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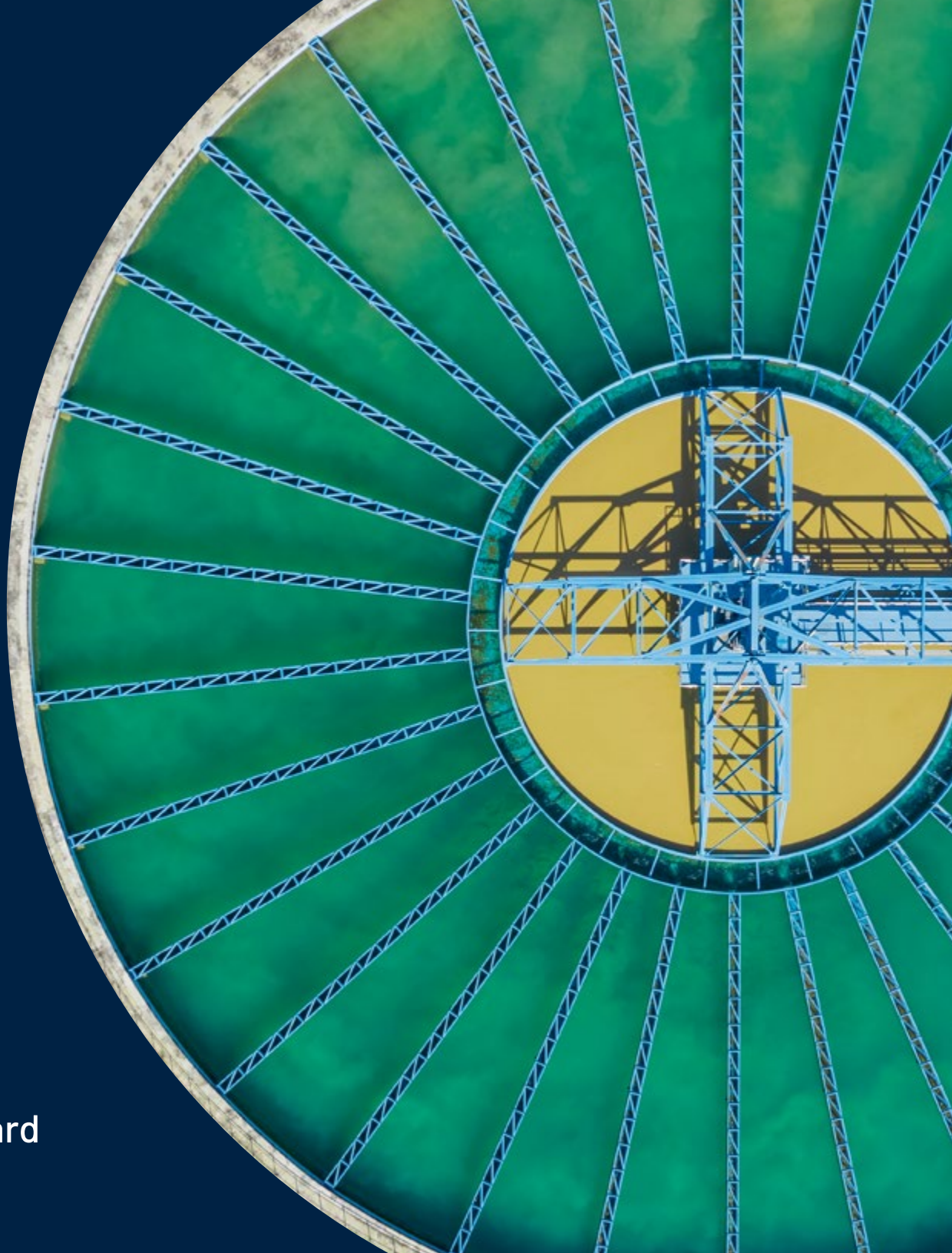
Scaling Water Reuse:

A Tipping Point for Municipal and Industrial Use

EXECUTIVE SUMMARY

Rochi Khemka and Rolfe Eberhard



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FOREWORD

Water reuse is no longer a marginal consideration; it is a strategic necessity. Around the world, cities and industries are under growing pressure from water scarcity, pollution, and climate stress. The treatment and reuse of used water offers a powerful and practical response—a dependable source that enhances water security, supports economic development, and strengthens climate resilience.

Cities and industries generate nearly 1 billion cubic meters of used water each day, much of it untreated and discharged into the environment. Capturing and purifying this water to meet municipal and industrial needs can reduce pressure on freshwater sources, lower pollution, and unlock new investment opportunities. With the right policies and financing structures in place, used water can become a cornerstone of a more resilient and circular water economy.

This report, *Scaling Water Reuse: A Tipping Point for Municipal and Industrial Use*, is the result of a joint effort by the World Bank, the International Finance Corporation (IFC), and the Multilateral Investment Guarantee Agency (MIGA). It reflects close collaboration with various institutions and builds on extensive consultations with governments, utilities, private water users, and financiers. Together, these partners are shaping a common vision for embedding reuse into national and local water strategies, anchored in strong public leadership and supported by private sector expertise and capital.

The case for scaling reuse is compelling. It is often more cost-effective than desalination or long-distance transfers, especially where collection and treatment infrastructure exists and where used water is available close to the point of reuse—such as for urban centers and industrial parks. As such, reuse should be considered part of a broader portfolio of water solutions, in conjunction with other demand-side and supply-side water management solutions. When water is properly valued and full lifecycle costs for various supply alternatives are considered, reuse stands out as both an economically sound and environmentally sustainable solution. Moreover, reuse as a solution can be promoted across the public sector and private sector, as well as at the national, municipal, and local levels.

Yet current adoption remains limited. As of 2024, global reuse across all applications accounts for only 12% of municipal freshwater withdrawals, and just 3% of potable and industrial use. Moving from isolated projects to sustained, large-scale programs will require a significant shift in how reuse is financed, delivered, and governed.

This report identifies five key transitions to enable that shift: (1) appropriately valuing clean water; (2) prioritizing high-value applications; (3) normalizing the creation and use of 'new' water; (4) advancing programmatic, platform-based approaches; and (5) mobilizing private innovation and finance. Taken together, these actions could unlock up to US$340 billion in investment and increase reuse capacity eightfold by 2040.

