

Unlocking wastewater value across water, energy, and food systems

Manzoor Qadir



The water realities of our time

- **Water resources and population densities** are unevenly distributed across the world.
- **Water quality** across the world is deteriorating, particularly in water-scarce areas.
- **Climate change** is leading to rainfall uncertainty and extended drought periods, mostly in dry areas.



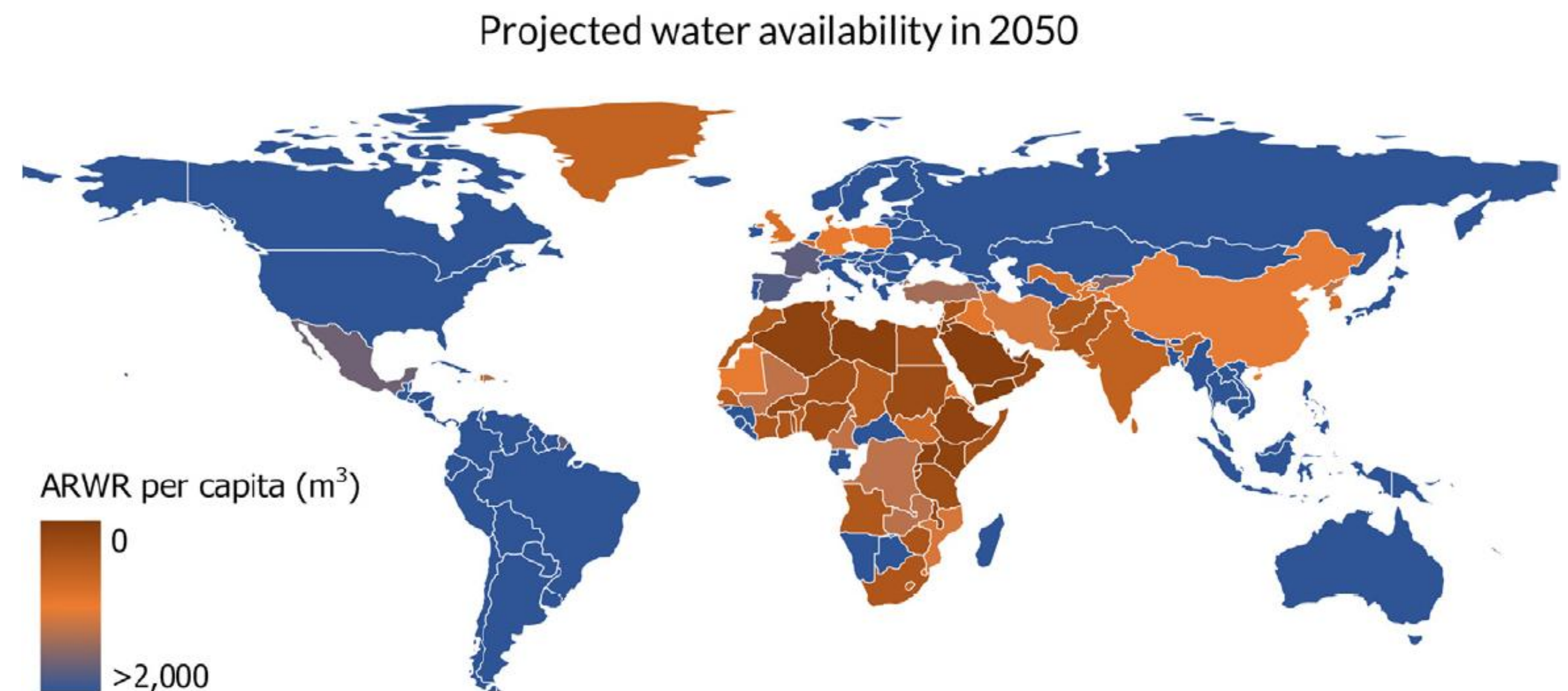
1 m³ = 1,000 L

ARWR: Annual Renewable Water Resources



The water realities of our time

- More than **two-third of the global population** is expected to face water scarcity by 2030.
- After Middle East and North Africa, Sub-Saharan Africa is expected to become next **hotspot of water scarcity**.
- The impacts of **running out of water** are multi-dimensional.



