



Water In Circular Economy and Resilience (WICER)

Circular economy and resilience
framework to transform the water
sector

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THE CHALLENGE

Increasing population, economic growth and shifting consumption patterns have driven a rapid rise in demand for water resources, while 36 percent of the world's population already lives in water-scarce regions.



Water is essential for socioeconomic development and it links with nearly every Sustainable Development Goal. Nevertheless, water is undervalued, and water resources are used inefficiently.



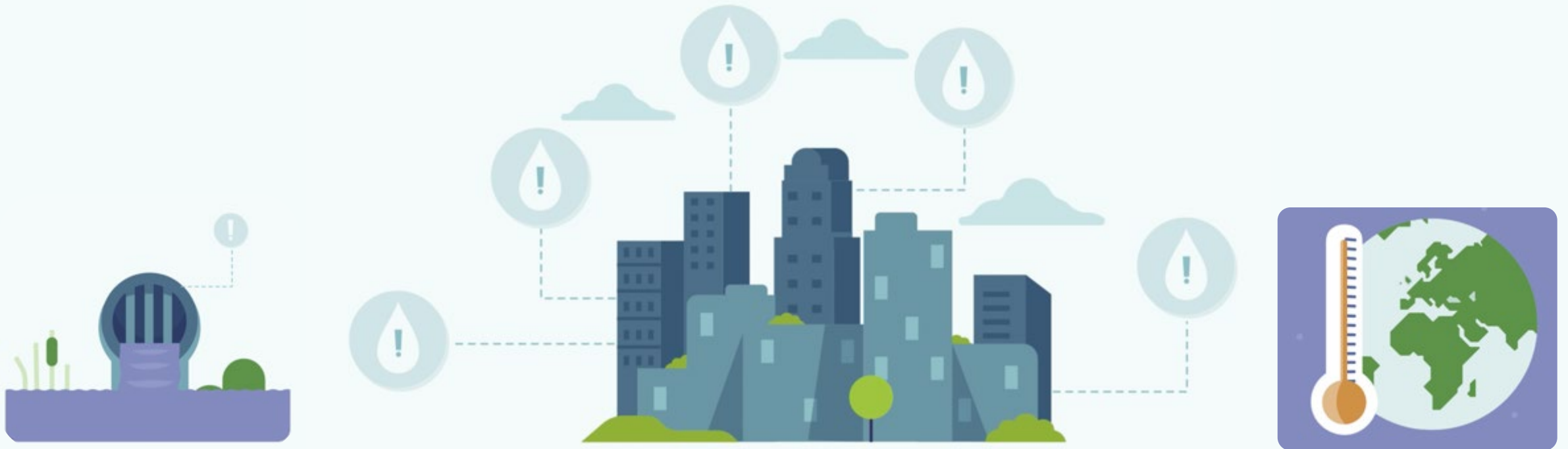
Water pollution resulting from human activities has clear health, socioeconomic and environmental impacts, and further threatens the sustainability of water supplies.



Climate change is challenging the sustainability of water resources, which are already under severe pressure in many regions of the world.

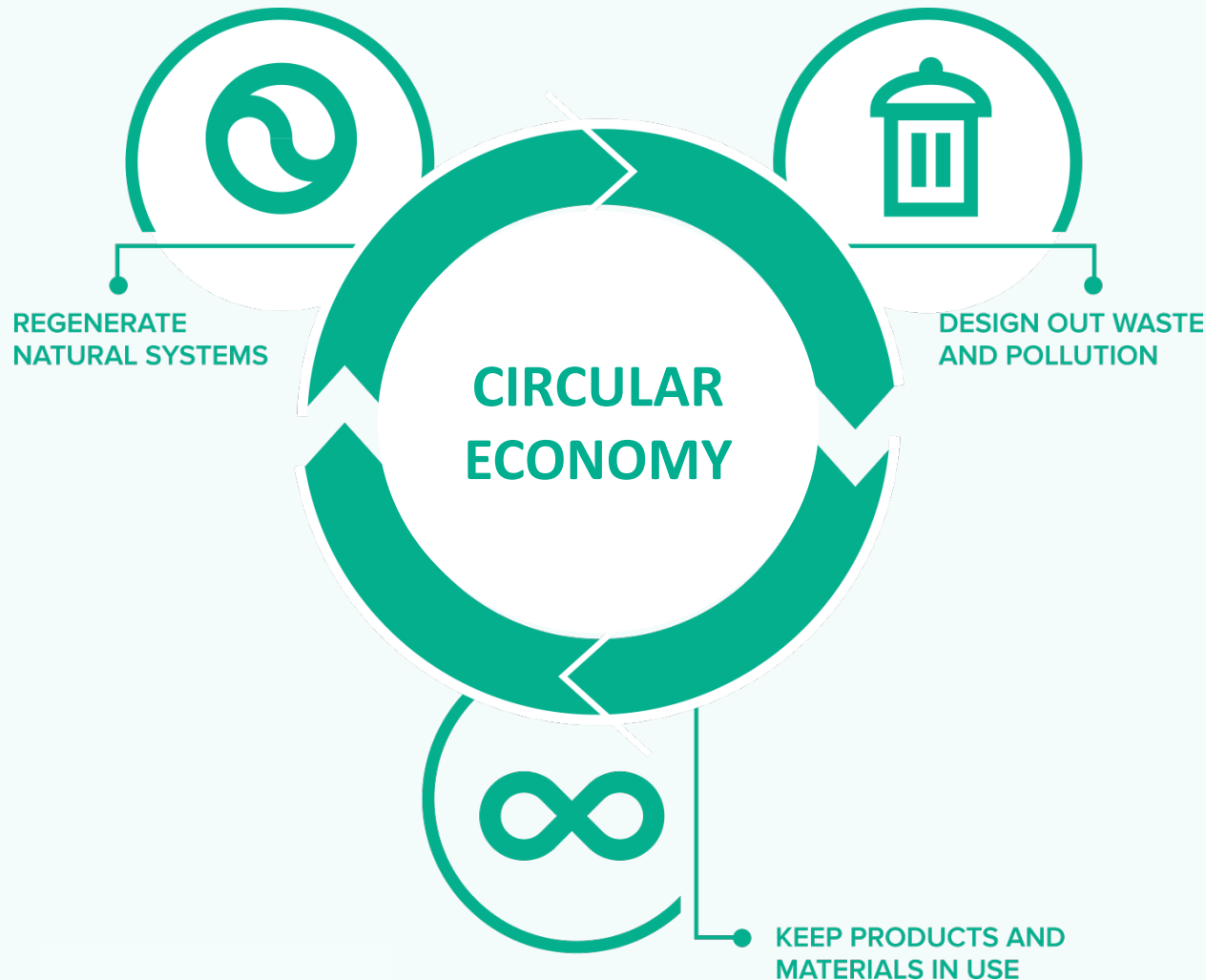


These challenges are particularly felt in urban areas



...where for the first time in history more than half the global population lives

What are the principles of Circular Economy?