Realizing this ambition will require a coordinated effort. Governments must provide regulatory clarity, establish economic incentives, and invest in the enabling infrastructure. The private sector plays a vital role as a user, financier, and solution provider. Through policy engagement, technical assistance, and financial instruments, the World Bank Group is committed to helping bridge these efforts, building the conditions for viable, scalable reuse markets.

This report comes at a critical moment. Water reuse is not a solution of the future—it is a solution for today. With the right frameworks and partnerships in place, it can become a defining feature of how we secure clean, reliable water for generations to come.

Saroj Kumar Jha
Global Director
Water Global Department
The World Bank Group

Bertrand Heysch De la Borde
Director
Global Head of Infrastructure
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PREFACE

This report makes a case for scaling investments in the treatment of used water[1] to make it fit for purpose for municipal and industrial use, turning 'waste' water into valuable 'new' water. The report sets out the business case for these investments and outlines roadmaps for governments and the private sector to achieve this transition to sustainable water use.

Investments in 'new' water[2] are critical to support water service delivery to all sections of the population and to enable job creation and economic development in municipal and industrial contexts. This document aims to advance such investments through the efforts of the public and private sectors, and, where appropriate, those of the World Bank Group.

It focuses on the creation and shaping of markets by the public sector to unlock private sector investments in and contributions to 'new' water, encompassing the role of the private sector as water users, solution providers, and financiers. This requires key public sector contributions toward setting and enforcing rules related to water abstraction, discharge, and water quality; creating financial and economic incentives through the design of markets and pricing; and investing in public infrastructure to shape the supply side of the market.

A core focus of the report is on the generation of 'new' water for municipal water systems and industrial users. This is because the business case for reuse is strongest when used water is available close to the point of use, which tends to be the case for urban centers and industrial parks. Agricultural reuse may be relevant in specific contexts with cost-reflective irrigation tariffs and where such use is planned in close proximity to the availability of used water. However, this is not the focus of this document.

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1 This 'used' water is conventionally called 'wastewater,' suggesting it has no value. This report has adopted new terminology to emphasize the intrinsic value of this source of water.
2 'New' water refers to purified used water.

ACKNOWLEDGEMENTS

This report is co-authored by:

- **Rochi Khemka,** Senior Private Sector Specialist, World Bank 2030 Water Resources Group (WRG) and Task Team Leader, and
- **Rolfe Eberhard,** Consultant, World Bank WRG.

It is a joint output of the **World Bank, International Finance Corporation,** and **Multilateral Investment Guarantee Agency.**

This work was carried out under the leadership and guidance of **Juergen Voegele** (Vice President, Planet, World Bank), **Saroj Kumar Jha** (Water Global Director, World Bank), and **Bertrand Heysch De la Borde** (Director, IFC). It received managerial support from **Michael John Webster** (Program Manager, World Bank WRG) and **Sumeet Thakur** (Senior Manager, IFC).

A core working group of experts across the World Bank Group provided input and support to this activity (in alphabetical order):

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The peer reviewers for this activity included technical specialists across the World Bank Group and an external client, to whom the team expresses its sincere appreciation (in alphabetical order):

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HUNGARY

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LIST OF FIGURES

KEY MESSAGES

1. **Cities and industries are already at risk** from an insecure water supply, **impacting livelihoods, jobs, and economic growth.**
2. Reuse can serve as an **insurance strategy** against water insecurity.
3. As such, reuse should be **considered part of a portfolio of options** for water security, alongside other water demand and supply-side management strategies.
4. Yet the **current levels of potable and industrial reuse** (at 53 million cubic meters per day) represent **only 3% of freshwater withdrawals for the municipal sector.**
5. **Reuse is at a tipping point:** accelerating **investments in reuse** can **develop the market, drive down costs, and spur innovation and commercial finance.**
6. **Impact at scale** can unlock **investments of up to US$340 billion over 15 years,** with **reuse capacity** for potable and industrial use **growing annually at 14%.**
7. The World Bank Group can support the **standardization of approaches** to drive scale, similar to Scaling Solar, through the **Scaling ReWater package of support.**

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SCOPE OF DOCUMENT AND DEFINITIONS

References to 'total reuse' in this report include industrial and potable reuse, agricultural irrigation, landscape irrigation, urban non-potable reuse, and recreational or miscellaneous reuse.

FIGURE 1: Categories of water reuse

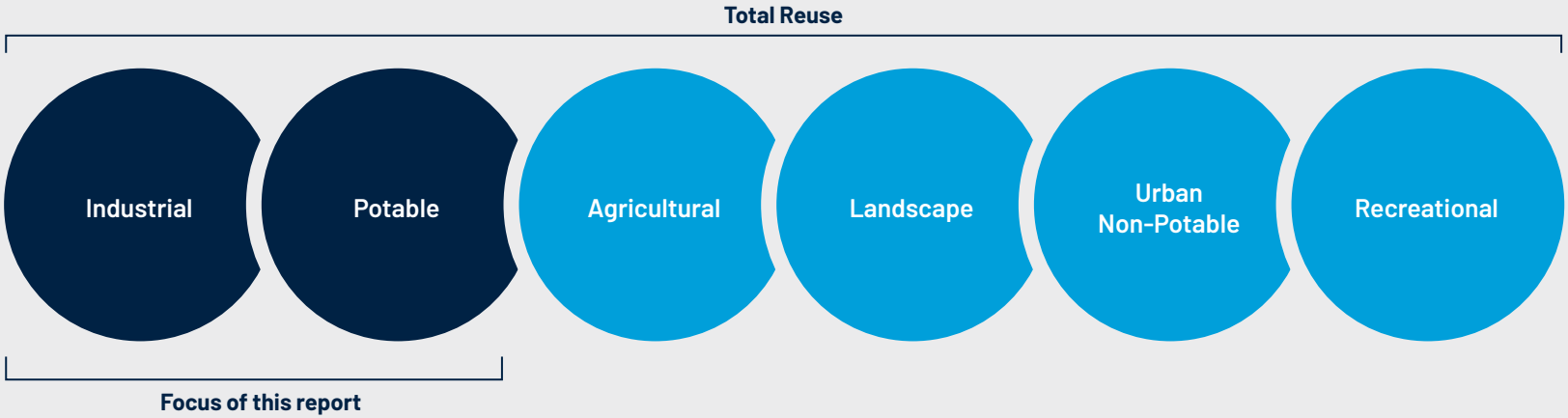
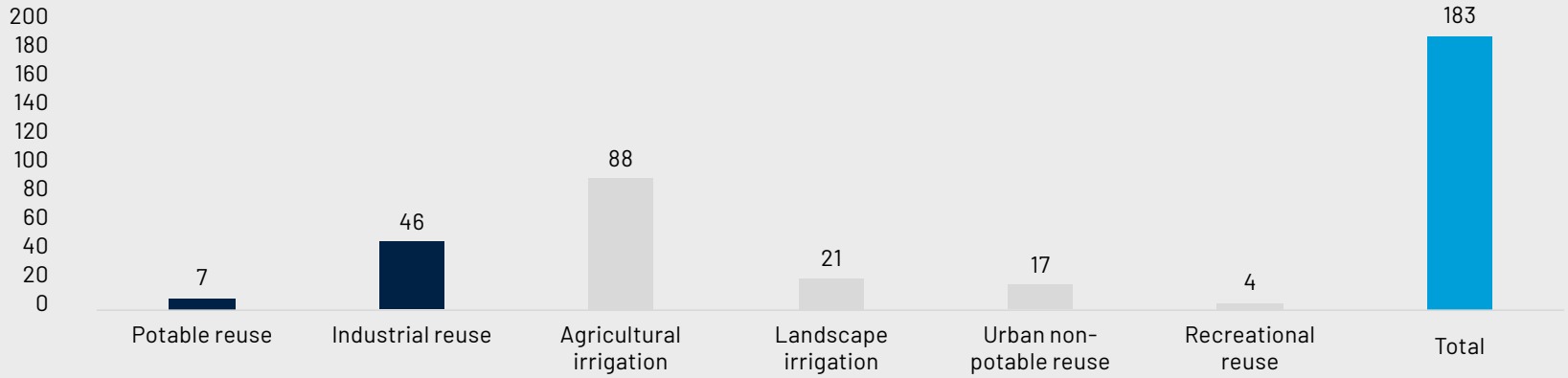


