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Water Reuse in a Circular Economy Context

THEME III

Water Reuse and Water Quality Challenges/ barriers

KEY POLICY MESSAGES

- The physical, chemical, and biological characteristics of reused water must match the use to which it is put.
- Wastewater can boost crop yields without harm if pathogens, salts, and other pollutants are removed.
- Mainstreaming water reuse requires broad cooperation and coordination across government levels.

This policy brief captures the key messages from: UNESCO and UNESCO i-WSSM. 2020. Water Reuse within a Circular Economy Context (Series II). Global Water Security Issues (GWSI) Series- No.2, UN ESCO Publishing, Paris, 2020. unesdoc.unesco.org/ark:/48223/pf0000374715.locale=en

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In a circular economy, wastewater is reused so it is no longer a 'waste' but, instead, becomes a resource that can improve the availability of water for populations, industry, and agriculture. Water reuse can reduce the need for water withdrawals, while decreasing the volume of effluents discharged into waterways.

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TRANSFORM WASTEWATER INTO VALUABLE RESOURCES

Worldwide, 80% of wastewater flows untreated back into the environment resulting in 1.8 million people with contaminated drinking water sources. Poor water quality has significant implications for public health, environmental sustainability, and social equity. Wastewater recycling holds the potential to improve water quality and ecological conditions by reducing the volume of untreated wastewater released to the environment.

Water reuse is an opportunity to not only take advantage of the environmental and health benefits of wastewater treatment, but to also transform polluted wastewater into valuable resources. Many components in wastewater can be recovered for beneficial purposes, starting with the water itself, followed by nutrients (nitrogen and phosphorus) and energy. Sale of these resources can increase project revenues or offset costs of wastewater treatment operations.

MATCH WATER QUALITY TO THE INTENDED WATER USE

Wastewater can be treated to different qualities to satisfy the demand from different sectors–agriculture, the environment, industry, and even human consumption. The reused water must have adequate physical, chemical, and biological characteristics for each use whether it is to recharge aquifers, supply agricultural systems, support industrial processes, irrigate parks and gardens, wash streets, or to supply drinking water. Many of these applications do not require water that meets potable quality standards, which can be costly to achieve.

Lower industrial demands on potable supply
Industries can often reuse wastewater generated from internal processes. Reuse can provide facilities with greater control over their water supply and wastewater treatment costs. It may also reduce or even eliminate the need to source water from external supplies and also offer opportunities to recover energy. A full assessment that considers the reduced risk of water insecurity, energy recovery potential, and other positive externalities can demonstrate that water reuse is an economically viable and preferred approach for many industries.

Maximize benefits and reduce harm from applying reused water to crops
Properly treated, wastewater from virtually any activity, including agriculture itself, can be reused for irrigation. It can improve crop yields and quality due to the nutrients available in wastewater to help meet the nutritional needs of crops.

Water reuse transforms polluted wastewater into valuable resources.

However, residual contaminants in treated wastewater also have the potential to harm crops, reduce soil quality, and pollute aquifers. For instance, depending on the water source, using recycled waters for irrigation practices can increase soil salinity over time, particularly in arid environments.

Best management practices, including soil amendments, soil aeration, monitoring, and crop selection, can mitigate negative impacts of wastewater irrigation. Water managers must analyse the water quality and treatment needs for agricultural application, which should at a minimum prevent contamination by pathogens, heavy metals, or other pollutants. In conjunction, farmers must consider the crop selection and soil properties when irrigating with reused water.

EXPLOIT EMERGING TECHNOLOGIES

As the requirement for holistic decision-making is expanded, the need for treatment technologies that can meet the challenges of water quality and efficient energy use become more apparent. Many water treatment processes require high energy inputs; however, on-going research holds the promise for increasing water quality at a lower cost. Advanced membrane-based technologies and forward osmosis technology are emerging options for lower energy consumption technologies. Deployment of these advanced technologies may challenge governments to revise technical standards and to assist with capacity development for implementation and use of the technologies.

Efficient and effective wastewater treatment operations that incorporate resource recovery from wastewater will increase the possibilities to explore innovative financing and sustainable business models that leverage circular economy principles.

SHIFT PUBLIC PERCEPTIONS

While technical solutions play a fundamental role in advancing water reuse, they represent only part of the solution. A major challenge to water reuse and the development of the resource recovery market is the negative perception of reclaimed water and recycled products, particularly from human waste. Public education, acceptance and engagement in water reuse activities are key to fully deploying reuse and recovery strategies.

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MAINSTREAM WATER REUSE IN GOVERNMENT INSTITUTIONS

Appropriate governance dimensions are key for the transition towards water in context of a circular economy – from raising awareness to engaging stakeholders, to developing appropriate information systems and adequate regulation.

Governments need to ensure they possess the institutional capacity to enforce environmental regulations such as water pollution control standards. Insufficient legislation, enforcement, regulation, and monitoring of wastewater result in excessive pollutants being released untreated into the environment. Without monitoring and enforcement of wastewater treatment and releases, it's difficult to incentivise wastewater and resource recovery initiatives since polluters can forego waste treatment costs without fear of fines, penalties, or other repercussions.

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Various sectors and levels of government share responsibilities for water use and reuse, complicating its regulation and application – policies and standards may be set by a national government, while local governments, which may not have enough technical expertise to assess or implement water reuse schemes, provide monitoring, and operations and maintenance of water services. Regulations in the water sector are often not aligned with the energy, health, industrial, and agriculture sectors. For example, electricity legislation in Bolivia requires complicated and costly administrative processes to produce electricity within the distribution network, restricting the ability of wastewater treatment plants to use methane produced during water treatment for electricity generation.

Most current water quality standards were not designed with wastewater reuse in mind. Wastewater regulations are often too restrictive, requiring the treatment of water to (almost) potable standards, rather than accommodating treatment to the quality required for reuse. More flexible governance structures that are suited to the objective of wastewater recovery investments should be introduced gradually to encourage innovative solutions and to create value from water reuse and resource recovery.

Mainstreaming water reuse requires broad cooperation and coordination across government levels. Taking a systems approach that examines wastewater as a subsystem of interconnected environmental, agricultural, industrial, and municipal systems may help foster policy coherence across sectors. Governments also need to work with stakeholders to understand perceptions about water reuse and to assess costs in a manner that takes into consideration externalities.

Unfortunately, many government agencies still consider wastewater in a negative light, as a hinderance or a substance to disposed of, rather than a resource. As a result, these agencies lack the political will to develop policies and regulations that support and incentivize wastewater reuse and resource recovery. Barriers due to knowledge and attitudes towards recycled water and the associated technologies still need to be overcome.

The quality and treatment of wastewater should align with its intended use. Government and public alike need to view wastewater as a resource not a nuisance. Only then can decision makers develop policies and regulations that support and incentivize wastewater reuse and resource recovery.

Public education, acceptance and engagement in water reuse activities are critical to success.

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