

Indian Plumbing Today

Vol 07/ Issue 11/ February 2026

Annual Subscription : ₹ 240

Total no. of Pages: 68

Challenges in Plumbing for Tall Buildings



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**Published by**

Chandra Shekhar Gupta

Printed by

Chandra Shekhar Gupta

On behalf of

Indian Plumbing Association

Printed at

Infinity Advertising Services Pvt. Ltd.,
Plot No. 171 & 172, Sector 58
Faridabad – 121 004. Haryana

Published from

Indian Plumbing Association
416, DLF Prime Tower
79 & 80, Okhla Phase 1
New Delhi – 110 020.

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Dear Friends,

Whenever discussions arise on water scarcity and the alarming possibility of future conflicts over water resources, I often find myself reflecting on India's

remarkable population growth—from about 33 crores at the time of Independence to nearly 143 crores today. This exponential rise has naturally led to a significant increase in water demand across domestic, commercial, industrial, and agricultural sectors.

However, as we move forward, it is clear that traditional approaches alone will no longer be sufficient. The time has come for a more holistic and sustainable strategy that places strong emphasis on rainwater harvesting, reuse of treated sewage, widespread adoption of low-flow plumbing fixtures in the construction sector, and promotion of low-water irrigation techniques in agriculture. These measures are no longer optional—they are essential.

March 2026 holds special significance for the plumbing fraternity as we celebrate both World Plumbing Day and Founders Day, which the Indian Plumbing Association (IPA) observes every year on 11th March. On this occasion, a wide range of activities will be organized across all IPA chapters along with webinars in regional languages to mark World Plumbing Day. On Founders Day, we will also conduct an online meeting with executive members from all chapters, providing an opportunity to reflect on our journey and discuss future initiatives.

IPA successfully organized Summit 2026 on 4th February in Bengaluru. The theme, "*Regenerative Built Environment: Beyond Sustainability – 2047*," was both timely and relevant. Eminent architects, developers, and consultants shared their perspectives and engaged in meaningful deliberations on this critical subject. Such dialogues among stakeholders are vital for driving sustainable development and aligning with the vision of Viksit Bharat by 2047, a dream cherished by every Indian.

The theme of the present issue is "*Challenges in Plumbing for Tall Building*". This edition features insightful articles on topics such as architects' perspectives on high-rise water management, plug-and-play STP systems, sustainability, and water efficiency. I am confident that readers will find these contributions by stalwart plumbing professionals informative, practical, and inspiring.

I once again request all readers to share their valuable feedback. Your inputs will help us uphold the principle of continuous improvement, ensuring greater value and benefit for the entire fraternity.

Warm regards,

Rahul Dhadphale

IPA Regional Director, South
Editorial Board Member



IPA Vision 2026
Gurmit Singh Arora



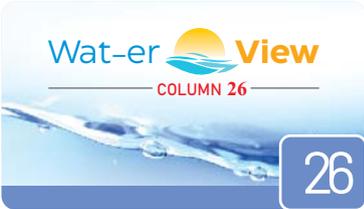
Vertical Circularity: An Architect's Perspective on High-Rise Water Management
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Sustainability, Water Efficiency & Energy Optimization in Vertical Developments
Anil Sawhney



Back to Basics
Rahul Dhadphale



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Chandrashekhar HariHaran



Plug and Play Compact STP Systems and High Recovery RO Systems for High-Rise Buildings
Minu Singh and Arjun Bhattacharya



Water Efficiency & Smart Plumbing Systems: Designing Buildings That Think
Madhava Narasimha Murthy Nedunuri



World Plumbing Day & Founder's Day 2026



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Warm New Year greetings as we step into a year of new opportunities and progress!

It gives me immense pleasure to share the continued progress and momentum that our Indian Plumbing Association and the nation are experiencing across multiple fronts.

The year 2025 has been significant for India's economic and infrastructure landscape. India's economy is projected to grow robustly, with real GDP expected to expand around 7.4% in the fiscal year 2025–26, showing strong resilience and momentum compared with earlier years. This growth outlook reflects sustained domestic demand, income, investment activity, and broad-based sectoral performance despite global uncertainties.

Infrastructure and urban development initiatives continue to advance at pace through the efforts of the Ministry of Housing and Urban Affairs (MoHUA) and the Ministry of Jal Shakti (MoJS). Major programmes such as the Atal Mission for Rejuvenation and Urban Transformation (AMRUT 2.0), Jal Jeevan Mission, Jal Sanchay Jan Bhagidari, Pradhan Mantri Awas Yojana (Housing for All), and Swachh Bharat Mission 2.0—extended through FY 2025–26—along with the rapid expansion of urban transport infrastructure, including metro networks, are driving transformative change across cities and towns nationwide.

These developments are creating strong upstream demand across the construction and real estate sectors—spanning EWS, LIG, MIG,

and HIG housing—as well as in water, sanitation, transportation, and allied infrastructure. For the Indian Plumbing Association (IPA), they present extraordinary opportunities to contribute to nation-building, enhance professional relevance, and advance water, energy, waste, and carbon neutrality goals.

Vision 2026 aims to ensure that IPA's growth remains in double digits and that our strategic priorities fully align with the country's development trajectory. We are therefore setting annual growth targets that balance near-term milestones with our long-term Mission and Vision, with the aspiration of making IPA one of the most respected professional associations in the country, anchored by a strong and engaged membership of 25,000+ professionals.

Our strength lies in our ability to convert ambitious goals into tangible impacts—working collaboratively to make Bharat water-positive and water-secure. Let us reaffirm our commitment to this IPA Vision 2026, not only to position IPA as a formidable institution but also to contribute to a greener, cleaner, and more sustainable planet.

I present to you IPA Vision 2026 and urge all members of the IPA, IPA Chapters, the NEC, NEB, and Team IPA HQ to uphold and implement this Vision in its entirety.

IPA VISION 2026



PlumbexIndia Exhibition

- To conduct the PlumbexIndia exhibition at Bangalore International Exhibition Centre (BIEC), Bengaluru, from 16th to the 18th of April, 2026 in an area of 14000 square meter.
- To conduct the IPA Bathroom Challenge in collaboration with IWSH / IAPMO USA at PlumbexIndia 2026.
- To conduct the IPA Water-Based Design Competition Workshop in collaboration with Ethos Empowers, primarily engaging architectural students, during PlumbexIndia 2026.