Options to address water scarcity challenge

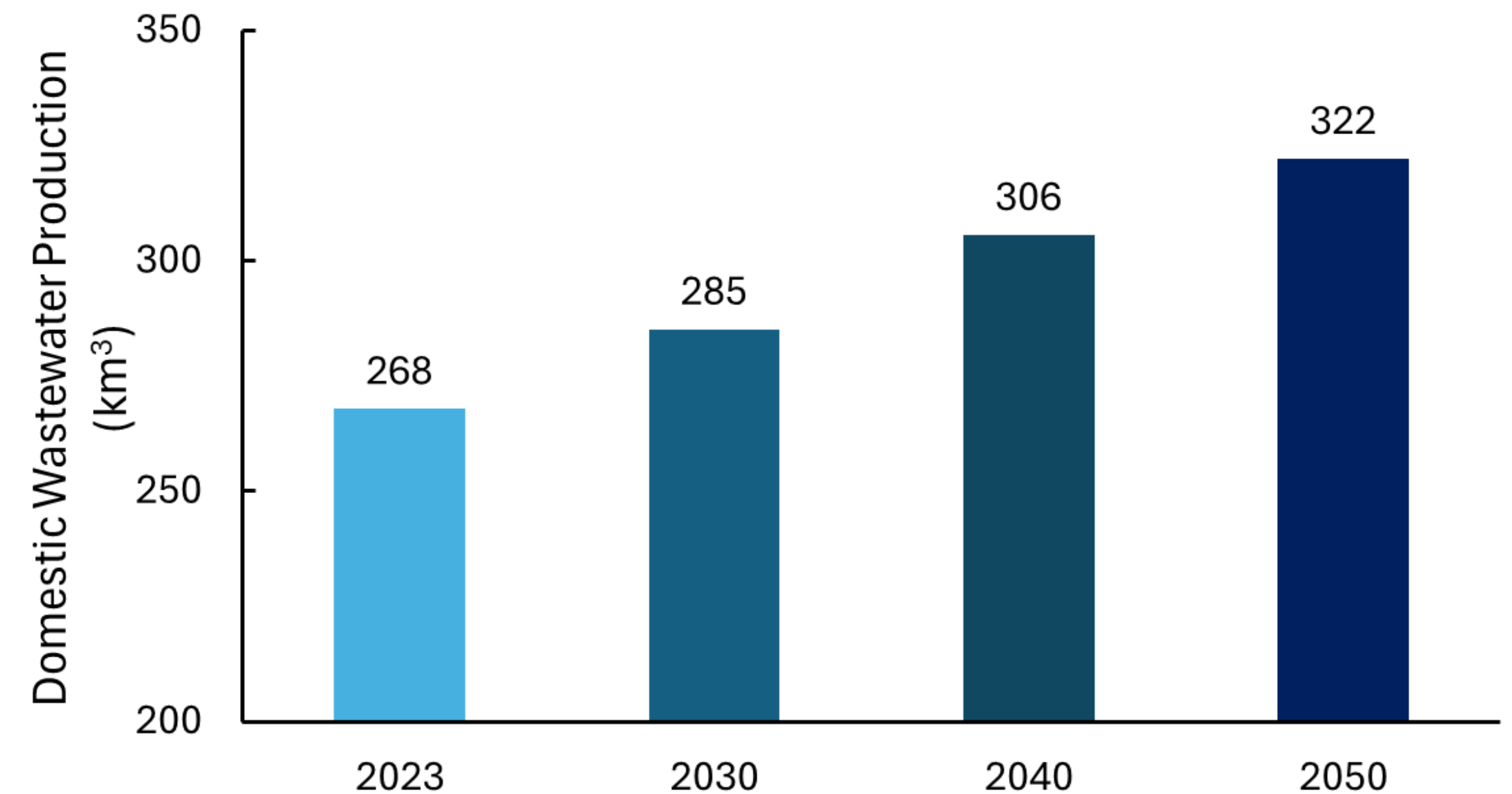
- **Conventional water resources** – *rainwater, snowmelt, river runoff, and easily accessible groundwater* – are not sufficient to meet growing water demand in arid regions.
- Arid-region countries and communities need to consider alternative – **unconventional water resources** – to narrow the water demand-supply gap.
- **Safe and productive use of urban wastewater** is a potential option to address water scarcity.



Wastewater status and stats

- Wastewater volumes continue to increase due to **population** increase, **urbanization**, economic **development**, and better **living standards**.
- **268 billion m³**; almost **3 times** the annual volume of water passing through **Niagara Falls**; about **7 times** the volume of **desalinated water**.
- Wastewater volume to reach **322 billion m³** by 2050.