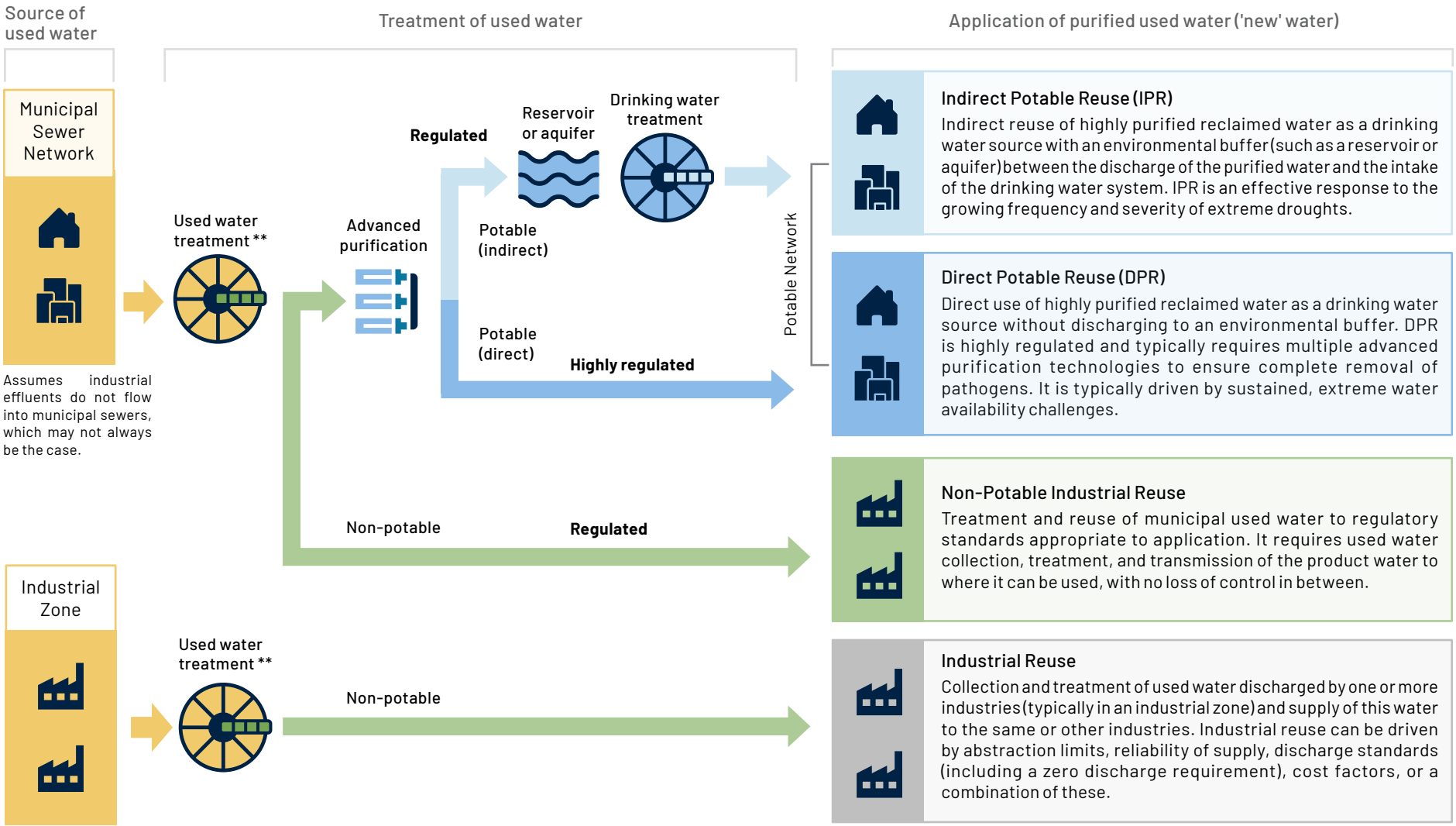
FIGURE 2: Breakdown of installed reuse capacity across different categories in 2024 (million m³ per day)[1]



1 Global Water Intelligence, *IDRA Desalination and Reuse Handbook 2024-2025* (Oxford: GWI, 2024).

SCOPE OF DOCUMENT AND DEFINITIONS

FIGURE 3: Sources of used water and application and definitions of purified used water ('new' water)*



* **Exclusion**: This report does not address: (1) Non-potable reuse for agricultural purposes and landscaping; (2) De facto reuse; (3) Reuse of seawater and brackish water; and (4) Decentralized reuse. See additional definitions in Annex 1. ** Typically called wastewater treatment. This report does not consider used water to be 'waste' water.