Summit 2026

- A building industry stalwarts meet, IPA SUMMIT 2026 to be conducted on the 4th February, 2026 at the Hotel Sheraton Grand in Bengaluru. The theme of IPA Summit 2026 is "Regenerative Built Environment: Beyond Sustainability – 2047".



Indian Plumbing Conference

- 32nd Indian Plumbing Conference & Exhibition to be held in Chennai from 17th to the 19th December, 2026 at Chennai Trade Centre, Chennai.



Plumbing Laboratories

- To complete the development work of the world class Centre of International Plumbing Practices (COIPP) at the Goa Engineering College, Farmagudi, Goa. The COIPP is poised to be inaugurated in the mid of 2026.



World Plumbing Day

- To celebrate World Plumbing Day (WPD) on the '11th March' with Blood Donation Drives, I Save Water Campaigns, Regional Language Webinars, Social Media contests, Painting & Drawing Competitions, so as to create awareness on the depleting water condition in our country.



Water Audit Council (WAC)

- To build the Water Audit Team.
- To offer Water Audit Services in the built environment and the industry to bring about an awareness of reduction of fresh water use.
- To target 250 participants to provide IPA water audit certification to them in collaboration with NSDC.

IPA VISION 2026



Association Interaction

- To initiate in conducting training sessions on the attributes of good and correct plumbing practices with designers and architects through COA, IIA, IIID and developers & hoteliers through CREDAI, NAREDCO & FHRAI.



IPA Neerathon

- To conduct 'IPA Neerathons' in different cities including Pune, Delhi, Bengaluru, and Chennai to spread awareness on water conservation. IPA Pune Chapter is all set to launch their first IPA Neerathon on 15th February, 2026. Across its last three editions, the IPA Neerathon has drawn over 14,000 participants.



Editorial Content (IPT)

- To strengthen the Indian Plumbing Today (IPT) magazine by bringing in authors from various horizons of Water, Plumbing & Sanitation adding more content scope for readers, offering a bouquet of relevant and current topics to savour, and improve their knowledge base.



Technical / Upgradation of Codes

To revise the following Codes in 2026:

- Convert 'A Guide to Good Plumbing Practices (AGPPP)' in 'Oriya' language.
- To undertake a revision of the Uniform Solar, Hydronics and Geothermal Code – India in 2026.



Indian Plumbing Professional League (IPPL)

- To conduct the IPPL in IPA chapters physically, and award them with NSDC IPA Co- branded Certification, with best of the Plumbing Gurus, to impart codal based plumbing, culminating into quizzes to a minimum of 1,000 building industry professionals.



Indian Architectural Plumbing League (IAPL)

- To initiate training of Architects registered with Council of Architecture under the IAPL course program. IPA has signed an MoU with COA for the IAPL partnership.



Membership Growth

- To increase membership by 1,500 members in 2026 to 14,000 (current strength 12,500 members).

IPA VISION 2026



Advocacy

- It is important that IPA interacts with Government regularly and the Developer & the Hospitality community through CREDAI, NAREDCO & FHRAI and the Design community through IIA, IIID and COA to ensure that we move towards low water consumption, water conservation, reclamation of used water, moving towards our goal of circularity in Water & Waste Water along with harvesting Rain Water, creating awareness on the depleting water condition in our country.
- Indian Plumbing Association is in conversation with Ministry of Housing and Urban Affairs (MoHUA) to conduct a joint conference on AMRUT 2.0, 24X 7 Water Supply and Drink from Tap, and to mandate low-flow fixtures, fittings, and sanitary ware.



'I Save Water' Mission

- To initiate saving of 1,000 Cr liters of water through all 28 chapters of the IPA, IPA Vanita & NAREDCO MAHI in 2026.
- To move towards Net Zero Water and Net Zero Sanitary Waste, achieving neutrality & circularity in built environment.



National Special Projects

- To help in special projects including provision of Toilets in Children's Schools, especially for the girl child.
- To also imbibe water saving initiatives & learnings in Schools through IPA Vanita.



New IPA Chapters

- To add 5 new Chapters in the Calendar Year 2026, making the total strength to 33 Chapters.



Student Chapters

- To add 20 Student Chapters across various Engineering & Architectural Colleges in 2026 to the current strength of 73.
- To ensure we regularly interact with our Student Chapters.



Webinars

- To conduct a minimum of 5 Technical Webinars in the months when there is no event



Improve IPA Chapter Activities

- To improve the IPA chapter activities through better co-ordination between various sister organizations and within the water, sanitation and plumbing fraternity of the Chapter & IPA Headquarters.
- To ensure that each IPA Chapter actively undertakes and implements new activities.



Knowledge Centers by IPA

- To establish IPA Knowledge Centers across India to propagate IPA activities and membership / chapter growth.



IPA VANITA

- To undertake social impact projects in defined areas
- Install Aerators in Hotels, Schools and other projects across PAN India.
- IPA Vanita to launch "My Water, My Story," a national story-writing competition for Classes VI–VIII, aimed at fostering water awareness, responsible practices, and sustainability among young learners.

On the completion of 33 years of service to the Nation, IPA commits to be the Change, as we ensure that IPA stands tall reaching unprecedented heights never reached before.

My NEB and NEC join me in wishing each one of you, health & happiness with the hope that we act as the change agents, in increasing awareness on Plumbing, Water & Sanitation - a crucial service among all building industry stakeholders, and are able to promote correct codal based plumbing practices in the building sector, which is the second largest employer and contributor to the GDP of our country, hence helping in reducing the medical bill of our country.

With my best regards, and best wishes for a resilient and prosperous 2026!

GURMIT SINGH ARORA
NATIONAL PRESIDENT
INDIAN PLUMBING ASSOCIATION



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Vertical Circularity: An Architect's Perspective on High-Rise Water Management

- Aryan Arora

The Indian urban skyline is undergoing a radical vertical transformation. As architects, we are increasingly designing "Vertical Cities" that conserve land but creates immense localized pressure on municipal infrastructure. For a professional entering the field today, the high-rise is no longer just a structural challenge; it is a resource management challenge. In our current climate of rapid densification, we can no longer view plumbing as a "hidden service" relegated to the final stages of MEP coordination. It has become a core design parameter.



Figure 1: The Urban Load. This comparison illustrates the intense localized pressure vertical cities exert on municipal infrastructure, necessitating a shift from municipal dependence to building-level autonomy.

