crops.

By implementing these strategies and others, water demand management aims to create a more sustainable and resilient water supply system, reducing water stress and ensuring water availability for future generations.

3.1.Household water demand management

Household water demand management refers to the practices and strategies implemented by individuals and households to effectively manage and reduce water consumption. It involves adopting water-efficient habits, using water-saving technologies and appliances, and implementing conservation measures to minimize water waste and ensure sustainable water use within the household. Household water demand management measures includes installing water-efficient devices such as low-flow showerheads, faucet aerators, dual-flush toilets. leak detection repair,behavioral changes, rainwater harvesting, greywater recycling, water-wise landscaping, education and awareness,advanced metering and monitoring, water-efficient gardening

3.2.Irrigation water demand management

Agricultural water use is vastly larger than industrial or domestic water use globally and in most countries, therefore irrigation water demand management is an important topic. As with domestic water demand management lack of appropriate data is a frequently encountered problem signaling the importance of measuring water usage at the farm and distributor level and at appropriate time steps. As a historical aside, there is evidence from both historical and archaeological records of technology development for water allocation and assessment in India, the Arabian Peninsula and Peru.

Two major themes dominate research in irrigation water demand management: attempts to understand, and manipulate, farmers' irrigation decision-making and understanding optimal irrigation strategies for specific crops or environments(2,3).

3.3.Industrial water demand management

Water demand management in the industry is managed primarily through the regulation of water abstraction (especially for large industrial water users) and the regulation of wastewater discharge. In many countries, large water users can apply for permits to directly remove ="abstract"- water from the natural environment for industrial purposes.

A common example is the energy industry which requires large volumes of water for cooling purposes in thermal and hydropower electricity generation facilities. In the UK electricity generators are responsible for more than half of all licensed water abstraction. In other countries, the proportion of abstraction earmarked for electricity generation varies widely, but it is almost always a significant factor in the overall water supply-demand balance(4). Many studies of this water-energy nexus focus on process optimization or input substitution(5).

An important part of industrial water demand management is the encouragement of "closed loop" processes within facilities. For example, in textiles production, which uses significant volumes of water for washing and dying, closed loop principles in water use reduce both the total demand for new abstractions and the risk to the natural environment from inadequately treated wastewater. Such approaches however require significant capital investment, especially in modern multi-stage wastewater treatment, and are not yet universal in textiles facilities around the world.(6,7)

4.Conclusions

Water is a finite resource, and with a growing population and increasing water scarcity in many regions, it is crucial to manage water demand effectively. Water demand management focuses on optimizing water use, minimizing waste, and ensuring the long-term sustainability of water resources. Water demand management helps protect and preserve natural ecosystems that rely on adequate water supplies.

Efficient water use can lead to economic benefits at various levels. Water demand management plays a crucial role in adapting to climate change effects by promoting resilient water practices, reducing vulnerability, and enhancing water security in the face of a changing climate.

Overall, effective water demand management is essential for ensuring sustainable water use, protecting the environment, and meeting the needs of growing urban populations. By implementing water-saving practices, raising awareness, and investing in efficient infrastructure, cities can address the challenges posed by rapid urbanization and secure water resources for future generations.

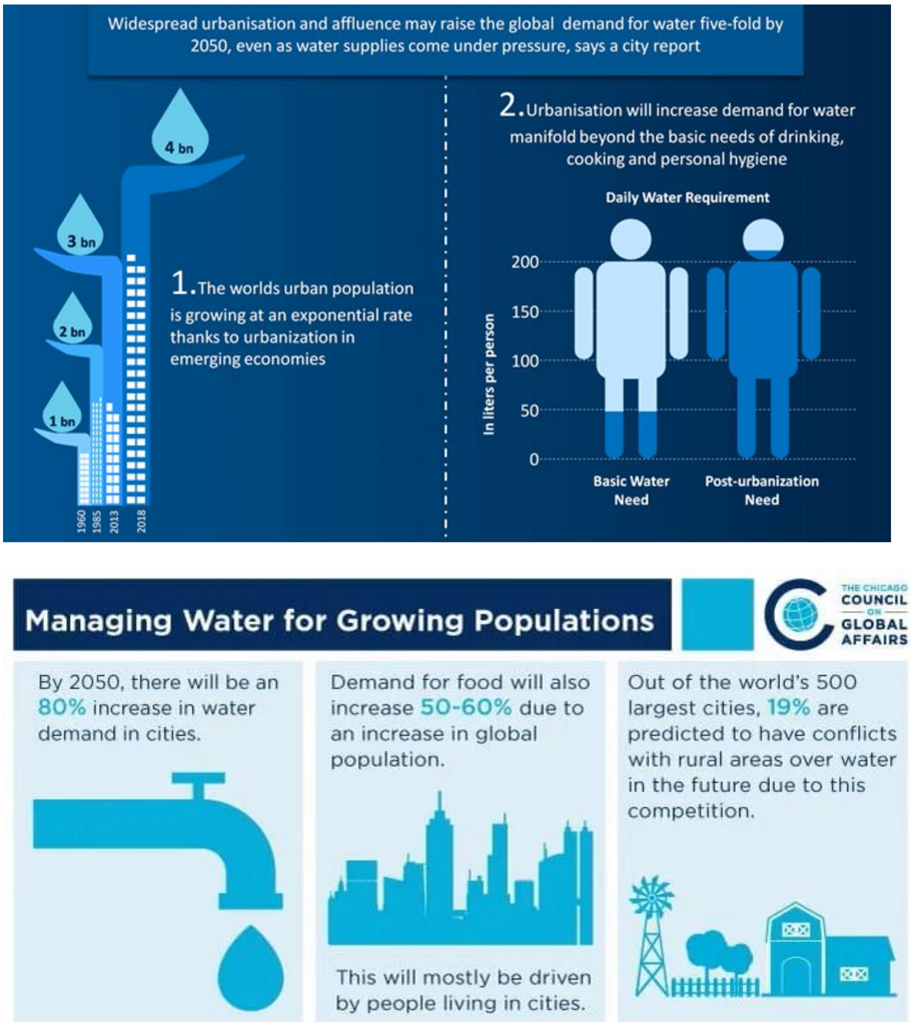

Figure 3.Growing World urban population and basic water need.[11]