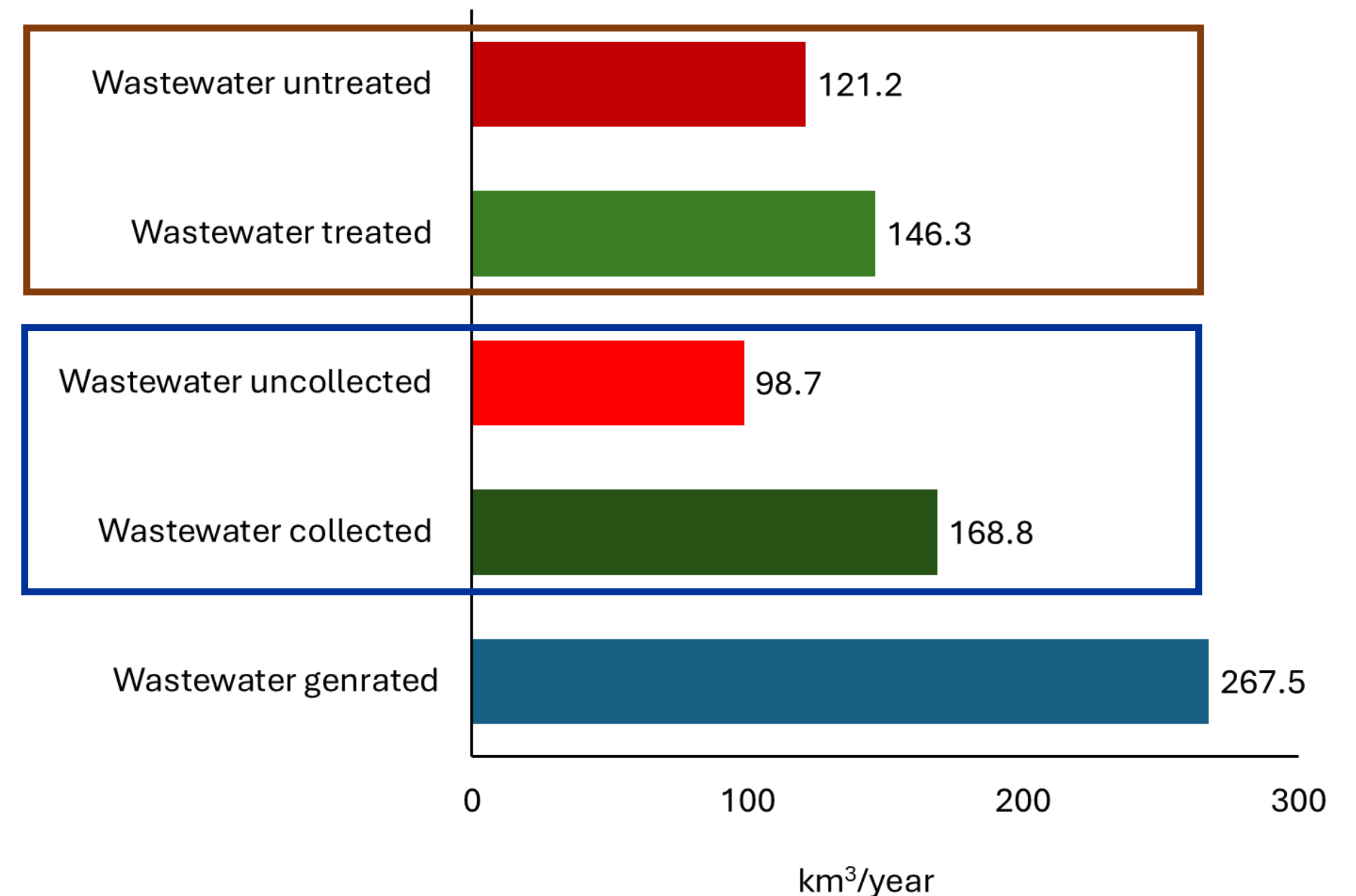
1 billion m³ = 1 km³



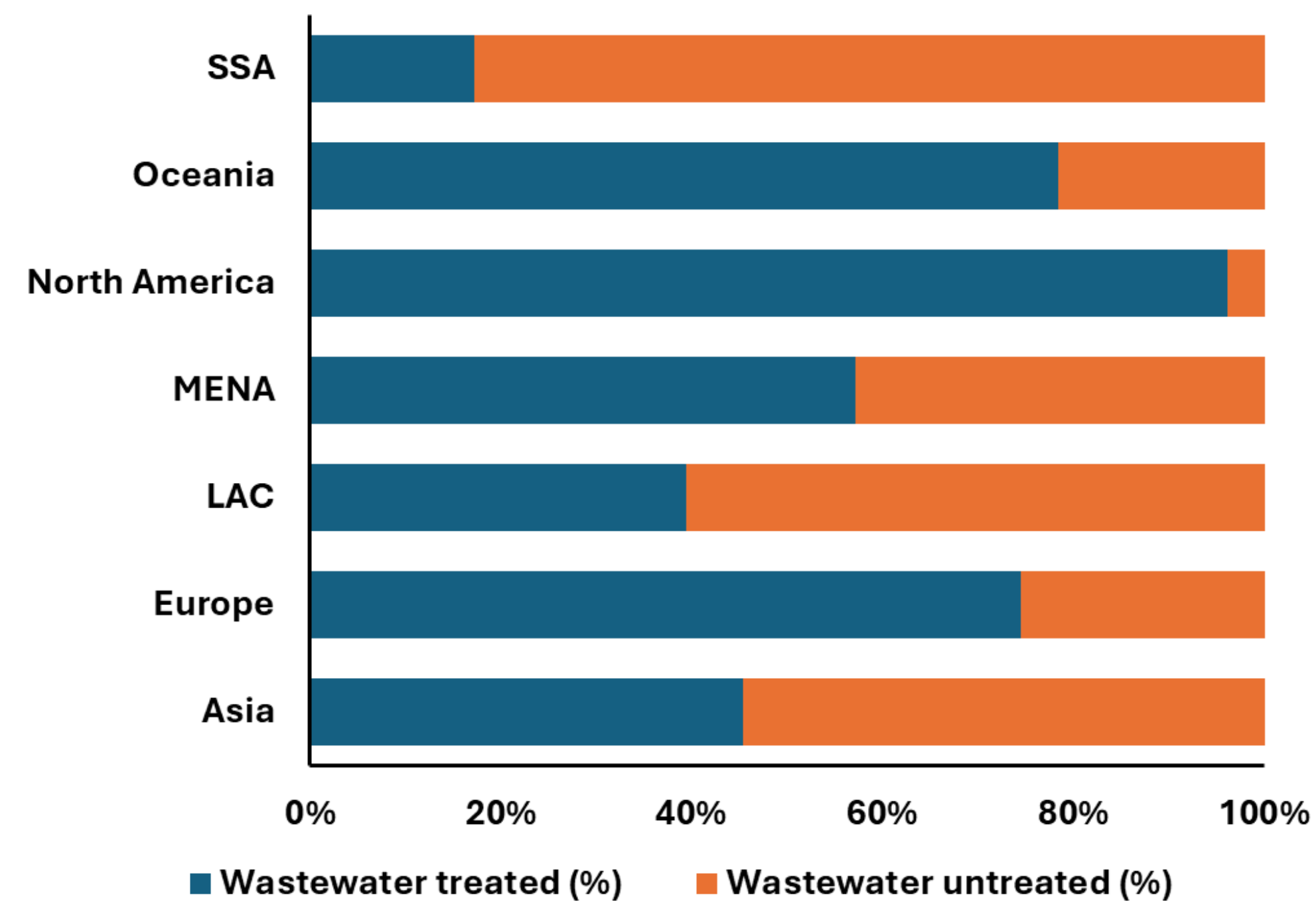