To meet the mandates of the National Building Code (NBC) 2016 and CPHEEO guidelines, we must pivot from a linear "supply-and-waste" model to a circular "recovery-and-reuse" framework. The goal is to engineer a self-sustaining hydrological cycle within the structure's own footprint, transforming the building from a resource consumer into a self-reliant cell. This shift toward autonomy is best understood by looking at how our approach to verticality has evolved over the decades.

This evolution is not merely technical, but a fundamental change in how we allocate spatial and structural resources within the building core.

The Evolution of Vertical Infrastructure

By comparing the landmark high-rises of the late 20th century with the super-talls of today, we see not just a change in height, but a fundamental evolution in how a building "breathes" and "circulates."

Charles Correa's Kanchanjunga Apartments in Mumbai remains a masterpiece of climatic design, but its plumbing logic belonged to an era of municipal abundance. At approximately 84 meters, its system was a "Linear Umbilical." Water was imported from city mains, stored in massive concrete basement tanks, and pumped to the roof in a top-down gravity feed. Waste was a liability to be exported immediately. In this era,



the spatial trade-offs of sprawling basement tanks were accepted because basement square footage was not yet the high-value asset it is today.

Contrast this with a 300-meter mixed-use spire like **Supertech Supernova** in Noida. Here, the sheer height and the diversity of "Water Personalities" ranging from high-traffic retail podiums to Grade-A offices make a linear system physically and economically impossible. The building must be "sliced" by mechanical service floors that act as pressure-breaks and decentralized treatment hubs.

As we move from the consolidated cores of the 80s to these interleaved service layers, a new problem arises for the architect: How do we fit advanced treatment technology into these high-value floors without sacrificing the Gross Floor Area (GFA) that developers rely on? This spatial conundrum is where the intelligence of modular treatment systems becomes a design necessity.

Spatial Intelligence and the Energy-Water Nexus

Traditional biological Sewage Treatment Plants (STPs) require deep, massive concrete tanks that often dictate the structural grid and eat into parking yields. The solution for the modern architect lies in Advanced Oxidation Processes (AOP). By utilizing UV and Ozone rather than biological cultures, these systems become "plug-and-play" modular units. They are silent and odorless, allowing them to be tucked into service zones on podium or mechanical levels, effectively reclaiming the basement for higher value uses.

However, saving space is only half of the battle. In a tower exceeding 200 meters, the energy required to lift water is a massive operational expense. This is where the **Energy-Water Nexus** becomes critical. One of the most reliable sources of 'recycled' water in a tall building is the **Cooling Tower Blowdown**. This is essentially the wastewater from the building's massive air-conditioning system. By using a high-efficiency filtration system like **Reflux RO**, we can recover over 90% of this water. Instead of letting it drain away, we loop it back into the building's plumbing, which is a massive win for our sustainability credits.

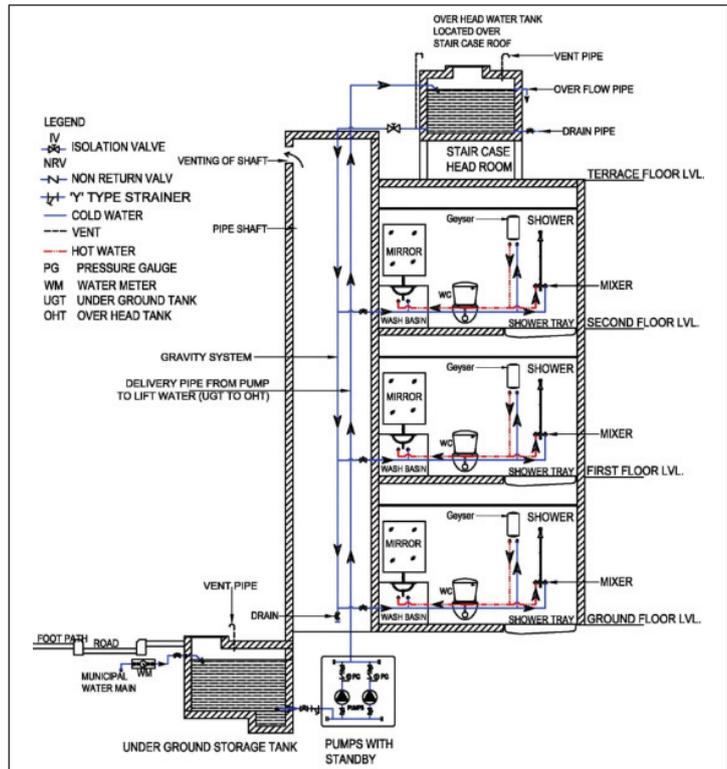


Figure 2: Schematic diagram showing a traditional Top-Down Gravity Feed System.

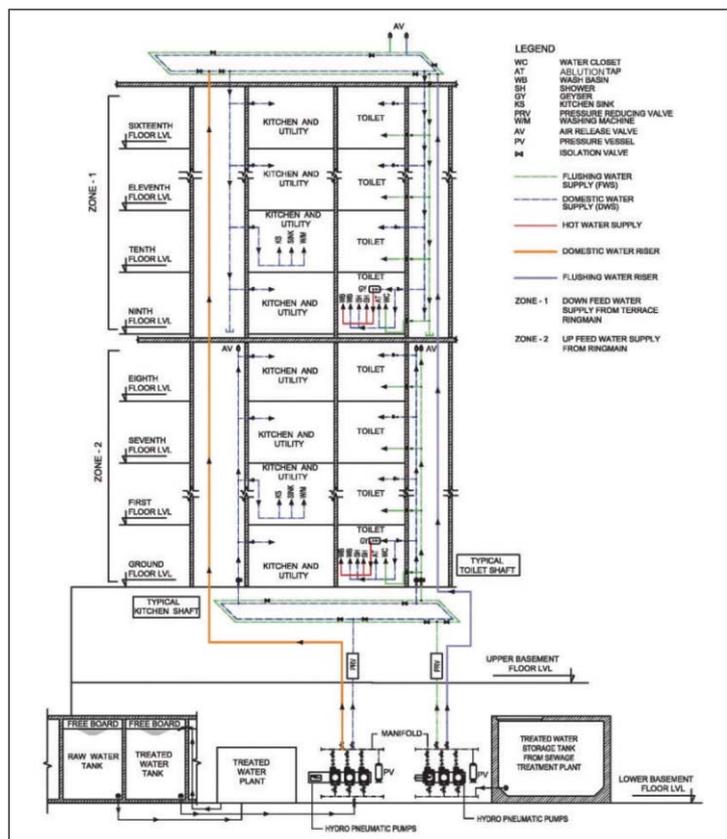


Figure 3: Schematic diagram showing a Modern Hydro - Pneumatic System.