- decoupling economic activity from the consumption of finite resources and from environmental degradation
- replacing the end-of-life concept with restoration
- restoring and regenerating ecosystems by intention and design,
- eliminating waste through superior design—of materials, products, systems, and business models
- not a synonym of recycling (recycling should be the last resort)

the circular model builds economic, natural, and social capital

Inspired by the circularity of the water cycle in nature...



+ resilience



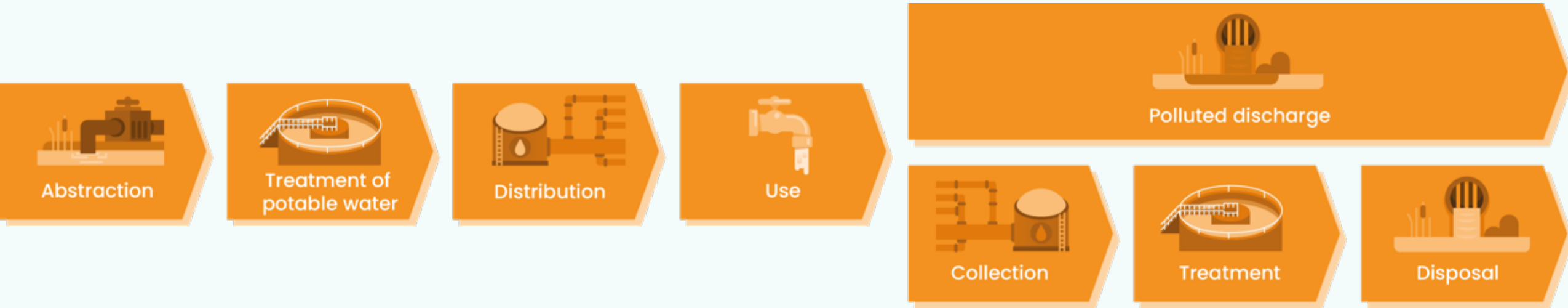
+ inclusivity



We must shift from...

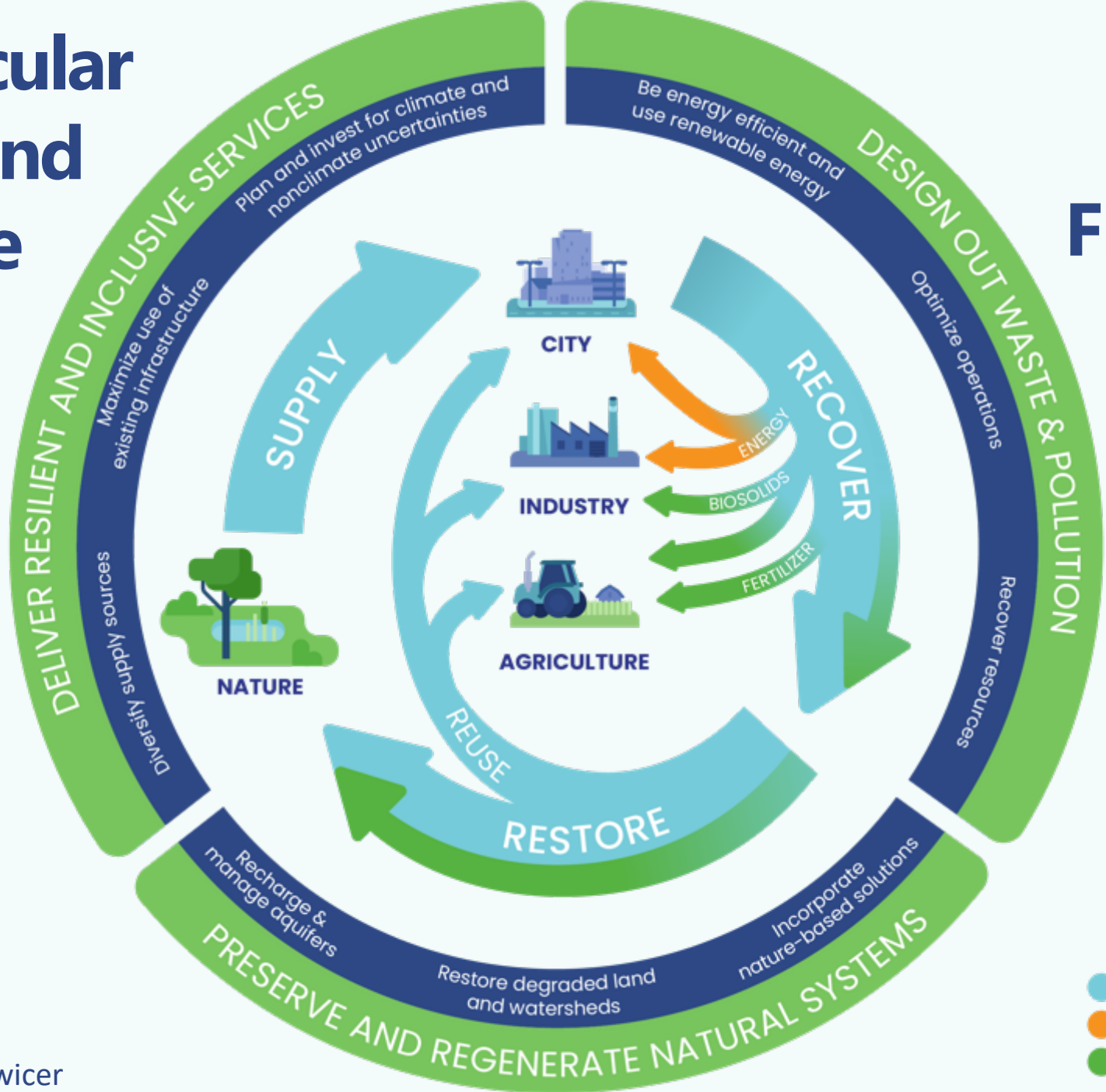


A LINEAR SYSTEM ...