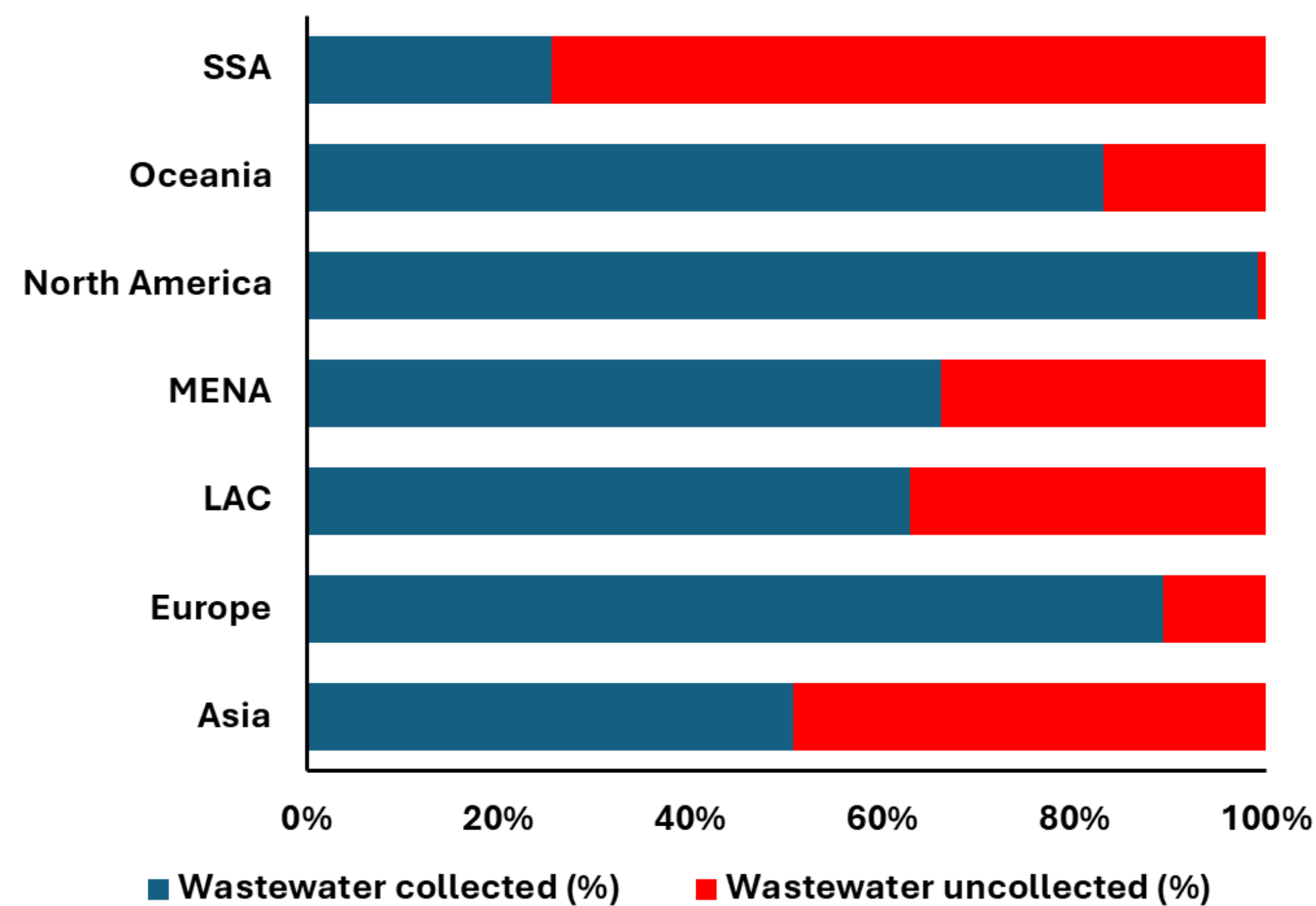
Source: Based on UN-Habitat and WHO (2024) and World Population Prospects (2024)