Figure 4: In high-rise architecture, localized water loops and compact treatment systems turn vertical density into a resource-efficient design advantage.

By placing these compact RO units on intermediate service floors, we treat the HVAC water at the level it is generated. This allows us to redistribute reclaimed water for flushing on the floors immediately below without ever sending it back to the basement. This strategy doesn't just save water; it drastically reduces the "Pumping Power Penalty." Understanding these localized loops is the key to moving toward the industry's highest sustainability of benchmarks and certifications.

Benchmarking Sustainability and the Path to Autonomy

Integrating AOP and Reflux RO is no longer just a "green" choice; it is the primary lever for achieving **IGBC Platinum** and **LEED v4.1** certifications. By reclaiming 90% of cooling tower waste, a project maximizes its points in the "Non-Potable Water Use" and "Water Consumption Reduction" categories. This technical circularity provides a validated roadmap for buildings aiming for the **IGBC Net Zero Water** rating, turning a logistical challenge into a marketable asset.

Beyond credits, a water-autonomous building is a resilient asset. By reducing reliance on municipal tankers and lowering operational energy costs, we enhance the long-term financial viability of the project. This makes the architect's role essential not just as a designer of form, but as a strategist of resource survival.

Conclusion: The Architect as Systems Integrator

As we design the next generation of the Indian skyline, our role must continue to evolve. We are no longer merely designers of the building envelope; we are the conductors of its internal metabolism. By integrating these circular technologies into the very DNA of our vertical structures, we ensure that the skyscrapers of tomorrow are as sustainable as they are soaring.



Aryan Arora
Architect-1, AECOM

Aryan Arora is an Architect at AECOM, specializing in data center design. He supports architectural planning through BIM workflows and digital coordination with critical building systems such as cooling, power, and water. With a keen interest in computational design, he is committed to developing practical design solutions that bridge architecture and engineering systems. He can be reached at aryan.arora@aecom.com



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Sustainability, Water Efficiency & Energy Optimization in Vertical Developments

- Anil Sawhney



In the context of rapidly urbanizing economies and global climate challenges, vertical developments have emerged as both a solution and a sustainability challenge. High-density, high-rise buildings concentrate water and energy demand, requiring sophisticated design and operational strategies to achieve meaningful resource efficiency. As cities grow skyward, sustainability in vertical infrastructure hinges on measurable performance—particularly in water efficiency and energy optimization.

Globally, **flushing can account for up to 27% of indoor water use** in residential buildings and even more in commercial facilities where occupancy is high. This makes flushing systems a strategic target for achieving building-level sustainability performance and resource optimization.

The Global Water Challenge and Urban Buildings

Urban water demand is expected to **double by 2050**, driven by population growth and urban expansion, placing immense strain on existing water resources and infrastructure. This trend underscores the urgent need for efficiency measures integrated into building systems, particularly in dense vertical environments where per-capita consumption compounds rapidly.

The United Nations has highlighted that relatively simple technological choices can deliver significant impacts—for example, adopting **dual-flush flushing systems with high-efficiency water closets can reduce water consumption by 40–60%** compared to traditional systems.



Water Efficiency as a Core Engineering Objective

Traditional flushing technologies in urban buildings have been slow to evolve, often relying on **high-volume flushes exceeding 9–11 litres per flush**. Such volumes, when multiplied across hundreds of toilets in a high-rise tower, drive significant freshwater demand and amplify infrastructure load.

In contrast, modern flushing systems—such as **dual-flush mechanisms**—reduce water use by offering separate flush volumes for liquid and solid waste, typically between **3–6 litres per flush** compared to conventional units. By replacing high-volume flush systems with these low-flow solutions at scale, buildings can **reduce annual water use by over 20,000 litres per toilet** and achieve **per-capita daily water savings of up to 30%**.

This reduction is not merely incremental but transformative in large vertical developments where the number of toilets can number in the hundreds or thousands.

Reuse and Recycled Water for Flushing

Water recycling for non-potable uses, particularly flushing, is a cornerstone of sustainable water management in vertical developments. Recycled sources—such as **treated water**, provide a significant opportunity to offset potable water demand.

Buildings that implement **greywater or rainwater reuse systems** can reduce reliance on municipal freshwater supplies by **up to 70–90%** when integrated across all non-potable demands, including flushing, landscaping, and HVAC systems.

International examples demonstrate how water reuse transforms building performance:

- **Rainwater capture and reuse for flushing** in high-rise buildings has reduced sewage outflow by as much as 95% in some cases, with rainwater collected at multiple building levels and repurposed after filtration.
- Usage of recycled/reclaimed water in commercial buildings have **reduced annual water consumption by ~25%** for toilet flushing and other non-potable uses like landscaping.

However, implementation challenges remain—particularly in regions where tertiary treatment infrastructure is lacking. In certain cities, treated wastewater currently cannot be reused for toilet flushing without additional treatment steps to ensure safety and quality.

Smart Monitoring and Digital Controls: Data-Led Efficiency

Beyond passive fixtures, smart monitoring systems are revolutionizing water management in high-rise developments. IoT-enabled meters and analytics platforms allow facility managers to track usage, detect leaks early, and optimize system performance in real time. Buildings with integrated water-use analytics have demonstrated reductions in waste of up to **30% through anomaly detection and usage profiling**.

Such systems are particularly valuable in vertical developments, where complex piping networks across multiple pressure zones make traditional leak detection and consumption forecasting challenging.

Technical Pathways for Water-Efficient Flushing

Low-Volume Flush Systems:

- Dual-flush systems provide water savings by tailoring flush volume to the waste type.
- Pressure-assisted and high-efficiency flushing systems can reduce water per flush significantly while maintaining performance in tall buildings with varied plumbing pressures.

Smart Controls and Monitoring:

Real-time monitoring of flushing usage and recycled water performance improves maintenance and identifies inefficiencies before they cause loss. While specific statistics on smart flushing systems are emerging, the broader trend in IoT-enabled water systems shows significant potential for reducing leaks and optimizing usage patterns.