Water in Circular Economy and Resilience (WICER)

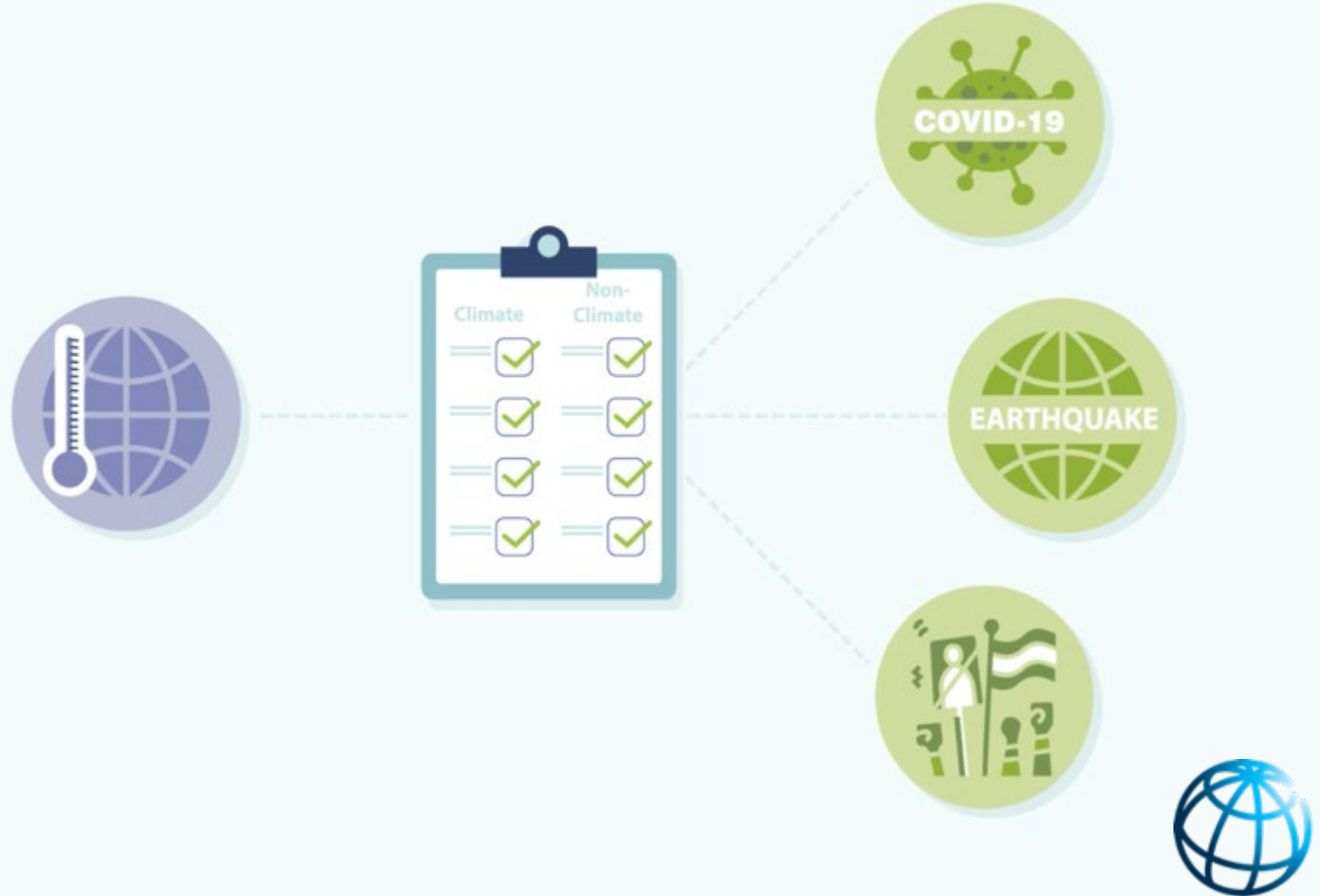
THE WICER FRAMEWORK



OUTCOME 1: DELIVER RESILIENT AND INCLUSIVE SERVICES



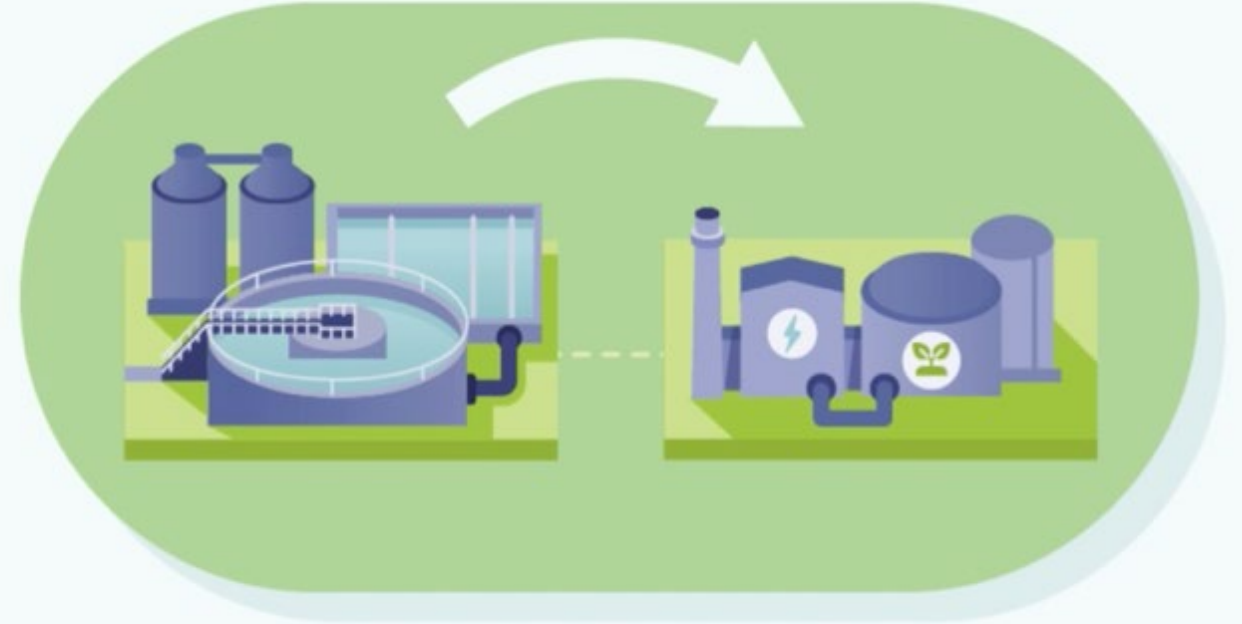
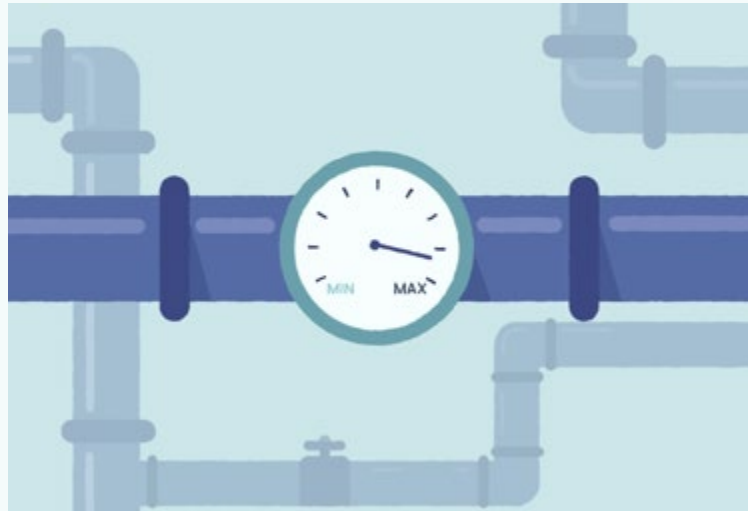
We need to plan and invest (differently) for climate and non-climate uncertainties



OUTCOME 1: DELIVER RESILIENT AND INCLUSIVE SERVICES



Maximize the use of existing infrastructure



OUTCOME 1: DELIVER RESILIENT AND INCLUSIVE SERVICES



Diversify supply sources

- Diversification of water supply sources (water balance)