Potential of wastewater remains largely untapped!

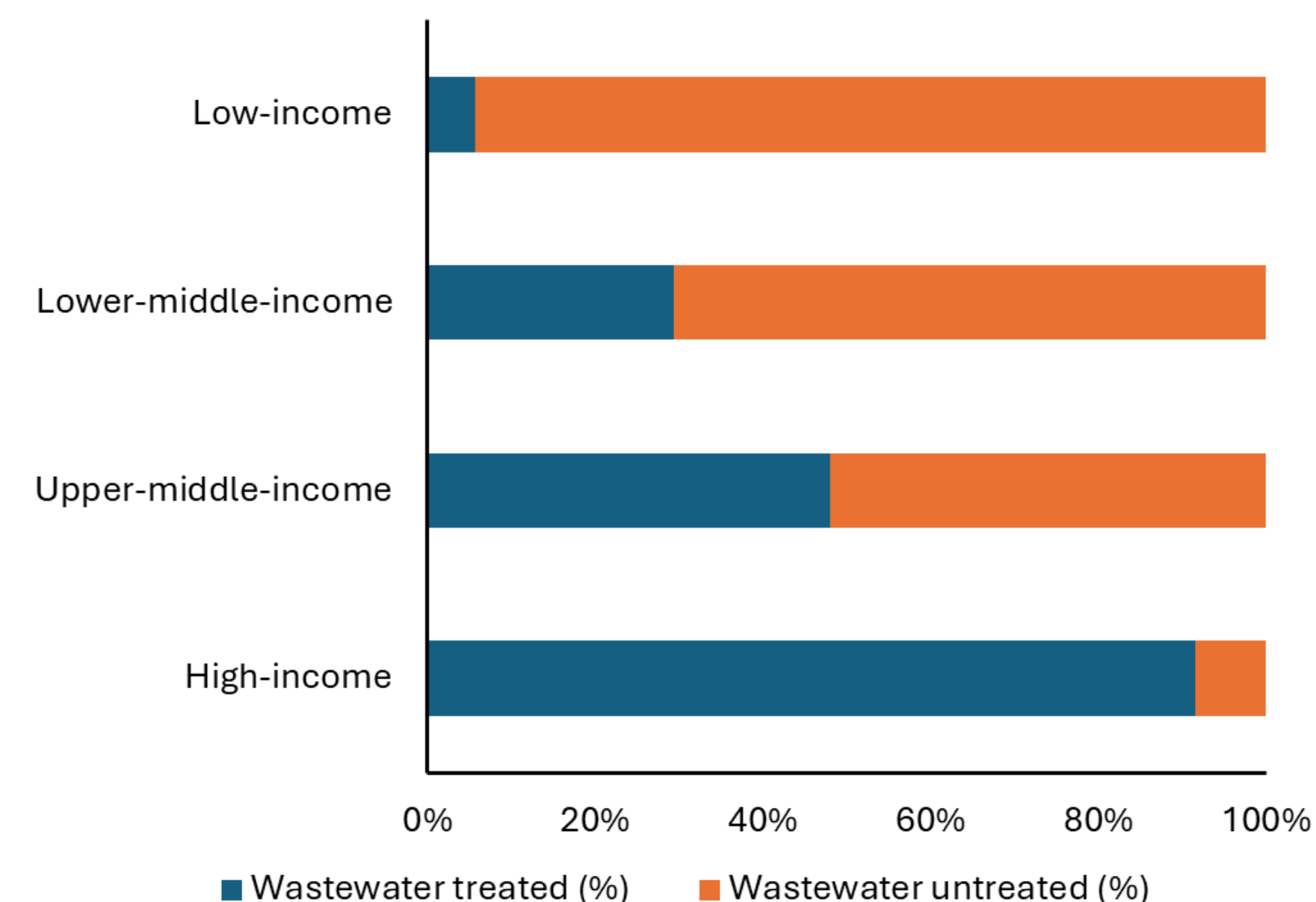
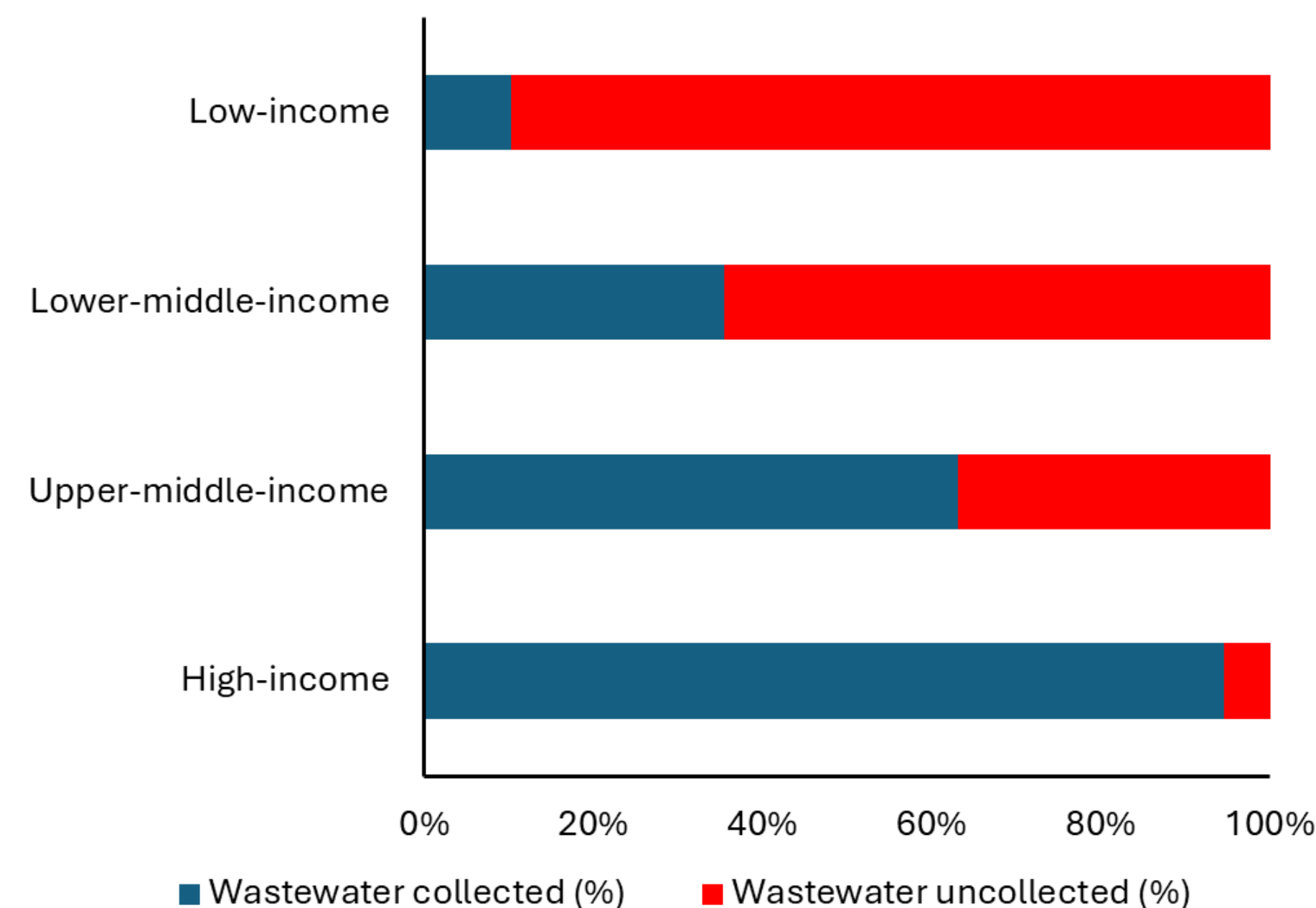
- 63% of the wastewater generated is collected while **37% remains uncollected**.
- 55% of the wastewater undergoes treatment while **45% is released to the environment untreated**.
- **Wastewater management guidelines** are partially implemented across the world.