ROLES OF THE PUBLIC AND PRIVATE SECTOR

The public and private sector have complementary roles in scaling investments in new water.

While investments in new water can and do take place in the absence of enabling government policies and regulations, this does not negate the fact that national and state government actions and inaction have a strong influence on new water investments and market creation. On the other hand, municipalities can commission reuse capacity, sell used water, and influence demand through pricing and local regulations. In addition, the private sector can support market creation in its role as a water user, solution provider, and/or financier.

National and State Governments

Set Regulations

Establish regulations related to water abstraction, discharge, and water quality, as well as frameworks for trading recovered resources.

Shape Incentives and Markets

Shape financial and economic incentives through market design and pricing, particularly with the aim of delivering water services, and supporting job creation and economic development.

Provide Core Funding

Supply public funding and/or undertake direct public investment in infrastructure that shapes the supply side of the market, including alternatives, and hence changes relative costs between alternatives.

Support Programmatic Approaches with Private Sector Participation

Use public resources efficiently to create programmatic approaches, with bankable projects that can attract commercial financing and private sector expertise for delivery.

Municipalities and Utilities

Commission Reuse Capacity

Incorporate reuse in city-level water security strategies and commission reuse capacity to meet such goals.

Support Applications of 'New' Water

Assess opportunities for the sale of used water and recovered resources to provide revenues for treatment of used water.

Plan Land Use with Reuse in Mind

Enable industrial zones and parks to be located in the vicinity of used water treatment plants, with the level of treatment adapted to the type of reuse application.

Facilitate Stakeholder Acceptance and Education

Engage in stakeholder education and consultations, including with citizens and industry, to normalize the use of new water.

Private Sector

WATER USERS: Purchase New Water

Support reuse in direct operations and/or indirectly through supply chains.

SOLUTION PROVIDERS: Provide Expertise and Innovation

Where appropriate, support the design, construction, and operation of advanced used water treatment and reuse facilities through public–private partnerships in various forms of design–build–finance–operate–transfer (DBFOT) and/or engineering–procurement–construction (EPC) contracts.

Accelerate innovations in treatment technology and reuse infrastructure to bring down costs over time and promote the scaling of reuse.

FINANCIERS: Finance Reuse Investments

Support financing for reuse through appropriate financing instruments and partnerships with the public sector.

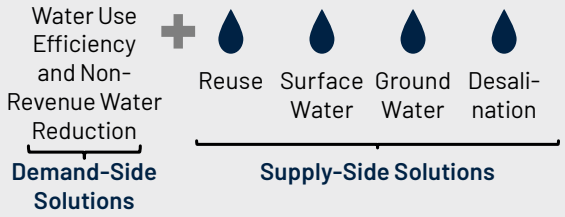
Used water has tremendous unrealized value...

Cities and industry produce a large volume of used water every day. Turning this used water into new water could create a more water-secure future for more than a billion people living in cities and facing increasing levels of water stress. Moreover, many industrial facilities globally face water supply insecurity, which can be mitigated through the use of new water.

...offering insurance against water insecurity...

As a **rainfall-independent source, reuse provides insurance against increasing climate and water stress** and should be considered within a portfolio of water security solutions.

FIGURE 4: Portfolio of water security options



...and a triple benefit for each cubic meter of water reused.

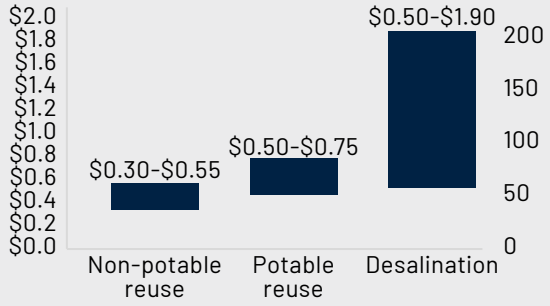
Turning used water into new water offers three benefits in one:

1. Recovery of **valuable water**,
2. Recovery of **energy and other scarce resources**, and
3. Recovery of the **environment** through reduced freshwater abstraction and reduced pollution.

Reuse has a strong business case...

Reuse makes good economic sense **where collection infrastructure is in place** and the **treatment facility is close to the point of reuse**. In addition, where the cost of alternatives reflects full costs, rather than a subsidized price of water, investments in reuse are attractive.

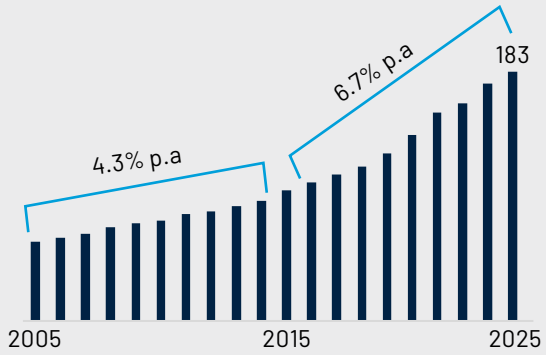
FIGURE 5: Cost per m³ of water (US$)[1]



...yet the extent of reuse is low...

Global installed reuse capacity at the end of 2024 was only **183 million cubic meters per day.**

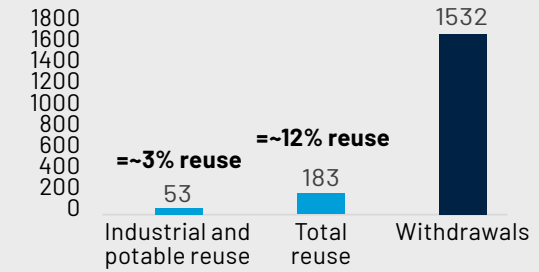
FIGURE 6: Global installed reuse capacity (million m³/day)[2]



...at 12% of municipal freshwater withdrawals.

Moreover, industrial and potable reuse of 53 million cubic meters per day in 2024 amounted to only 3% of freshwater withdrawals for the municipal sector.