 - including sources with different risk and cost profiles, and low vulnerabilities
- Protecting those water supply sources
- Including integrated water storage



OUTCOME 2: DESIGN OUT WASTE AND POLLUTION



Recover
resources from
water and
wastewater



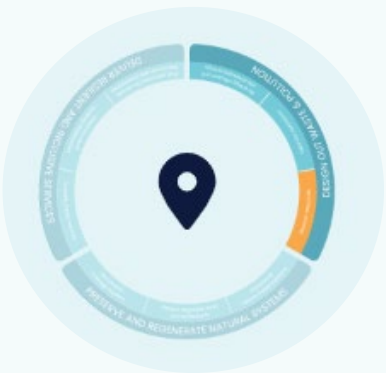
Energy



Water



Nutrients



OUTCOME 2: DESIGN OUT WASTE AND POLLUTION



Optimize operations

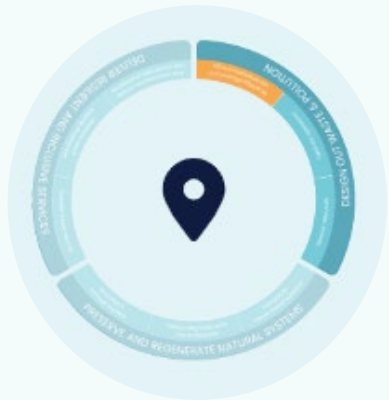
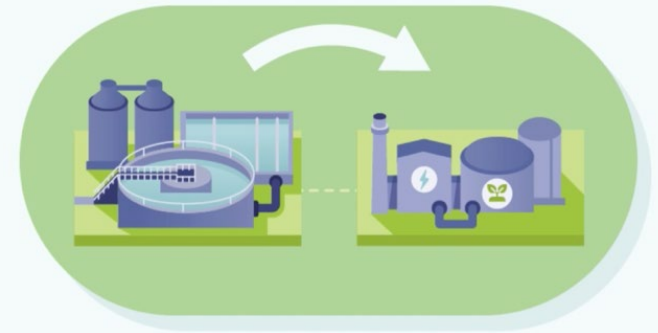
- Reduce NRW
- Increase overall efficiency of processes
- Optimize the amount of energy, minerals, and chemicals used in the operation of water systems



