

FROM WATER SCARCITY TO WATER SECURITY: WHY INDIA NEEDS SMARTER WATER INFRASTRUCTURE

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India's water challenge is no longer solely about scarcity; it is increasingly about how effectively available water resources are managed, treated, and reused. It is now a matter of having enough infrastructure in place to support its water needs. Although decreasing water levels, uncertain monsoon rainfall and increasing demands still dominate much of the discussion on this topic,

evident, India supports nearly 18% of the world's population with just 4% of global freshwater resources, while per capita water availability has declined by almost 70% since 1961. Further, around 75% of the country's districts face varying degrees of water stress or scarcity. These realities make it imperative to move beyond water extraction and focus on better management, treatment, recycling, and reuse of available resources.

Another topic is India's capacity to treat, recycle and reuse the water that it has access to, is also gaining importance. With the rapid pace of urbanisation, industrial development and changing climate in the country, long-term water security in India will not be possible without the proper management of existing water resources through improved infrastructure.

This change in focus can be seen in the latest reports and policy deliberations on India's water challenges, which increasingly highlight untreated wastewater, inadequate treatment capacity & inefficient water management as critical concerns. The urgency is

Water Is Becoming a Crucial Economic Infrastructure Asset

Water has transcended its status of being an environmental or civic asset, it has now become an economic necessity.

According to World Bank Group, by 2036, the urban population in India will comprise almost 40% of the total population of India.

At the same time, there are increasing demands from manufacturing industries like electronics & semiconductor industry, pharma sector, food processing units and chemical manufacturers who require reliable water infrastructure.

Industrial corridors, logistic parks, smart cities and hyperscale data centres, everything requires reliable water supply, making water an increasingly crucial factor in investment decisions. As water-intensive industries expand and urban population continues to grow, the ability to secure sustainable water supplies is becoming a key determinant of economic growth and investment attractiveness.

It is about time that we move beyond just ensuring fresh water supply and start building infrastructure that can maximize efficiency of every drop.

Wastewater Is the Biggest Untapped Water Source of India

The biggest possibility for India in its water story could be the change in perception of wastewater.

For many years now, wastewater has been seen as a resource that must be disposed of. But today, there is an understanding among the government and industries that it is another source of water that could lead to sustainable development and reduced dependence on freshwater resources.

As per the Central Pollution Control Board (CPCB), India currently generates more than 72,000 million litres of sewage every day, yet only around 28% of it is treated. This highlights a significant missed opportunity, as treated wastewater can serve as a valuable resource for industrial cooling, process water requirements, urban landscaping, construction activities, and groundwater recharge. As rainfall patterns become increasingly unpredictable and water stress intensifies across regions, wastewater recycling and reuse are emerging as critical pillars of long-term water security. The problem is even further complicated as there are alterations in rainfall pattern and rising water scarcity.

This gap entails much more than a mere environmental issue. This is an area where there could have been an effort to reclaim water that would have been utilized again in industrial processes, construction work, horticulture, cooling, and many other purposes.

Considering the same, National Mission for Clean Ganga (NMCG) is increasingly calling for a circular water economy wherein the used water becomes a resource rather than a liability. There are states who have also made policies related to the reuse of treated wastewater.

Creating Circular Water Systems Involves Intelligent Infrastructure

Water recycling cannot be accomplished by treatment plants alone; it is a function of an integrated infrastructure that includes treatment, distribution, monitoring, and reuse of water at various stages of its life cycle.

Recent advances in treatment technologies are making such a shift possible.

The biological treatment processes, including Moving Bed Biofilm Reactors (MBBRs) and Sequencing Batch Reactors (SBRs), allow for effective treatment of wastewater while requiring minimal land area. The Membrane Bioreactors (MBR) and Ultrafiltration (UF) technologies help to

obtain water of extremely high quality that can be reused in industries. The Reverse Osmosis (RO) helps to reclaim process water for production purposes, whereas Water Treatment Plants (WTPs), Effluent Treatment Plants (ETPs) and Sewage Treatment Plants (STPs) are becoming more than just tools of compliance but are becoming the elements of intelligent infrastructure to create circular water systems.

Other key technological advancements include the increased use of Zero Liquid Discharge (ZLD). Through ZLD systems, industries can cut down their reliance on fresh water by reusing and recycling virtually all the water that comes out as effluent. Similarly, in many coastal areas, where sources of fresh water are still limited, desalination has become a crucial part of the diversified water supply system.

Overall, through the adoption of such technologies, the water cycle in India is changing from a linear process of extraction, consumption, and disposal into a more circular approach of recovery, reuse.

The Future of Water Infrastructure Relies on Integration

While technology certainly has a lot to offer, it cannot be the whole picture. The next stage of India's water transition would see the integration of an infrastructure ecosystem of engineering, digital technologies, automation, and long-term

operations. Rather than relying solely on stand-alone treatment facilities, cities and industries are increasingly seeking comprehensive water lifecycle solutions from sourcing to treatment to distribution and recycling to asset management.

In doing so, they are transforming the engineering industry itself. Infrastructure firms are not only expanding from their traditional municipal business to bespoke industrial water and wastewater treatment facilities, as they recognise that different sectors like manufacturing, pharmaceuticals, chemicals, food processing, and other industries have very specific water needs.

The current annual reports of leading companies active in the sector clearly demonstrate the shift towards more advanced water treatment, zero liquid discharge facilities, lifecycle operations, and use of digital technologies like Building Information Modeling (BIM) and AI monitoring and prediction.

India's Water Security Will Depend on Reuse, Not Extraction

For India to become water secure, it will be imperative for the country to concentrate on the effective utilization of the existing water sources rather than looking out for any additional sources of water. Due to rising urbanization and industrialization, it is important that wastewater is considered an asset rather than a liability.

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Mr. Singh is a Mechanical Engineer from BIT, Mesra and has done Advanced Management from OT Hamburg. He is having 35 years of experience in EPC Projects industry. He has worked with L&T for 20 years and Indian Oil Tanking for 7 years before joining Voltas. He has executed large EPC projects in Energy, Petrochemical, Refineries, Fertilizers, Oil & Gas pipeline and Automobile sector with P&L responsibility. He joined Voltas as a head of Domestic Project business and was later appointed as Chief Operating officer post restructuring of B2B business into a wholly owned subsidiary called Universal.

Mr. Singh has held many important positions during his tenure and as JT, President of Indian Oil Tanking he was Director on the board of KOTECs Oman, IOTWTO Turkey, PTOT Indonesia.

Mr. Singh has also been associated with two startups for a brief period of two years as a Managing Partner.

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