

The Water Paradox

India stands at the threshold of a paradox. On the one hand, it is home to some large water bodies and a vast monsoon-fed squiffer network; and on the other, it faces acute water scarcity that threatens industrial continuity, urban growth, and ecological balance. The heart of this paradox lies not only in availability, but in the management of water, particularly the way the nation manages its wastewater.

India generates an estimated 72,368 million litres per day (MLD) of sewage, yet only 37% of this volume can be treated, and just 28% undergoes any form of treatment before discharge. Industrial wastewater paints a similar picture.

As urbanisation and industrialisation accelerate, wastewater generation is projected to increase by 75 to 80% by 2050, three and a half times the country's present treatment capacity.

Despite this, less than 1000 MLD of treated wastewater is reused, representing a mere 3% of treated volumes and 1% of total sewage generated. The gap between generation and reuse has become a defining challenge of India's developmental decade.

From Linear Disposal to Circular Reuse

India's traditional approach to wastewater has been linear: collect, treat and discharge. But

this compliance-driven model is no longer tenable. Wastewater 2.0 signals a necessary shift towards a circular approach, one that sees wastewater as a renewable resource to be treated, recovered and reused.

Across India, both municipalities and industries are beginning to embrace reuse. Secondary treated effluent is increasingly being repurposed for cooling towers, process water, landscaping, and even indirect potable applications. Industrial clusters in Gujarat, Maharashtra and Tamil Nadu have shown how Zero Liquid Discharge (ZLD) and closed-loop systems can reduce freshwater dependency, while cities such as Surat, Nagpur and Chennai are redirecting treated wastewater to power plants - conserving freshwater and generating new revenue streams for utilities.

Building End-to-End Water Ecosystems

The next frontier in wastewater management is integration, designing and executing water infrastructure that links treatment, distribution, energy, and digital control systems within one lifecycle framework.

Leading infrastructure companies today are delivering turnkey solutions that span the entire water value chain, from water and effluent treatment plants to distribution pipelines, pumping stations and multi-year Operations and Maintenance (O&M).

This model transforms how water infrastructure is built and operated.



Prefabrication and modularisation compress construction timelines, while agile project management and digital tracking tools enhance predictability and transparency. Multi-year O&M contracts ensure continuity and compliance, helping utilities and industries maintain uptime and meet environmental norms without constant re-tendering.

Such integrated delivery has already enabled the execution of large urban and rural water programs under national missions such as AMRUT 2.0, State Water and Sanitation Missions (SWSM) and Namami Gange, projects that demonstrate how design-build-operate frameworks can drive measurable water outcomes at scale.

Digital and Decentralised: The Next Frontier

Digitisation is quietly transforming wastewater management. Smart sensors, SCADA systems, and digital twins are now enabling continuous monitoring of flow, chemical dosing, and energy consumption. Predictive analytics flag maintenance needs before failures occur, reducing downtime and operational cost.

Predictive maintenance algorithms can now anticipate equipment failures, reducing unplanned downtime and extending asset life. Power BI-based dashboards provide real-time visibility to decision-makers, enabling governance models that rely on metrics rather than manual inspection.

Equally transformative is decentralisation. Smaller modular plants for communities and industrial clusters are easing the burden on centralised networks. These plug-and-play systems are quicker to commission, easier to maintain, and more financially viable for peri-urban and rural regions. The future, therefore, lies in a hybrid ecosystem, centralised for dense cities, decentralised for distributed reuse, all digitally connected for accountability.

Policy, ESG and the Investment Lens

Policy evolution has been critical in accelerating the wastewater transition.



National programmes, such as AMRUT 2.0, Namami Gange, and State Water and Sanitation Missions (SWSM) have pushed for decentralised treatment, reuse mandates and improved O&M frameworks. These schemes emphasise lifecycle performance rather than just asset creation, compelling EPC players to embed sustainability and governance discipline in their delivery models. On the industrial side, Zero Liquid Discharge (ZLD) norms and tightening compliance from the Central Pollution Control Board (CPCB) are encouraging factories to integrate reuse within their process designs. The rise in ESG investing adds further momentum.

Companies are increasingly measured on water neutrality, recycling intensity, and scope three impacts, driving demand for engineered reuse systems that align with global sustainability frameworks.

Investors, too, are recognising water as a critical ESG metric. Asset managers and lenders now evaluate project bankability based on water resilience and circularity. Utilities that monetise treated wastewater through reuse contracts demonstrate higher financial sustainability. The result is a new asset class of "blue infrastructure," blending public health, environmental stewardship, and long-term economic value.



Sustainability in Practice

Sustainability in wastewater is no longer aspirational; it is operational. The most effective infrastructure models embed circularity and carbon reduction directly into project execution.

At the same time, corporate water stewardship has emerged as a parallel responsibility. Many large organisations now publish assured data on their own water withdrawal, consumption, and reuse, demonstrating internal alignment with the same principles they deliver to clients.

Factory-level ZLD systems, recycling initiatives and rainwater harvesting all reinforce that water efficiency and business performance are not mutually exclusive but mutually reinforcing. The industry's commitment to becoming water neutral by 2030 and water positive by 2040 aligns with global frameworks such as the UN Sustainable Development Goals and India's National Water Policy.

This dual commitment, delivering sustainable projects externally while practising stewardship internally, is redefining credibility in the water sector.

The Way Forward: Towards India's Water Renaissance

The transition to Wastewater 2.0 is no longer optional; it is an imperative. Population growth, industrial expansion, and climate

volatility are converging to make water reuse a national priority.

Three imperatives that will redefine the path ahead:

- **Mandating reuse at scale:** Move beyond incentives to enforce minimum reuse quotas for industries and utilities.
- **Financing circularity:** Channel ESG-linked bonds and PPP models into reuse and digital O&M infrastructure.
- **Institutionalising digital governance:** Make real-time dashboards and predictive analytics standard practice across utilities.

India's next infrastructure wave will be built by enterprises capable of integrating engineering disciplines, water, power, and renewables under a single sustainable vision. They will not just build treatment plants; they will create ecosystems of resilience, where every litre of wastewater becomes a litre of opportunity.

Wastewater 2.0 is India's blueprint for a circular, water-secure future, engineered through innovation, integration, and intent.

About the Author

Mr. Dharmendra Pratap Singh is the Executive Director and Chief Executive Officer, UMPESL.

For more information about the author, please write to us at info@thewaterdigest.com