Market and Regulation Trends

Market research underscores the growing demand for water-efficient flushing systems as part of broader sustainability agendas. The global flushing systems market is expanding on the back of water scarcity

concerns, regulatory mandates, and corporate sustainability commitments.

Regulations in many regions incentivize or mandate low-flow systems and reuse infrastructure—accelerating adoption in both new vertical developments and retrofits.

Sustainability Certifications and Market Signals

Water efficiency is a critical component of many green building rating systems globally. In India alone, green buildings certified under sustainability frameworks collectively **save nearly 199 billion litres of water annually**, while also reducing carbon emissions by over 50 million tonnes—comparable to planting 2.4 billion trees. These figures demonstrate the real impact that integrated water and energy strategies can have at scale.

Conclusion: Flushing Systems as Strategic Sustainability Assets

Flushing systems in vertical developments are no longer

peripheral design elements; they are strategic technology nodes for sustainable resource management. Their optimization—through water-efficient flush mechanisms, smart control systems, and recycled water integration—delivers multi-dimensional value:

- **Substantial potable water savings**
- **Reduced energy use associated with pumping and heating**
- **Lower operational costs**
- **Enhanced resilience in water-scarce contexts**

As cities continue to drive upward, flushing system innovation and recycled water integration will be critical levers in transforming vertical buildings from resource consumers into efficient, resilient, and sustainable assets. Integrated, data-centric approaches to flushing system design and operation will define the next generation of sustainable developments.



Anil Sawhney
Managing Director, Sloan India

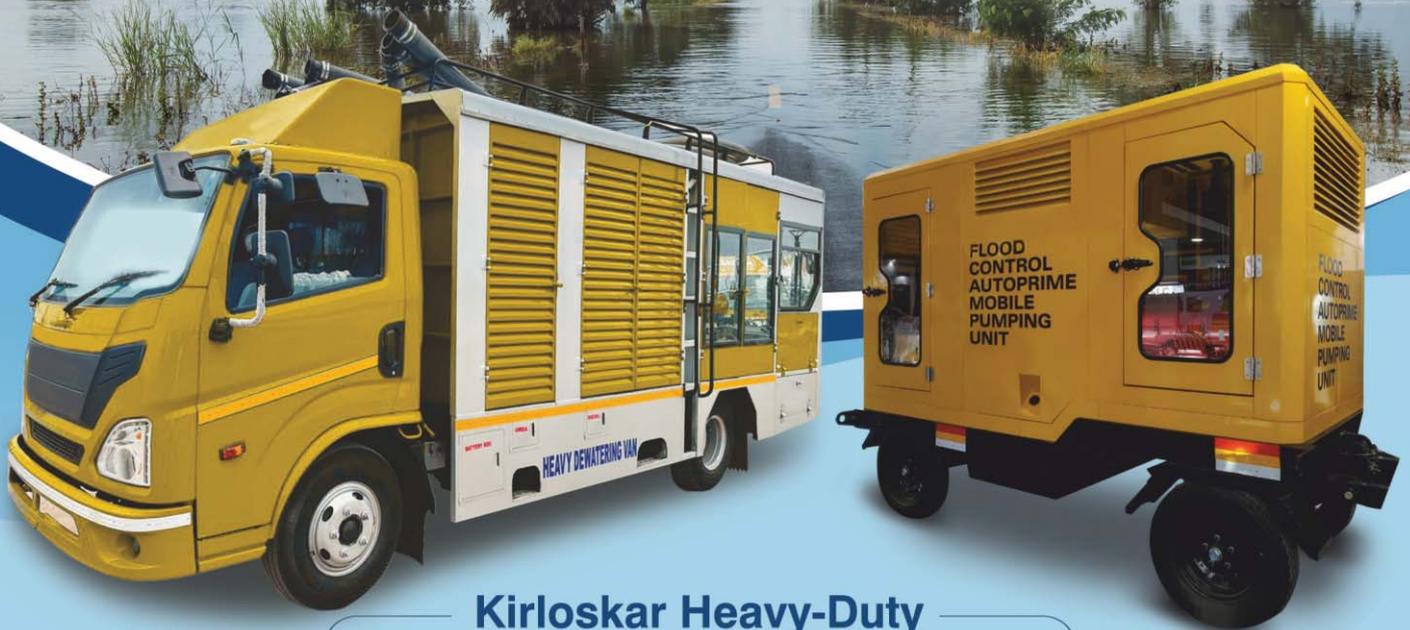
Anil Sawhney is a results-driven business leader with nearly two decades of experience shaping high-growth organizations across the Building Materials and Consumer Electronics sectors. As Managing Director of Sloan India, he provides strategic vision and operational leadership, steering the organization through expansion, transformation, and sustained performance improvement.

Anil brings deep expertise in business strategy, operational excellence, commercial execution, talent development, and enterprise-wide governance. He is known for building high-performing teams, strengthening profitability, and institutionalizing operational discipline. His leadership is marked by a strong focus on customer-centricity, process rigor, and long-term value creation for stakeholders.

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Fixed-Speed and Variable-Speed Systems

-Rahul Dhadphale

1. Introduction

Let's understand what's the difference between variable speed motors and fix speed motors.

All motors are basically fixed speed motors and are designed for 50 hz frequency in India.

Whenever we design a Hydro- Pneumatic System on a fixed speed pump gives fixed discharge based on the pressure setting but the consumption rate may vary and to accommodate and compensate for this variation we design the capacity of Hydro Pneumatic tank.

When we change the speed of the motor which is possible only by changing the frequency of the motor. As we change the speed of the motor and in turn speed of pump Head, Discharge and Power varies and without any Hydro-Pneumatic Tank we can run the system. But in that case we need to keep the motor on continuously. So whenever a motor runs at minimum speed for a certain duration logically it is assumed that there is no consumption and speed of the motors is increased slightly if the pressure also increases along with the speed it is confirmed that there is no consumption and motor is stopped. As soon as consumption starts immediately pressure starts falling down as the capacity of the Hydro-Pneumatic tank is small. As soon as pressure drops to set value the motor starts.

VFD are and can be used when

- You expect constant flow without any fluctuation.
- When the flow rate of the pump is very high and therefore capacity of the Hydro-Pneumatic Tank is high.

- Pressure of the pump is already high and you don't have room to accommodate additional pressure for cut in and cut out for fixed speed motors.