OUTCOME 2: DESIGN OUT WASTE AND POLLUTION



Be energy efficient
and use renewable
energy



OUTCOME 3: PRESERVE AND REGENERATE NATURAL SYSTEMS



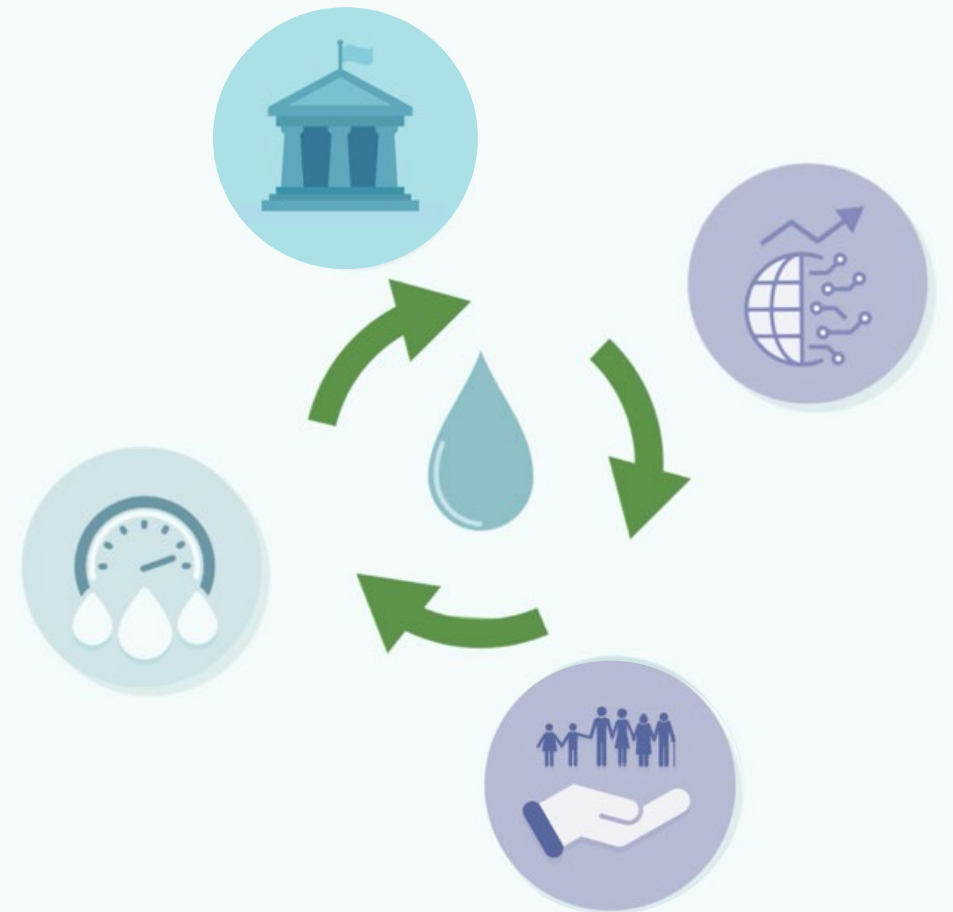
- Restore degraded land and watersheds
- Manage and recharge groundwater
- Incorporate nature-based solution



Cross-cutting Issues



- Manage water demand & decrease water use
- Leverage the power of digitalization
- Create the right Policy, Institutional and Regulatory (PIR) environment
- Ensure solutions are inclusive
- Funding and financing




Funding and Financing



Circular economy offers the opportunity to:

- Create additional revenue streams
- Reduce O&M costs
- Offer a better return on investment in a sector heavily subsidized

- 
- Potential to create more innovative business models
 - Potential to attract the private sector (PPP)
 - Potential to tap into other sector's financing (green/climate bonds, environmental impact bonds, etc)

Example of additional revenues or savings



Recovering resources from wastewater

ENERGY

Revenue:

- Sale of biogas or electricity
- Sale of carbon credits
- Tipping fees for the collection of organic matter (in co-digestion)

Savings:

- Using own-generated electricity in the plant
- Improving energy efficiency



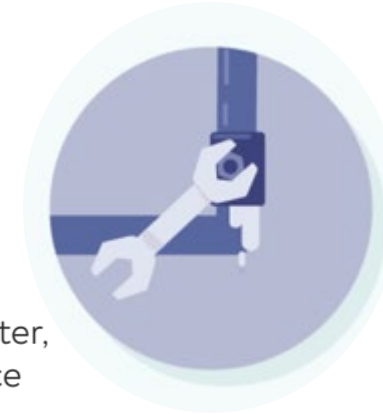
WATER

Revenue:

- Sale of treated wastewater, especially in water-scarce areas

Savings:

- Discharge fee/tax



Investments in energy efficiency and reducing NRW can be recovered in less than 3 years

BIOSOLIDS and NUTRIENTS

Revenue:

- Sale of phosphorus as fertilizer
- Sale of biosolids as compost

Savings:

- If the biosolids are given away for free (for agriculture, to restore degraded land, etc.) the utility saves transport costs and landfill fees



Investments in nature-based solutions such as upstream reforestation, can reduce treatment needs and costs

Case study: Arequipa Peru

Financing of infrastructure by private end user



Challenge:

- Water scarce region
- Wastewater from Arequipa untreated and polluting the river Chili
- Cerro Verde, the largest copper mine in Peru, was planning a large-scale expansion that required access to additional water supply.

Cerro Verde explored several options, such as using desalinated seawater or water from faraway aquifers.



Utilizing wastewater from the nearby city of Arequipa turned out to be the most sustainable and economical solution.

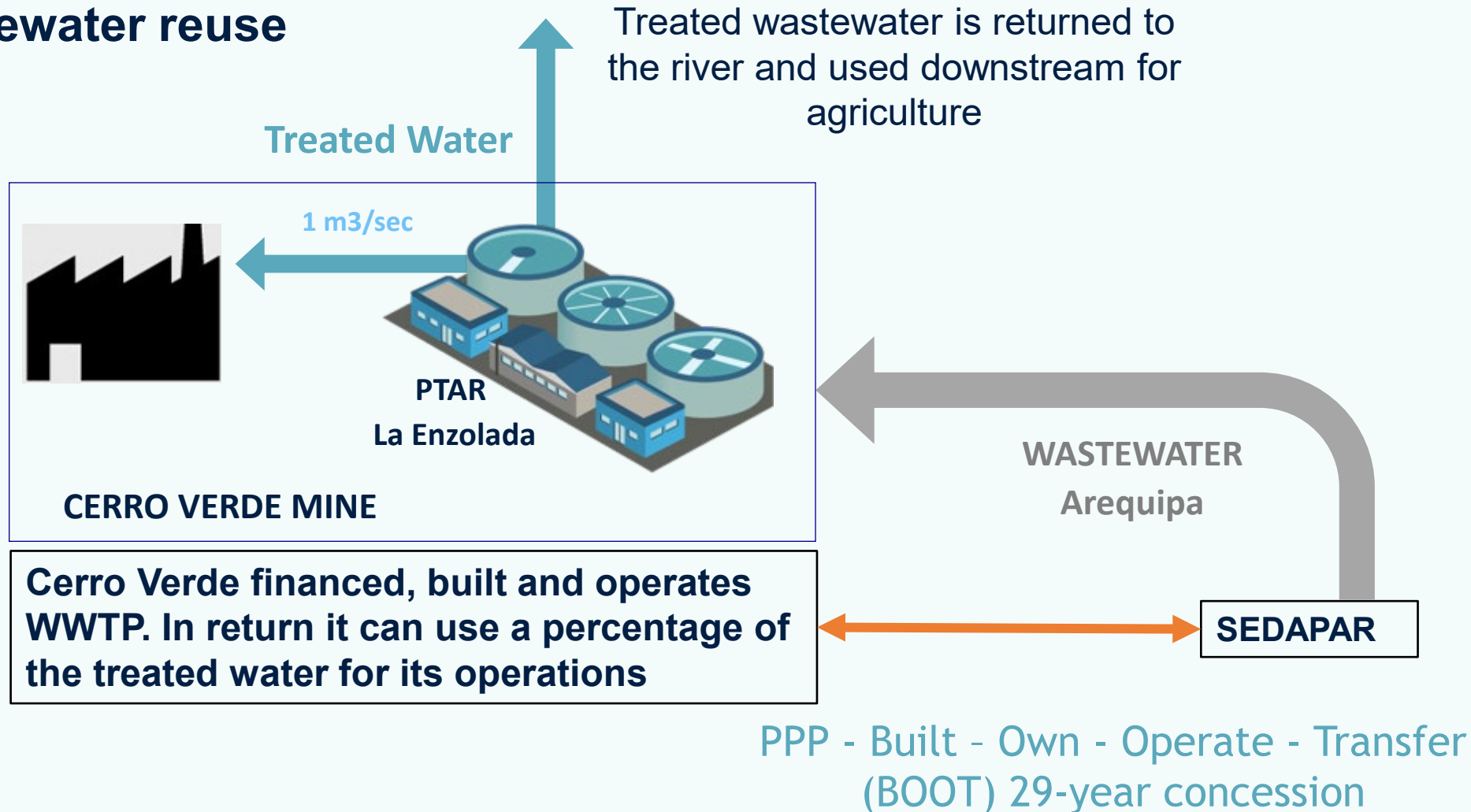
A potential Win-Win solution for the mine and Arequipa