Deep divide across geographic regions



Divide gets deeper across country income groups



Multiple challenges to wastewater management

- Little attention is being paid to **aging water and wastewater infrastructure**.
- **Wastewater composition** is changing significantly over time.
- **Climate change** is fast-tracking water quality deterioration.
- **Limited financial resources** and **lack of skilled human resources** are restricting management options.

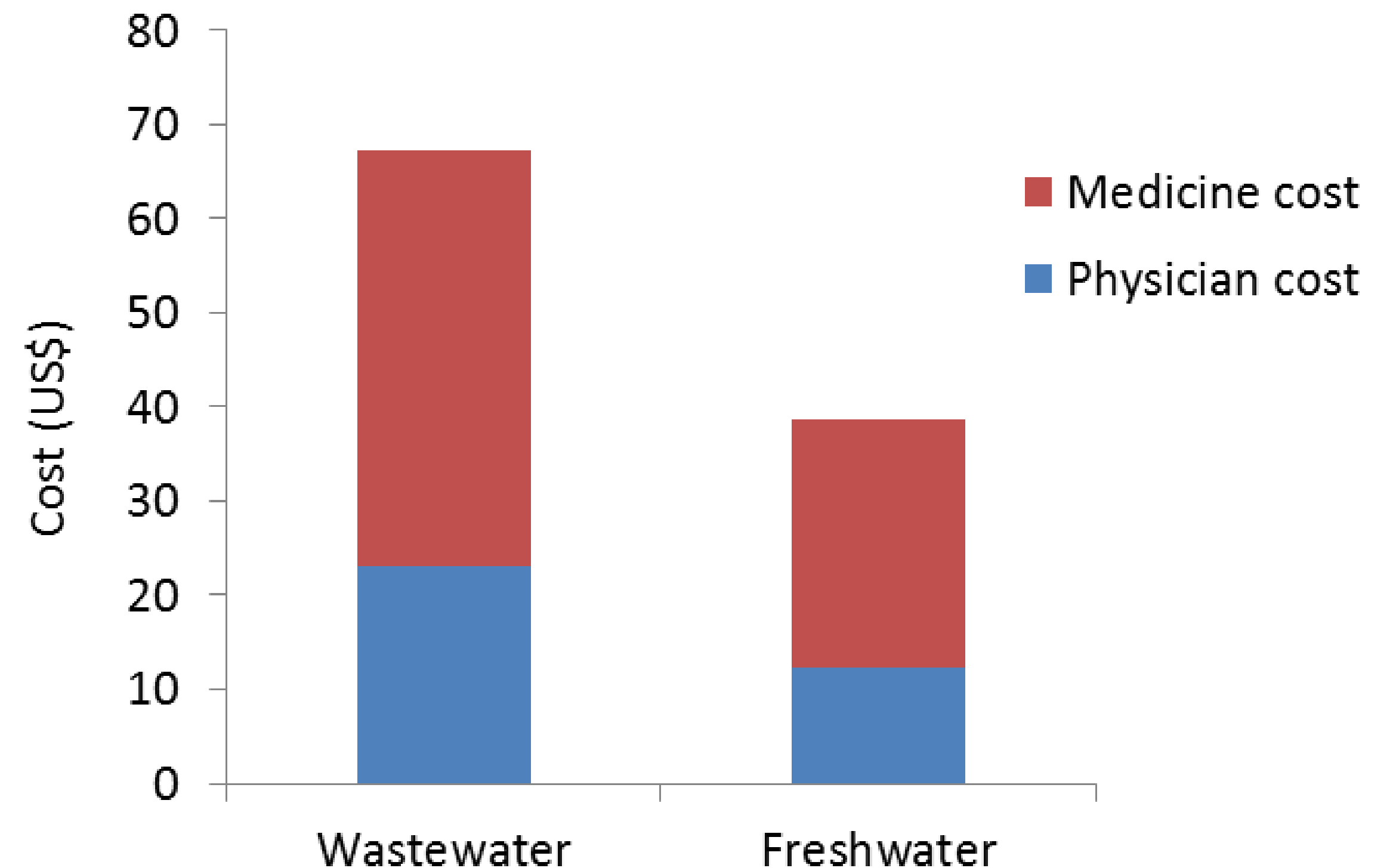


implementation and better coordination of efforts by governments, water authorities and healthcare



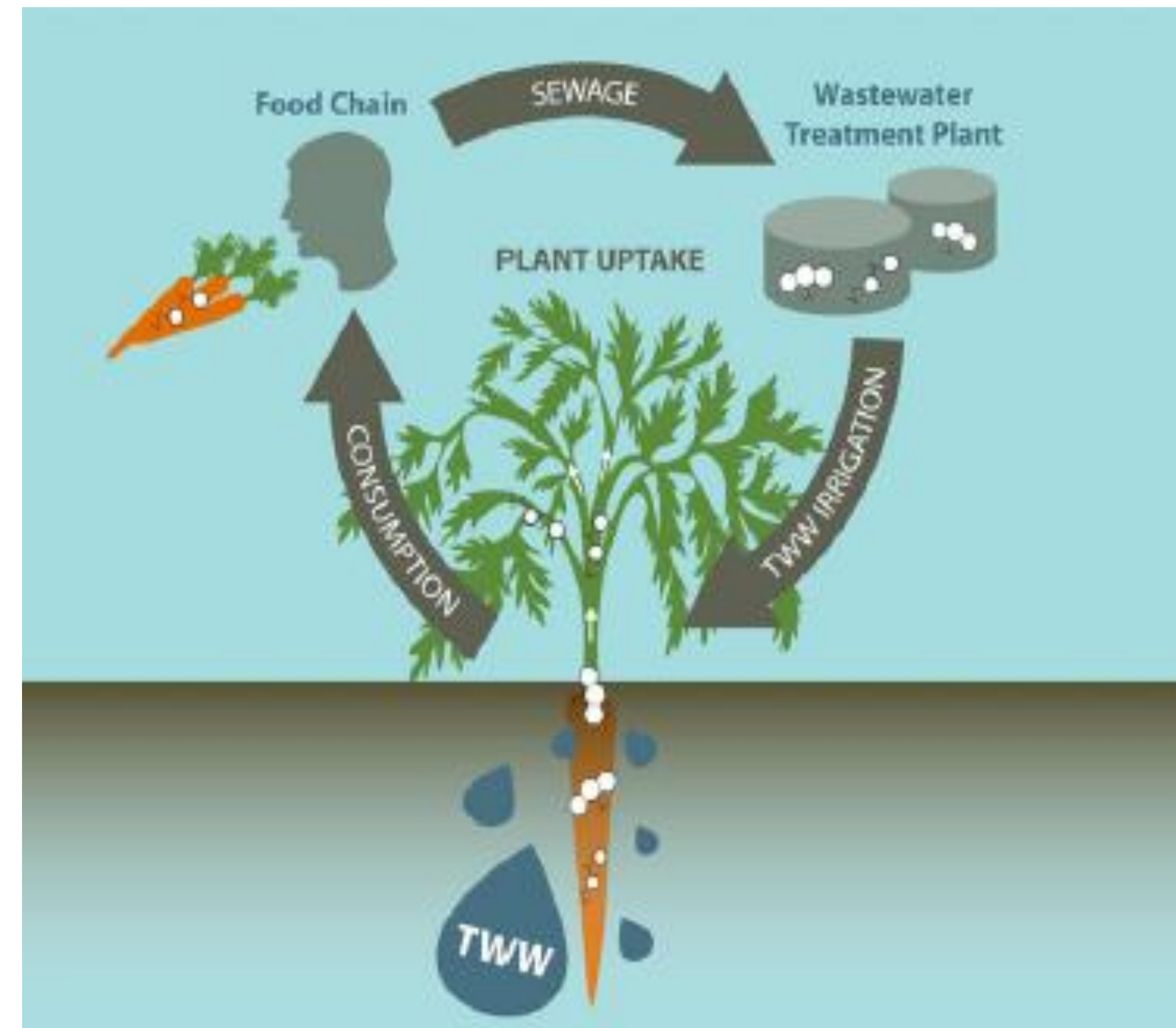
Increase in health cost in low treatment areas

- In areas with untreated or inadequately treated wastewater, local populations face:
 - Higher prevalence rates of water-borne diseases in wastewater areas than freshwater areas.
 - Health costs in wastewater areas 73% higher than freshwater areas.



Conventional treatment is not enough to eliminate all risks

- Emerging pollutants (Human pharmaceuticals, cosmetic products, microplastics) in wastewater are making conventional treatment less effective.
- Selecting appropriate crops in line with fit-for-purpose water reuse.
- Improving the quality of the reclaimed wastewater using advanced treatment options to significantly reduce human dietary exposure.