Now lets understand the technical part of VFD and Fixed speed motor.

Electric motors are the backbone of industrial and building services applications — from pumps and fans to compressors and conveyors. How these motors are driven greatly influences **energy consumption, process control, and maintenance requirements**. Traditionally, motors were operated at **fixed speed**, with fixed output. In modern systems, **Variable Frequency Drives (VFDs)** provide precise, efficient speed control by electronically varying the motor's input frequency.

This article compares:

- **Fixed-speed systems**
- **VFD-controlled systems**

2. Working Principle

Fixed-Speed System

- All Motors are designed with constant-frequency AC (typically 50 Hz or 60 Hz).
- Output control (flow, pressure, torque) achieved by:
 - o Flow and pressure is achieved as per the performance chart of individual pumps.
 - o On/off cycling
- Application- These pumps are used for point to point water transfer or Hydro Pneumatic Systems with larger Hygro Pneumatic tank.

Variable-Speed System

- Speed in electrical motor can be adjusted only by altering frequency. As already mentioned all motors are designed for a specific speed and in any situation of increased load motor tries to achieve designed speed and draws more current to achieve the same and ultimately burns. As you change frequency speed of motor changes and discharge pressure and renergy consumed by motor also changes.
- **Application:** When you want supply water at multiple locations from one tank and one pumping system VFD systems are used.

Pump Type Comparison	
Fixed Speed Pumps	Variable Speed Pumps
<p>Much like an on/off light switch, fixed-speed pumps operate at a constant speed, regardless of the system's load.</p> <p>They are a straightforward solution where a steady flow is needed, such as in irrigation systems, which require a constant supply of water.</p>	<p>Like a light bulb controlled by a dimmer, variable speed pumps adapt their speed to cater to the system's fluctuating demands.</p> <p>They fit like a glove in scenarios where load demand varies, such as HVAC systems in commercial buildings, which must adjust to changing occupancy levels and climate conditions.</p>

VFD (Variable Frequency Drive) System

- Electronic device converts fixed-frequency AC to a variable-frequency, variable-voltage output.
- Speed = proportional to frequency supplied to motor.
- Adjusts motor RPM to match process demand.
- For centrifugal loads:
 - o Flow \propto speed
 - o Pressure \propto speed²
 - o Power \propto speed³ (huge energy savings at reduced speed)

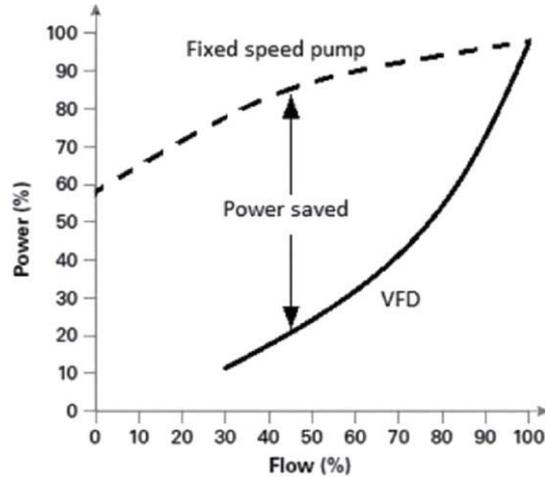
3. Energy Efficiency

System	Efficiency at Full Load	Efficiency at Partial Load	Energy Loss Sources
Fixed-Speed	High	Poor	Throttling losses, bypass losses
Mechanical Variable-Speed	Medium	Medium	Gearbox/belt losses, slip losses
VFD	High	Very High	Minor electronic losses (2–4%), some harmonics

Example:

For a centrifugal pump designed for 100% flow:

- Reducing speed by 20% with a VFD cuts power consumption by nearly 50%.
- In a fixed-speed system, throttling to achieve the same flow reduction still draws ~90% of full-load power.



4. Control & Automation

- **Fixed-Speed:** Minimal control; process adjustments are manual or via throttling devices.
- **Mechanical Variable-Speed:** Adjustment possible but often manual; limited automation potential.
- **VFD:** Allows full integration with sensors, PLCs, Building Management Systems (BMS), SCADA, etc., for automated and adaptive control.

5. Maintenance Requirements

- **Fixed-Speed:**
 - o Simple system, low motor maintenance.
 - o Valves/dampers wear faster due to throttling.
- **Mechanical Variable-Speed:**
 - o High maintenance: belts, pulleys, gearboxes require lubrication, alignment, and replacement.
- **VFD:**
 - o No mechanical wear parts in speed control.
 - o Requires electronic maintenance (cooling fans, dust protection, capacitor lifespan).
 - o Harmonic distortion may require mitigation.

6. Cost Considerations

Cost Type	Fixed-Speed	Mechanical Variable-Speed	VFD
Initial Investment	Lowest	Medium	Highest
Operating Cost	Highest (variable load)	Medium	Lowest (variable load)
Payback Period	N/A	Long	Short (1–3 years possible)

Note: For applications with constant load and low energy costs, fixed-speed may still be more economical.

7. Applications

Fixed-Speed

- Water transfer pumps in constant flow systems
- Basic conveyors
- Fans with constant ventilation requirements

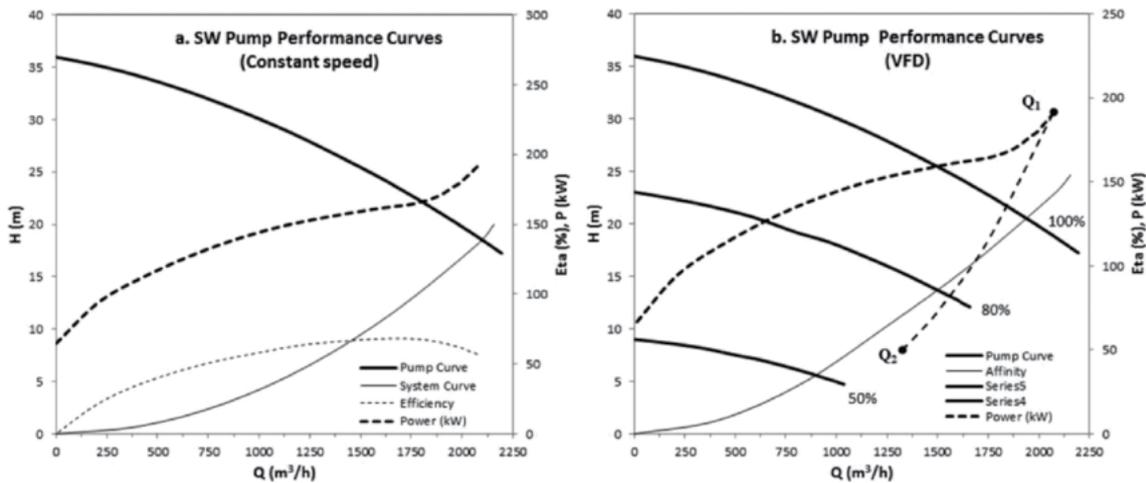
Mechanical Variable-Speed

- Older industrial setups without electronic speed control

- Explosion-proof areas where VFD-rated motors aren't feasible
- Small-scale workshop machines