Case study: Arequipa Peru

Financing of infrastructure by private end user



SOLUTION: PPP for wastewater reuse



Case study: Arequipa Peru

Financing of infrastructure by private end user



Benefits

- **For SEDAPAR (municipal utility):**

- Avoided the costs of constructing and operating the wastewater treatment plant (US\$ 540M capital investment + O&M costs)
- More than 95% of the city's wastewater is now treated at no cost to taxpayers

- **Cerro Verde:**

- Savings: Treated wastewater is cheaper than the next available option
- Reduced risk related to water availability (quantity, quality and cost stable for the next 29 years)
- For Cerro Verde was able to take most of the risks (technical, financial, construction, and operation), which together were smaller than the losses of not expanding the mine operations

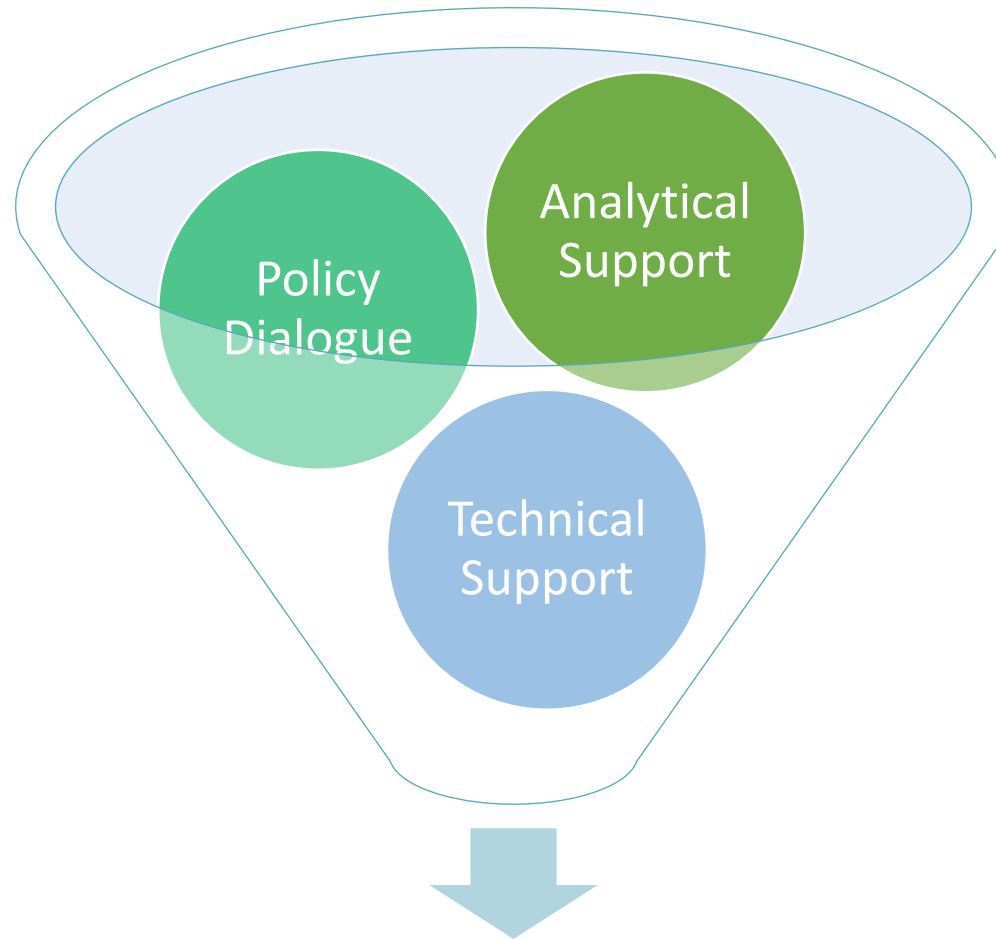
- **Social and Environmental:**

- Decontamination and restoration of the river Chili
- Farmers can also use the better-quality water for irrigating their crops, potentially allowing them to switch to higher-value crops.

WICER in practice - How is World Bank working with clients to promote a WICER approach?