Word at large is offtrack in achieving SDG 6 and SDG 6.3.1 by 2030

SDG Target 6.3: “By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally”

SDG Indicator 6.3.1:
“Proportion of domestic and industrial wastewater flow safely treated”

UN-Water report: SDG6 on Water and Sanitation will not be achieved by 2030 at current rates of progress



Home » News » SDG6 update: the world is off-track

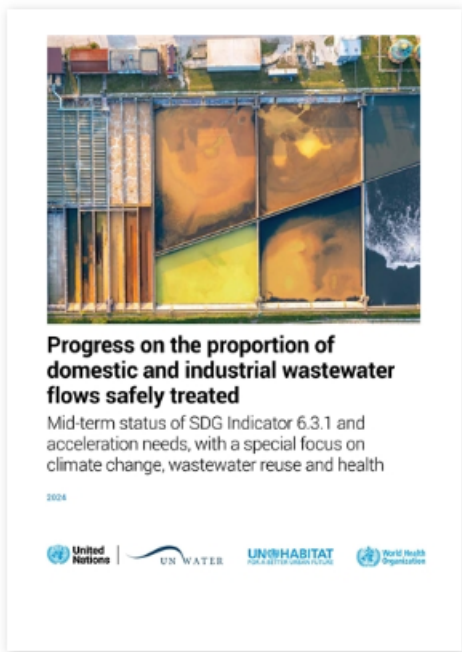
SDG6 update: the world is off-track

23 August 2021



The world is off-track on its journey to ensure water and sanitation for all by 2030, according to new progress updates launched today by the [UN-Water Integrated Monitoring Initiative for SDG 6 \(IMI-SDG6\)](#).

The 2021 Progress Updates are based on the '2020 Data Drive', coordinated by the IMI-SDG6, which received unprecedented levels of information from country focal points. The data show that we need to accelerate progress, in some areas up to four times faster, to meet SDG 6 within the next nine years.



Progress on the proportion of domestic and industrial wastewater flows safely treated – Mid-term status of SDG Indicator 6.3.1 and acceleration needs, with a special focus on climate change, wastewater reuse and health

Publication date: 2024

Health topics: [Sanitation](#), [Water](#)



Need to harness the potential of wastewater for fit-for-purpose use

- **Use in 4 major sectors (AAAA)**
 - **A**griculture
 - **A**quaculture
 - **A**groforestry
 - **A**quifer recharge
 - Other small uses in industrial processing, heating and cooling systems.
- Potential to irrigate **30 million ha** (without dilution)



Recovering nutrients and precious metals and reusing them

- Collectively, **8.3 tera-gram (Tg)** of nitrogen, phosphorus, and potassium are embedded in wastewater produced annually.
- Comparable to **25 times** the mass of the **Empire State Building**.
- Removing these nutrients would also be environmentally beneficial resulting in **minimized eutrophication**.



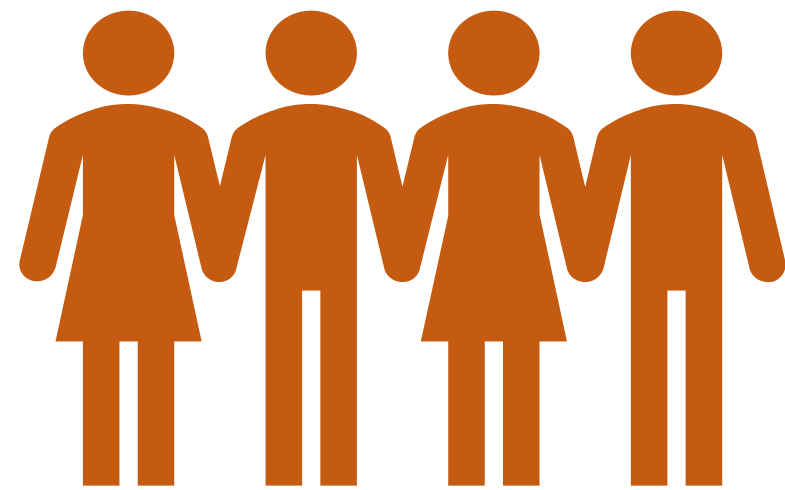
1 Tg = 1 million metric ton = 1 billion kg