VFD

- HVAC pumps and fans
- Water distribution networks with fluctuating demand
- Process industries requiring precise speed control
- Energy-saving retrofits for centrifugal pumps and blowers



8. Pros & Cons Summary Table

Aspect	Fixed-Speed	Mechanical Variable-Speed	VFD
Speed Control	None	Limited	Excellent
Energy Efficiency	Poor (variable load)	Medium	Excellent
Initial Cost	Low	Medium	High
Maintenance	Low	High	Medium
Automation	Low	Low-Medium	High
Payback from Energy Savings	None	Limited	High

Fixed Speed Pumps	Variable Speed Pumps
<p>Capital Costs</p> <p>When it comes to initial costs, fixed speed pumps usually carry a lower price tag, making them an attractive option for budget-restricted projects.</p>	<p>Capital Costs</p> <p>While the initial costs of variable speed pumps are often higher, due to advanced technology, costs can often be offset by the savings achieved in other areas.</p>
<p>Running Costs</p> <p>The operational costs of fixed speed pumps can be high, primarily due to their continuous operation at full capacity.</p>	<p>Running Costs</p> <p>By adjusting speed to meet demand, these pumps minimise energy wastage, leading to lower running costs.</p>
<p>Energy Usage</p> <p>Fixed speed pumps can consume more energy than variable speed pumps, as they run at a constant speed.</p>	<p>Energy Usage</p> <p>With their ability to fine-tune operational speed, variable speed pumps are usually more energy-efficient.</p>
<p>Noise</p> <p>Noise levels for fixed speed pumps remain constant and are usually predictable.</p>	<p>Noise</p> <p>Variable speed pumps may produce more noise at higher speeds.</p>
<p>Longevity</p> <p>Provided the application aligns with the pump's constant speed operation, the longevity of fixed speed pumps can be impressive.</p>	<p>Longevity</p> <p>Because variable speed pumps usually do not operate at full capacity continuously, they often experience less wear and tear, increasing their lifespan.</p>
<p>Power Requirements</p> <p>The power requirements for fixed speed pumps are steady and straightforward, without a need for intricate control systems.</p>	<p>Power Requirements</p> <p>Power requirements for variable speed pumps are more complex, requiring VFDs or similar technology to modulate the pump's speed.</p>

9. Conclusion

When comparing **VFD systems** with **fixed-speed** and **mechanically variable-speed** drives, the choice depends largely on the **load profile** and **application needs**.

- **If the load is constant** and system simplicity is the priority, **fixed-speed** operation is cost-effective.
- **If moderate speed variation is required** but electronics are not feasible, mechanical variable-speed is an option, though less common today.
- **For modern systems with variable load**, **VFDs** deliver the greatest energy savings, process control, and flexibility, often achieving a payback period of less than three years.



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Solutioning Sustainability as Retrofits

- Chandrashekhari Hariharan

PART 2

We discussed in the last edition the need for engaging beyond conceptual frameworks, and policy formulation. We went about offering you a quick ride of the terrain that awaits you as an MEP Designer if you want to make smart changes in the way you address facilities of your clients. Given constraint of space, we took you through one specific case study of what net zero water solutioning can potentially offer you in terms of cost savings, high IRRs, carbon reduction, reduction in water-related energy, and improvement in ESG bottom lines. Intent is to offer readers here insights gained from mentoring a bunch of water startups across many such challenges in many typologies of buildings and facilities, while helping us all, of course, see what the future of water and plumbing is.

In this edition, let us look beyond the first case study we examined in the January 2026 edition. The narrative this time expands on two more case studies. The first of the 'stories' was of a hospital which paid a bill of ₹2.4 Cr last year [2023-24] on water purchase alone—120 million litres a year at 20 paise per litre. All of the water was, and is being, bought from the municipal grid. And the story unfolded on how work is well on its way to make the hospital a Net Zero Water campus, with 80%, or ₹2 Cr of its bills being reduced, with the water being met by either supply-side options, or demand-side measures to reuse.

Let us learn from the other two Case studies.

Case Study 2. A secondary steel plant drives plan to secure dependence from Tanker Water

Set in a large industrial area to the south-western edge of Tamil Nadu, spanning over 100 sq km, this plant's 50-acre spread has been beleaguered by the challenge of dry borewells on the campus, a need of 450,000 litres a day of water, and the crippling, expensive dependence on Tankers for high-TDS [>700 ppm] water supplied from groundwater extraction from the neighbourhood.

This has meant a total annual demand of about 180 million litres/year. Even at a bare 10 paise per litre it amounts to a staggering ₹1.8 Cr every year that this organisation has had to cough up for tankers that supply water every day, all 100 percent of it, to this campus. Of the 400,000 litres a day, about 50% is to meet the raw water need of 200,000 litres for securing 125,000 litres of manufacturing Process Water of DM grade. Of the rest, 40% goes for other Process washing needs, and the balance 10% is for human use with 400 workers on site.

The high-TDS groundwater supply [about 700 ppm] also means the necessary evil of RO water filtration to secure low-TDS water [DM grade water with 1 ppm TDS] for the process plants of the Rolling Mills, Induction Furnaces, Ladle Furnaces, Vacuum Degassing Plants, Vacuum Oxygen Decarburization Plants, and

Continuous Casting Machines. This use of very-low TDS water is an imperative because the direct use of High TDS water will cause equipment damage, scale formation, corrosion, and will reduce operational efficiency, ultimately compromising product quality.