FIGURE 7: Reuse as a % of freshwater withdrawals for the municipal sector (million m³/day)[3]

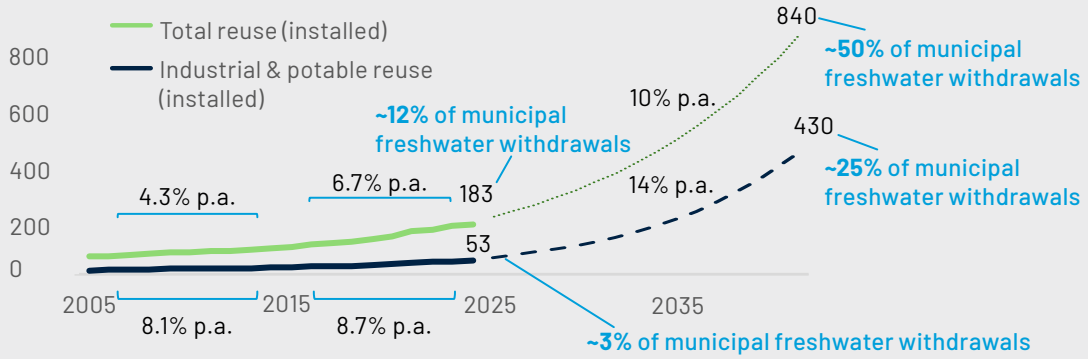


1 Levelized water costs from World Bank and IFC treatment plant project data and GWI project data; excludes collection and distribution infrastructure costs. Levelized water costs include the cost of capital and depreciation, as well as operating costs.
2 Global Water Intelligence, *IDRA Desalination and Reuse Handbook 2024-2025* (Oxford: GWI, 2024). Excludes water reuse labelled as environmental enhancement in the dataset.
3 Municipal freshwater withdrawal from AQUASTAT, 2021 data escalated to 2024 at 2% annual growth, and GWI data for installed reuse capacity.

Nonetheless, reuse is at a tipping point...

Reuse programs are being actively implemented in 22 countries, with a shift toward higher-value applications, particularly through potable and industrial reuse. The **pace of investment in reuse has increased from ~4% per year (2005–14) to ~7% (2015–24).**

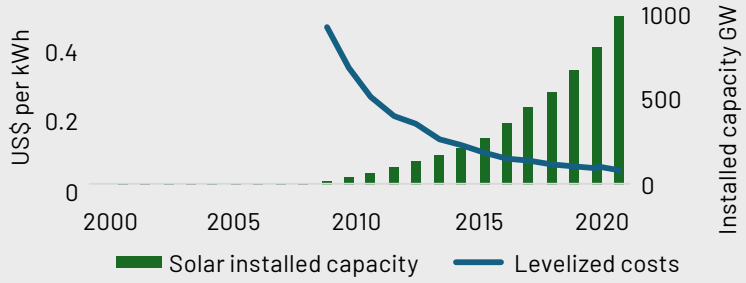
FIGURE 8: Reuse potential by 2040 (in million m³/day and as a % of municipal freshwater withdrawals)[1,2]



...and urgent investments can reduce costs through economies of scale, unlocking up to US$340 billion in investments.

The investment required to achieve impact at scale is between **US$170 billion and US$340 billion over 15 years**, representing an annual growth in reuse capacity of 14% until 2040 for potable and industrial reuse. This investment could achieve an **eightfold increase** in treatment capacity for highly purified water and result in reuse for industrial and potable use at a **scale of 25% of municipal freshwater withdrawals from the current level of 3%.**

FIGURE 9: Solar levelized costs (US$ per kWh) and installed capacity for 2000–23 (GW)[3]



This ambition is achievable, as the experience of the renewable energy sector highlights.

Renewable energy achieved an 18-fold increase in installed capacity over the last 15 years. Annual investment in wind and solar—in just one year (2022)—was close to US$500 billion. This was achieved through **ambitious policy goals and programs, and a dramatic reduction in unit costs**, enabled by scaling and leveraging private sector innovation and financing. In reuse, cost reductions will also require adopting fit-for-purpose standards and treatment, combining reuse with resource recovery, and shortening the length of distribution to enhance viability.

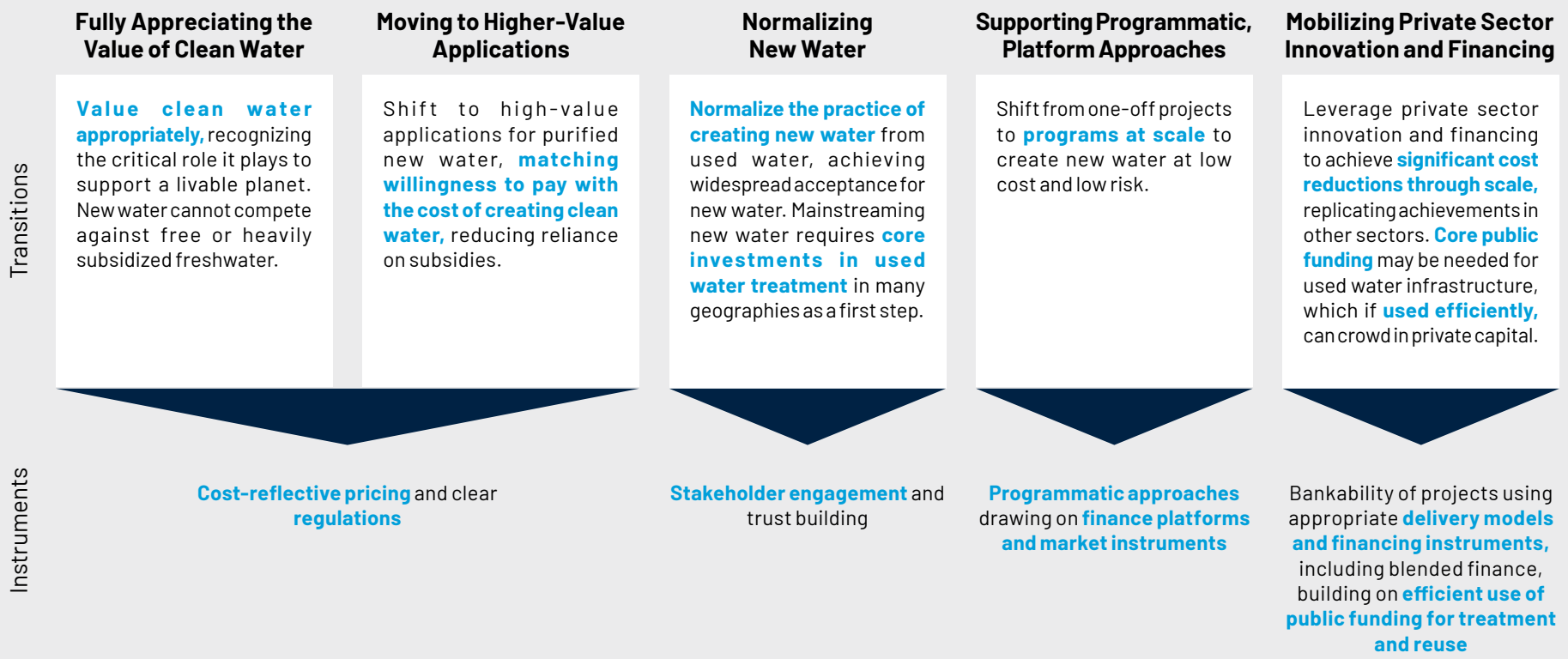
Notes: Installed capacity from GWI data; municipal freshwater withdrawals assumed to grow at 1% per year.