WICER



Operational Support

Documenting relevant case studies



● WICER

● Waste to Resource

www.worldbank.org/wicer

www.worldbank.org/wastetoresource



From Waste to Resource

Shifting paradigms for smarter wastewater interventions in Latin America and the Caribbean

Diogo J. Rodrigues, Hector Alvarado Soriano, Anna Delgado, Daniel Hildebrand and Gustavo Salda



WATER GLOBAL PRACTICE

Water in Circular Economy and Resilience (WICER)

The Case of Lingyuan City, China

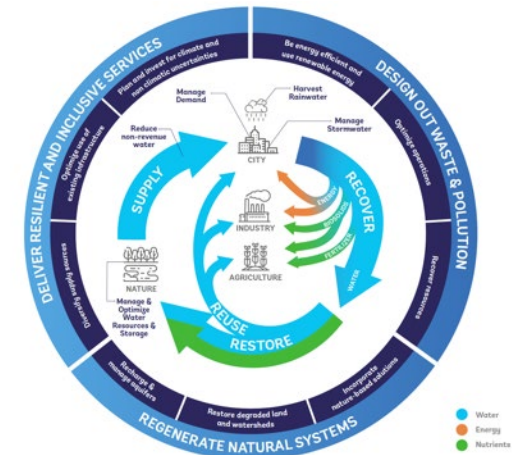
Unconventional Water Resources in a Water-Scarce City: Recycling Treated Municipal Wastewater for Industrial Users and to Reduce the Importation



Context
Lingyuan City in Liaoning Province, China, is a coastal city with a population of around 100,000 people who have been facing water scarcity. The water resources and hydrological data indicate a decline in groundwater in Lingyuan. Municipality over the past three decades installed treatment plants in only one or two water sources, which is one-fourth the national average and one-fifth of the world average. The falling level, which has brought the city, more dry for about seven months, a small

reservoir. The limited availability of surface water, combined with pollution of the Lingyuan, has led to the unavailability of groundwater resources. Between 2005 and 2015, exploitable groundwater resources decreased by 50 percent.

Circular economy as a vital water supply source for the city allowed to generate of total water use, which exceeds to 100 percent, groundwater, surface water, and more than 100 million (including several large industrial users that consume one million per day). To address the local applica-



Policy Dialogue



Review of existing regulatory frameworks in Middle East and North Africa Region (wastewater reuse and desalination)



Dialogue on regulating reuse and circular economy in Colombia & Turkey



Advice to Senegal on revision of Water and Sanitation Codes

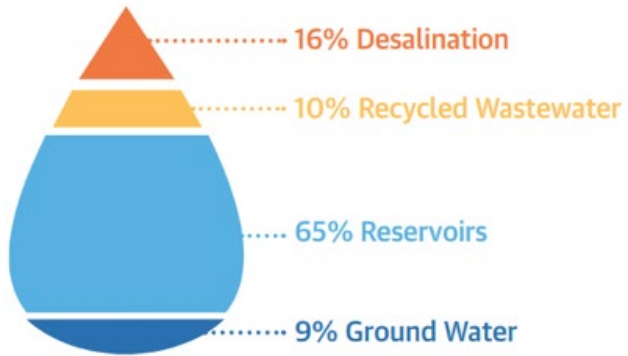


Policy, Institutional and Regulatory (PIR) assessment to promote unconventional sources of water in South Africa



Targeted project
activities and
investments

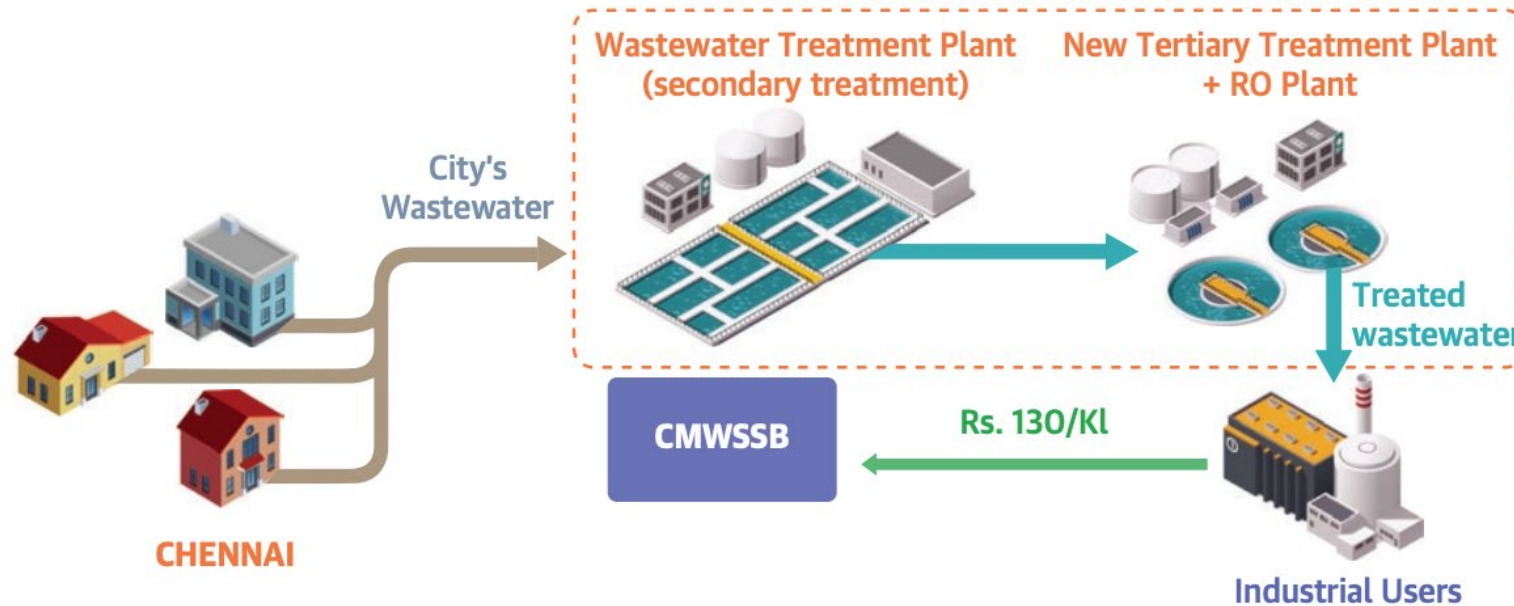
Applying circular economy principles in Chennai, India