It is projected that a significant portion of the world's population will reside in urban areas by 2050. The United Nations estimates that approximately 68% of the global population will live in urban areas by that time[8]. Many cities already face water scarcity issues due to limited freshwater resources or overexploitation of existing sources Rapidly growing cities experience an influx of residents, resulting in increased water demand. Without effective water demand management, the existing water supply infrastructure may become insufficient to meet the growing population's needs. Managing water demand helps ensure that water resources are utilized efficiently and sustainably, reducing the strain on existing infrastructure.

Overall, water demand management is vital for the sustainable and responsible use of water resources, ensuring their availability for future generations, protecting ecosystems, and addressing the challenges posed by water scarcity and climate change.

Despite many advantages of water demand management, it is difficult to fully implement, especially in underdeveloped and developing countries. For this reason, during a certain period of time , water supply management and demand management should be applied together in these countries. As the institutional and legal infrastructure of water management develops, the application of water demand management can become more widespread.

References

[1] Staddon, Chad (2016). Managing Europe's water resources: twenty-first century challenges. London: Routledge. ISBN 9781315593548.

[2] Karami, Ezatollah (January 2006). "Appropriateness of farmers' adoption of irrigation methods: The application of the AHP model". Agricultural Systems. 87 (1): 101–119. doi:10.1016/j.agsy.2005.01.001.

[3] Sun, J.; Li, Y.P.; Suo, C.; Liu, Y.R. (May 2019). "Impacts of irrigation efficiency on agricultural water-land nexus system management under multiple uncertainties—A case study in Amu Darya River basin, Central Asia". Agricultural Water Management. 216: 76–88. doi:10.1016/j.agwat.2019.01.025. S2CID 159274700.

[4] Liu, Lu; Hejazi, Mohamad; Patel, Pralit; Kyle, Page; Davies, Evan; Zhou, Yuyu; Clarke, Leon; Edmonds, James (May 2015). "Water demands for electricity generation in the U.S.: Modeling different scenarios for the water–energy nexus". Technological Forecasting and Social Change. 94: 318–334. doi:10.1016/j.techfore.2014.11.004.

[5] DeNooyer, Tyler A.; Peschel, Joshua M.; Zhang, Zhenxing; Stillwell, Ashlynn S. (January 2016). "Integrating water resources and power generation: The energy–water nexus in Illinois". Applied Energy. 162: 363–371. doi:10.1016/j.apenergy.2015.10.071.

[6] Bidu, J. M.; Van der Bruggen, B.; Rwiza, M. J.; Njau, K. N. (15 May 2021). "Current status of textile wastewater management practices and effluent characteristics in Tanzania". Water Science and Technology. 83 (10): 2363–2376. doi:10.2166/wst.2021.133. PMC 2021. PMID 34032615.

[7] Sözen, Seval; Dulkadiroglu, Hakan; Begum Yucel, Ayse; Insel, Guclu; Orhon, Derin (April 2019). "Pollutant footprint analysis for wastewater management in textile dye houses processing different fabrics". Journal of Chemical Technology & Biotechnology. 94 (4): 1330–1340. doi:10.1002/jctb.5891. S2CID 104299263.

[8]UN DESA- “68% of the world population projected to live in urban areas by 2050, says UN” 16 May 2018 available at https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html

[9] Turner, A., Willetts, J., Fane, S., Giurco, D., Kazaglis, A., and White S., (2008). Guide to Demand Management. Prepared by the Institute for Sustainable Futures, University of Technology, Sydney for Water Services Association of Australia Inc.

[10] Shafique S.M.,(2015)" Demand Side Water Management & Water Crisis in Pakistan" Sept. 14 2015. Available at https://www.linkedin.com/pulse/demand-side-water-management-crisis-pakistan-muhammad-s-shafique/

[11] AQUA TECH 2019 Sustainable Water: Our Essentıal Guide To Sustainable Water Resource Management Solutions & Strategıes Monday, 19 August 2019.available at https://www.aquatechtrade.com/news/water-treatment/sustainable-water-essential-guide

Biography

Dursun Yıldız (Msc.) is a hydropolitics specialist and Director of the Hydropolitics Academy Association located in Ankara-Turkey.He is a civil engineer and used to be Deputy Director at State Hydraulic Works in Turkey; completed a hydroinformatics post graduate course at the IHE in Delft, a Technical training program in USBR-USA, and a master's degree in Hydropolitics at the Hacettepe University-Turkey. He has over 5 years of teaching experience in some Turkish Universities and now works as head of his own Hydro Energy & Strategy consulting company located in Ankara. He has published several international articles and 15 books. He received the Most Succesful Researcher Award on International Water Issues from Turkish Agricultural Association in 2008 and from the Central Union of Irrigation Cooperatives in 2016. He received the Professional Services Award of Excellence from İstanbul Çekmeköy Rotary Club in 2021. He becomes a part-time lecturer at the IZTECH International Water Resources Department in In the 2020-2021 academic year

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