1 Authors' estimates.

2 In addition to industrial and potable reuse, total reuse includes agricultural irrigation (amounting to 88 million cubic meters per day in 2024), landscape irrigation (amounting to 21 million cubic meters per day in 2024), urban non-potable reuse (17 million cubic meters per day in 2024), and recreational/ miscellaneous reuse (4 million cubic meters per day in 2024).

3 International Renewable Energy Agency, *Renewable Power Generation Costs in 2023* (Abu Dhabi: IRENA, 2024).

Five transitions will support the creation of new water at scale.



Core public resources may be needed to support treatment and reuse...

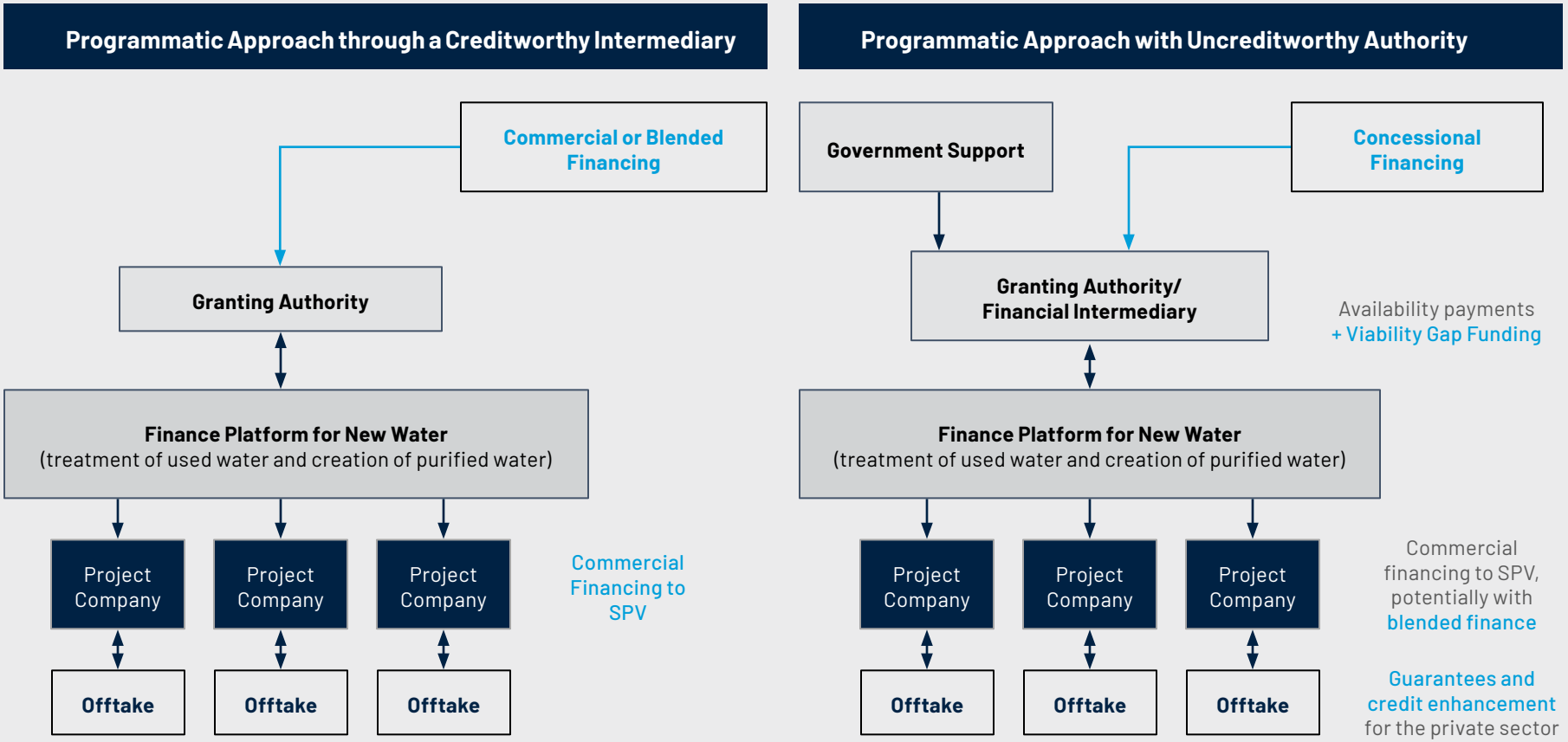
Public and concessional resources should be prioritized for reuse, while ensuring efficiency in their use to crowd in private capital. In addition, an acceleration in reuse investments may require reforms to the enabling environment to create the conditions for private sector participation.

...which can unlock private capital through relevant financing instruments and programmatic approaches.

Private capital may be mobilized through several options, including traditional infrastructure debt financing; joint ventures; blended finance instruments that make use of climate finance; a variety of green, blue, and sustainability-linked financing and outcome bonds; and asset recycling.

Programmatic approaches to reuse can reduce time and costs and attract investor interest. The resultant economies of scale through such approaches can also reduce the cost of finance. Creditworthy granting authorities may be able to tap commercial financing under such approaches, while uncreditworthy entities may require the use of concessional financing and/ or payment guarantees to attract private sector interest.