Capturing energy from wastewater for multiple uses



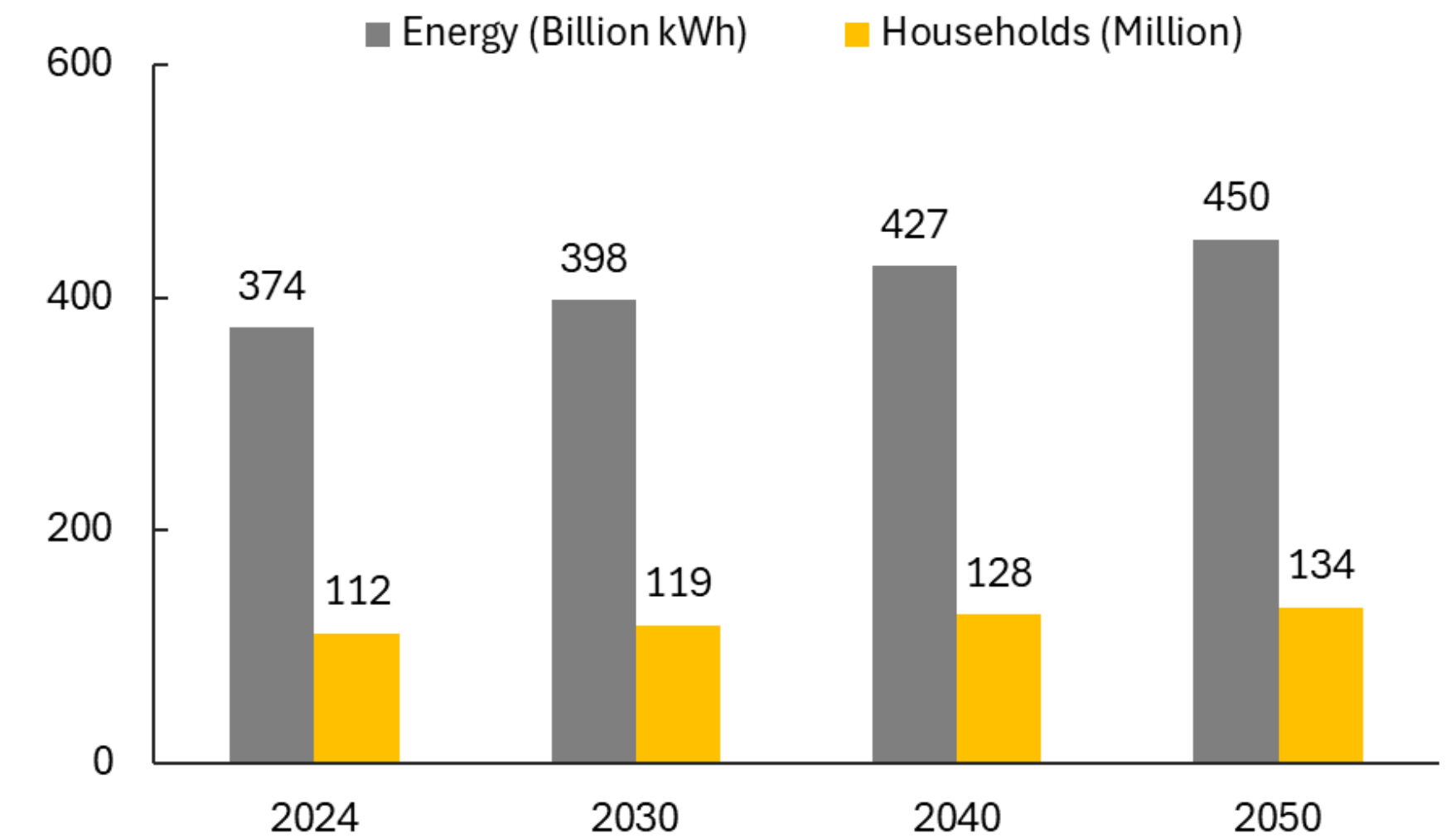
112 million households



374 million people



Energy neutral treatment plants



Strengthening policies and regulations, and institutional support

- Enhancing **political will** to address wastewater management.
- **Integrating** water recycling and reuse in water **policies** and practices.
- Promoting **flexible policy options** supporting safe and productive wastewater management.
- Incorporating **wastewater** in the national level water resources **accounting and water budgets**.
- **Overcoming institutional fragmentation** and providing clarity on roles and responsibilities.

United States Environmental Protection Agency

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Clean Water Act (CWA) Compliance Monitoring

EPA works with its federal, state and tribal regulatory partners to monitor and ensure compliance with clean water laws and regulations in order to protect human health and the environment. The Clean Water Act is the primary federal law governing water pollution.

On this page:

- Wastewater Management
 - Municipal Wastewater Overflows and Stormwater Management
 - Pretreatment
 - Stormwater
 - Discharges from Concentrated Animal Feeding Operations or CAFOs
 - Biosolids
- CWA Section 404
- Oil Spills and Spill Prevention

Related Information

- Compliance Monitoring Resources and Guidance Documents
- State Oversight Resources and Guidance Documents

Wastewater Management

The CWA's [National Pollutant Discharge Elimination System or NPDES](#) Program regulates point sources that discharge pollutants into waters of the United States. Compliance monitoring under the NPDES Program encompasses a range of techniques, from [Discharge Monitoring Report](#) reviews, to on-site compliance evaluation as well as providing assistance to enhance compliance with NPDES permits. The objective is to address the most significant problems and to promote compliance among the regulated community. The [NPDES Compliance Inspection Manual](#) provides information on how compliance inspections are conducted.

The European Parliament adopts provisional agreement on the Urban Wastewater Treatment Directive

Aqua Publica Europea welcomes the adoption of the provisional deal on the Urban Wastewater Trea. Directive (UWWTD) by the European Parliament yesterday. While some requirements remain challen, for water operators, the deal strikes a fine balance between environmental protection and technical feasibility, while introducing innovative provisions for a more equitable distribution of the costs that achieving new objectives will involve.



Integrating circular economy applications

- Growing **algae** in nutrient-rich wastewater for **biofuels**, **bioplastics**.
- Building climate resilience while using treated wastewater in **drought mitigation practices** to sustain agriculture and urban green spaces.
- Providing **ecosystem services** to sustain wetlands, and support fish and shrimp farming.
- Creating economic value by introducing **tax credits**, **subsidies**, or other **incentives** for industries and businesses adopting **circular wastewater management** practices.



Introducing effective financial mechanisms

- **Monetizing recovered resources** such as biogas, fertilizers, or reclaimed water.
- Moving gradually from **subsidies to full cost recovery** mechanisms for wastewater services.
- Creating **employment opportunities** in resource recovery, system maintenance, and innovation.
- **Promoting PPPs** and fostering collaborations between governments, businesses, and communities to finance and implement wastewater management systems.

BUSINESS MODEL 19

Enabling private sector investment in large scale wastewater treatment

Katharina Felgenhauer

Key characteristics

Model name	Enabling private sector investment in large-scale wastewater treatment
Waste stream	Wastewater treatment for reuse
Value-Added Waste Products	Treated wastewater for irrigation and a healthy environment
Geography	Water-scarce regions
Scale of production	Medium- to very large-scale
Supporting cases in the book	As Samra, Jordan
Objective of entity	Cost-recovery []; For profit [X]; Social/Environmental enterprise [X]
Investment cost range	USD 100–400 million
Organization type	Public-private
Socio-economic impact	High-technology setup and efficient, nearly energy neutral operation of waste-water treatment facility while maintaining affordable tariffs for water users
Gender equity	Socio-economic benefits for male and female population. All users benefit from affordable water tariffs



WATER GLOBAL PRACTICE

Wastewater: From Waste to Resource

The Case of Atotonilco de Tula, Mexico

Reuse of Treated Wastewater for Agriculture, Energy Generation, and Transfer of Value to Stakeholders in the Valley of Mexico

Context

The Valley of Mexico metropolitan area (Zona Metropolitana del Valle de México [ZMVM]) is the country's financial, political, and cultural epicenter. The ZMVM is the OECD's third largest metro area and the world's largest metro area outside Asia (OECD, 2015). It is composed of over 50 municipalities and is home to the federal government in Mexico City. Nearly 20 million people live in this area and in the last decade the population has grown at an average of 1.2 percent per year.

PHOTO 1. Aerial View of Atotonilco Waste Water Treatment Plant



Source: Acciona.



Implementing interim strategies in countries with low treatment

- Interim strategies while **full capacity wastewater collection** and treatments systems are developed.
- Safe reuse practices and use of **protective measures**.
- **Rehabilitation** of existing **non-functional treatment plants**.
- Improvement in existing operational, but **overloaded plants**.



Sustainable Management of Urban Wastewater for AAAs