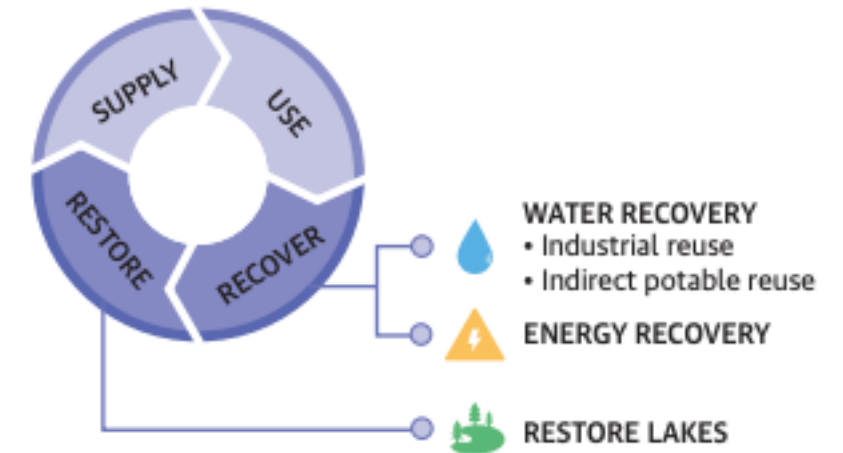
Benefits:

- Tariff for water reused in industry covers O&M costs
- Lower operating costs and decreased risks of water scarcity for industrial users
- Recovering energy in WWTP – payback of 3 years from energy savings

Source: CMWSSB, 2020.



CIRCULAR ECONOMY ELEMENTS



Example of World Bank projects with circular economy components:






- India: Tamil Nadu Sustainable Urban Development Project - reuse for industry
- China: Liaoning Coastal Economic Zone Urban Infrastructure and Environmental Management Project - reuse for industry and environmental restoration
- Uruguay: Uruguay OSE Sustainable and Efficient Project - Improving Resiliency, Sustainability and Efficiency in Uruguay's National Water Supply and Sanitation Company
- Brazil: The Watershed Management and Restoration of Forest Cover project - Targeted green infrastructure for source-water protection
- Senegal: Water Security and Sanitation Project - recovering resources from wastewater and fecal sludge (biosolids, water and energy)
- Countries with interest: Turkiye, Peru, Egypt, South Africa, Botswana, Fiji, Barbados, Vietnam...

Developing Tools and Frameworks

Online quick assessment WICER Tool:

Visual results with colors (traffic light) to assess whether the project or city is circular and resilient – is your project WICER?

-  To continue
-  To improve
-  To start doing/exploring

www.wicer-tool.com

Quantifying Economic and Financial Benefits of WICER vs linear system

Economic and financial analysis and prioritization of investments using the WICER framework.



Circularity is not the end goal, but the means to achieve greater outcomes



Sustainability



Jobs created



Restored
Ecosystems

Universal
access



Equity



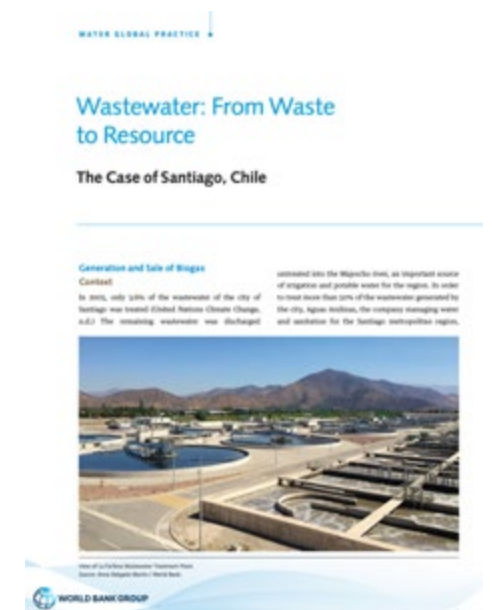
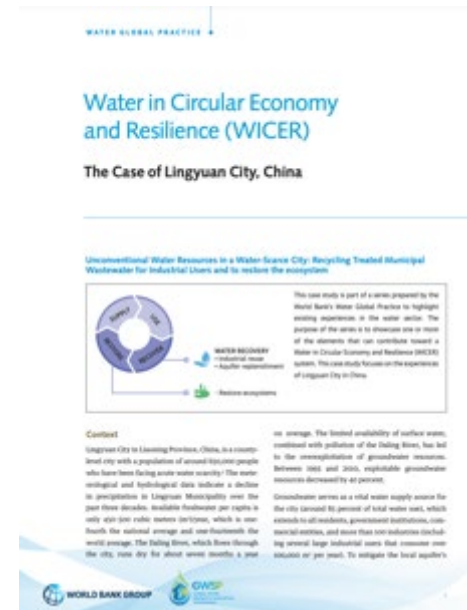
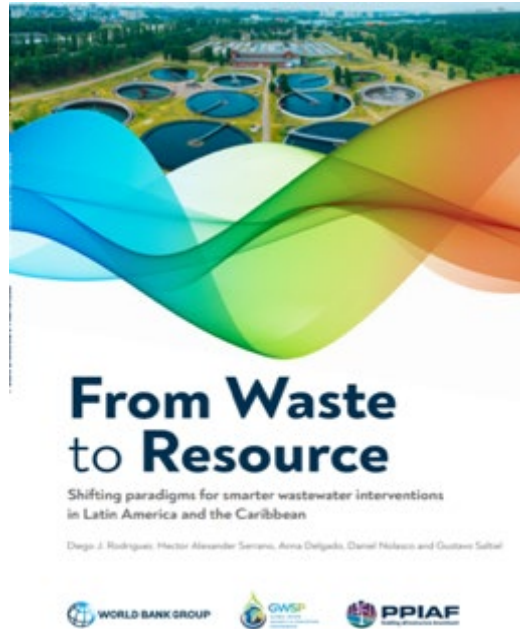
Urban prosperity

To learn more....



Reports with examples and guidelines to implement the concepts in the water sector

Several case Studies



www.worldbank.org/wicer

www.worldbank.org/wastetoresource

www.wicer-tool.com – check our new online tool!!!





Thank You!

Anna Delgado, Water Specialist

www.worldbank.org/wicer

www.wicer-tool.com