FIGURE 10: Programmatic approaches to support the mobilization of private financing for new water creation

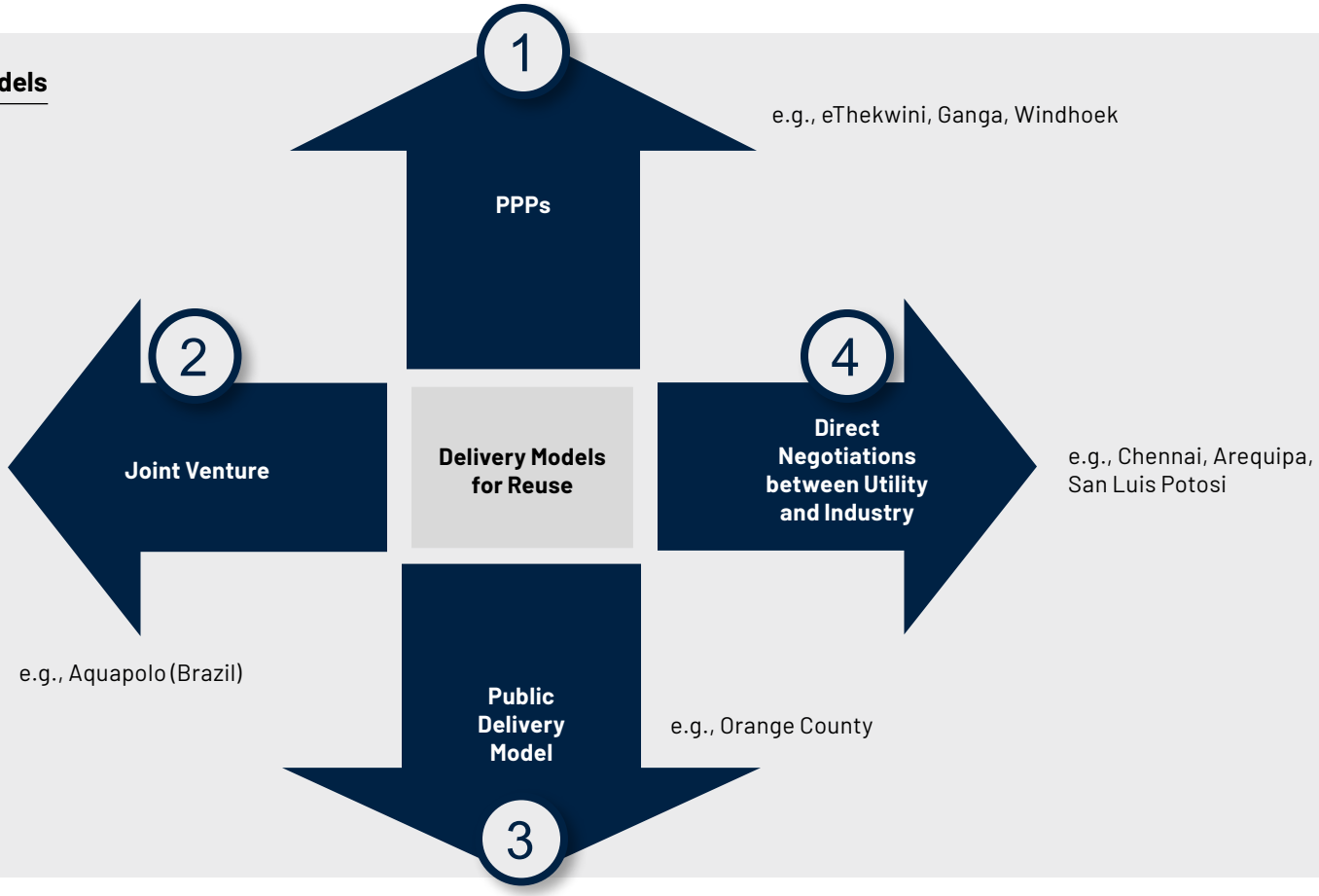


Moreover, various delivery models can be applied to reuse.

The choice of delivery model depends on various factors: (1) the respective capacities of the public and private sector, (2) affordability considerations, (3) the extent to which stakeholders wish to mobilize private or off-balance-sheet financing, (4) the availability of public funding, and (5) the allocation of risk between parties.

For example, **PPP structures, such as DBFOT and BOT models,** may support price disclosure of the full levelized cost of treated or sold water. In the context of transparently tendered projects, this can create competitive price pressures, driving innovation and efficiency. **Joint ventures between the public and private sector** may support the joint investment of equity and a collaborative effort to raise finance. Where the public sector has adequate technical and financial capacity, **public sector delivery models** may be preferred. At the municipal level, there may be **direct negotiations between the utility and industrial offtakers** through long-term water purchase agreements, which also support bankability.

FIGURE 11: Reuse delivery models



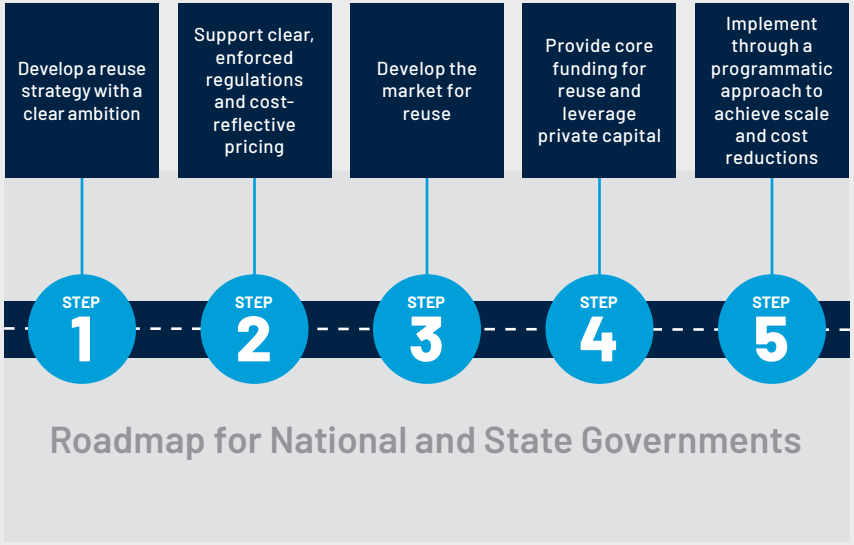
Scaling reuse requires synergistic collaboration across various levels of government and the private sector...

While national and state governments, and municipalities and utilities, need to **set clear reuse goals** as a starting point, the different instruments and levers at their disposal to facilitate reuse vary.

National and State Governments

Federal and state agencies can influence **pricing and regulations**, which can address two of the main constraints to reuse in most contexts. The subsidized and unregulated availability of freshwater has been the single biggest bottleneck to the scaling of reuse globally. In addition, national governments can support **programmatic approaches**, which can enable economies of scale and cost reductions over time. **Public resources** can also facilitate the mobilization of private capital.

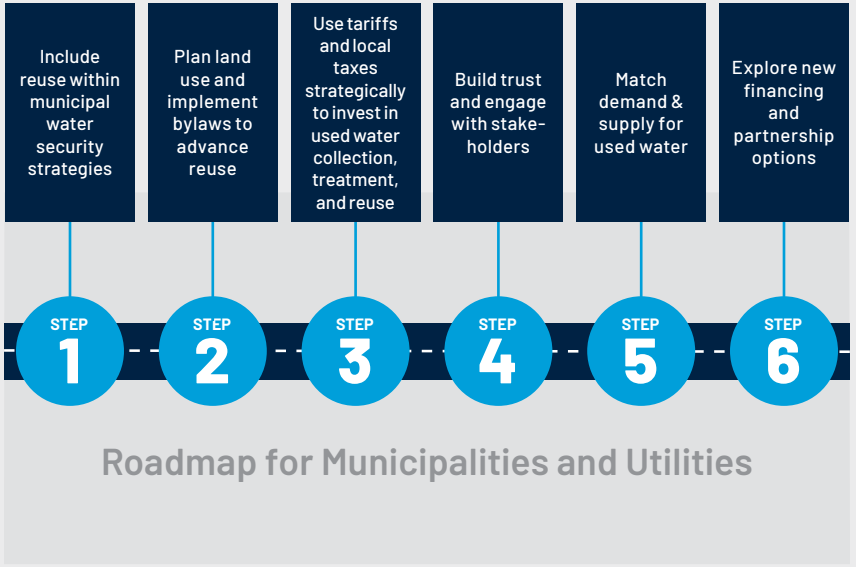
FIGURE 12: Roadmap for national and state governments



Municipalities and Utilities

Local government and water utilities can support **land use planning** with reuse in mind, locating industrial parks in the vicinity of municipal used water treatment infrastructure. **Tariffs and local tax instruments** can promote investments in used water collection, treatment, and reuse. **Stakeholder acceptance and communications** is a core role that municipalities can support, which can enable the development of a **market for reuse.**

FIGURE 13: Roadmap for municipalities and utilities



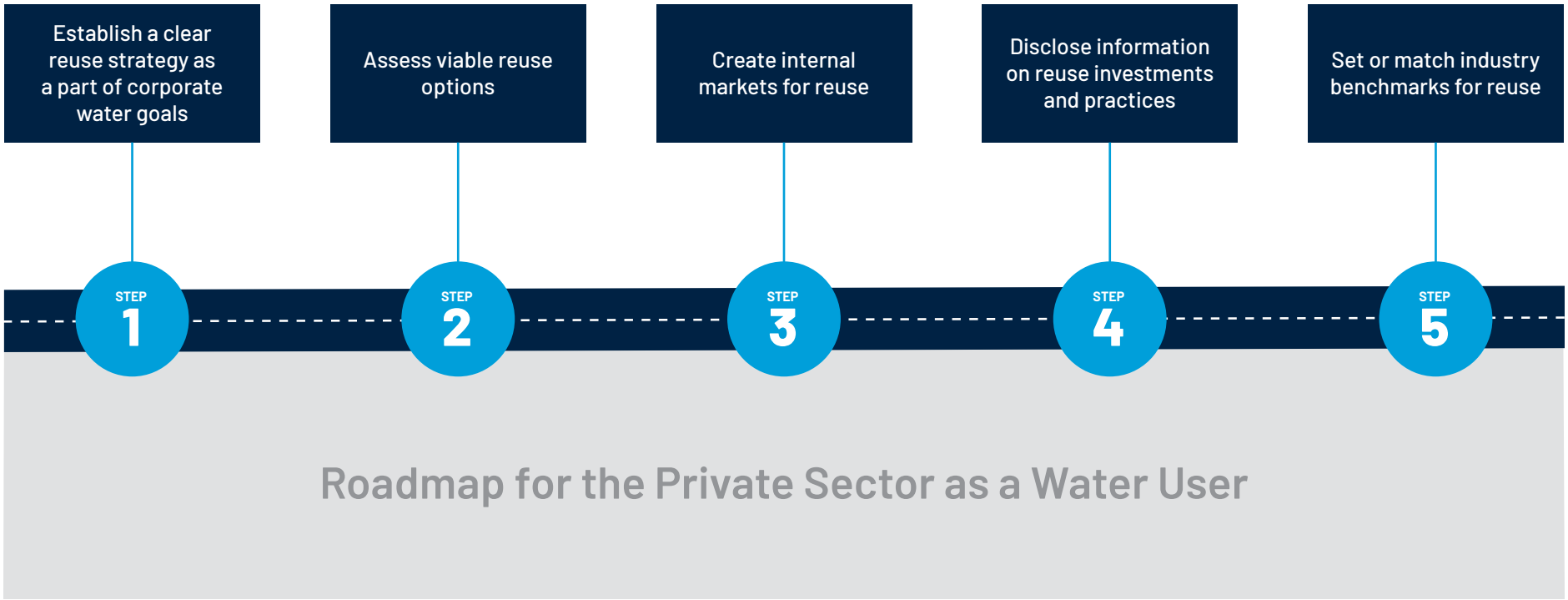
...with private sector water users shaping the demand side of the reuse market.

The private sector, as a water user, can influence reuse through both: (1) **global corporate water strategies**, and (2) **local offtake of new water** in specific geographical locations.

The establishment of **internal water fees** based on the water footprint of business units can support the creation of reuse markets. In addition, corporate **disclosure on reuse practices and investments** can foster trust and support finance facilitation, besides offering reputational benefits.

Moreover, corporate efforts to **set or match benchmarks for reuse** can promote best practice adoption and encourage more research and innovation in the sector.

FIGURE 14: Roadmap for the private sector as a water user

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