It bears repetition that on the RO Process alone, for every 200,000 litres a day, the factory 'loses' 75,000 litres a day as RO Reject water which carries over 5000 PPM of concentrated salts, with need for responsible disposing being a challenge. The company suffers a delta cost of about ₹50-70 lac every year, on this additional purchase of water for RO processing because of the loss of nearly 50% in 'recovery'. There is then the energy cost of running the RO filtration process—every tonne of permeate [filtered] water costs about 3 units of electricity. This electricity cost alone claims in a year about ₹22-23 lac at ₹10/unit of tariff, at the current level of usage in this plant. [As a digression, let me add that there is another manufacturing plant needing 450,000 of such net DM grade water, extracting every day 1 million litres of groundwater. This plant again has the challenge of disposing the salt concentrate for the RO Reject water, for nearly 500,000 litres every day. They muddle around with a weak effort at directing such high-TDS waters to large open tank areas in the hope that the salts will evaporate with the sun! That is about 200 million litres annually which transforms from 1500 ppm of TDS of raw water, to 6000 ppm, in just one project! The cost of creating scientific landfills is far too deterring for the company to want to invest on them. But that's another story.]

Having set out a series of problem statements at the steel plant, the team huddled down to creating a solution framework that would focus on maximizing the use of high-quality internal water sources, and prioritizing sustainability as well as efficiency.

In this case, too, as in the hospital, the first need was to get a good fix on the actual water consumption by various plants, and at multiple Points-of-Use [POUs]. Then came an understanding of the quality of water stored at various places, and in different times of the rainy season, given turbidity dynamics and the violent swings in NTU count of water that was stored. The

analysis of the existing water infrastructure of storage led to formulating a plan for harvesting in three tiers -- with surface water management, aquifer waters, and rooftop waters – all being harvested with sets of solutions for each that was unique and needed an understanding of the rainfall pattern, the geomorphology of the land, the pressure in distribution, the levels of contamination, the health of existing STP units for tertiary water treatment and the installation of no-chemical, no-energy systems for treating sanitation water to acceptable levels for reuse in landscape as well as in certain requirements of the net zero water plan that was chalked out.



A typical water body for harvesting surface water runoff in large catchments. This helps harvest water that needs very little treatment, with the TDS less than 50 PPM.

The core objective at the steel maker's campus was to address the plant's crippling dependence on expensive, poor-quality external water sources by shifting to a sustainable, low-TDS, in-house water management system. This project, in its making of the water re-engineering, also has brought to play a unique CFEW matrix (Carbon, Finance, Energy, Water) for measuring impact.

When it comes to solutioning retrofit options that are ecologically and economically sustainable, such examples as this steel plant stand out for what it can do to dramatically reduce operational costs for a vital resource like water in the manufacturing process.

Case Study 3. Hebbal School: Building Solutions that Schoolchildren learn to adopt

The Government High School in Hebbal, Bengaluru, presented a textbook example of urban water stress, struggling with dual challenges of supply and quality. The school was entirely dependent on external water tankers, a high-cost, high-risk solution. Crucially, the absence of an in-house treatment facility meant the water quality was poor, forcing staff to instruct students to bring their own safe drinking water. The goal was to transition the campus to a state of Net Zero Water and achieve water self-sufficiency.

The project originated from a CSR partnership with an external organisation. This partner, while seeing the potential to replicate the project in multiple schools wanted to document the transformation from the state-of-water-supply before, to the change after. The school's location—only 500 metres from a major, arterial flyover to the north of city—highlighted its presence in a high-density, resource-strained urban area, underscoring the urgent need for local water resilience.

It was a structured **Net Zero Water Plan** based on the basic design precepts of Source, Storage, Distribution, and Disposal of waste water. This involved deploying

water infrastructure with a series of steps engineered to save about one million litres a year in a school that hosted 400 children and about 18 teachers.

- **Rainwater Capture & Storage:** A system was designed to utilize the full rooftop area, channelling runoff through first-flush diversion and multi-layer filtration into interconnected storage tanks. With a total storage capacity of 27,000 litres to the daily demand of 4,000 litres, the school is now able to meet its complete water requirement during the monsoon months (June–November) without any external supply. The system provides reliable drinking-grade water during this period.
- **Groundwater Recharge:** To ensure long-term resource security, the system incorporates an innovative boulder trench system. These structures serve to manage excess runoff, facilitating groundwater recharge and actively contributing to the replenishment of the local aquifer. An open well, strategically located at the school's lowest point, is supported by an 80-metre "boulder-trench" infiltration network. This managed aquifer recharge approach drives excess monsoon runoff into the shallow aquifer, enhancing water retention and the well's strength to yield water during dry months. This is projected to reduce purchased water by 50% during non-rain months from the second monsoon from installation.



This is a typical freshwater treatment plant employed in this case for treating rainwater ... with remineralisation systems and a UV filtration for safe output. Rainwater is usually acidic at <math><6</math> and needs to be treated to reach a pH value of 7.2-7.3. The UVV is to ensure that no residual organic impurity remains in the water that is used as Drinking Grade water. Most compliance norms stop short at using of rainwater capture for merely recharging pits and borewells.



This is a classic Boulder trench system of watershed intervention adopted to an urban building. The graded aggregate that is stacked in these dug trenches help drive water to an open well [not visible in this pic]. It accelerates charging of the open well, which can yield water in the summer months. In large campuses, if strategically located, these can be perennial sources of water from the shallow aquifer, while such wells at 3 or 4 metres, help to strengthen the groundwater retention capacity of the shallow aquifer over a longer time.

- **Water Efficiency Fixtures:** High-efficiency taps were installed across the school. These fixtures regulate flow to about 6 litres per minute—less than half the earlier rate of 15-16 L/min. Combined with leak-proof plumbing, this intervention alone achieves an estimated annual saving of 200,000.
- **Digital Management:** A key functional element of

the installation is **digitisation**. This includes the placement of **flow sensors and smart meters** to monitor the operational efficiency and consumption of the entire water system. This measure-monitor-manage approach is vital for sustaining **water self-sufficiency** and detecting any wastage or operational issues immediately.

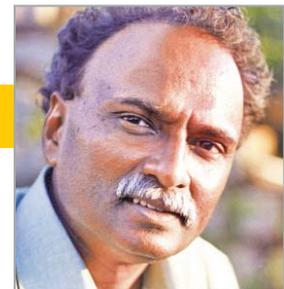
Outcome: Harvest the skies and grow water freedom. The integration of these solutions successfully transformed the Hebbal Government High School into an "inspiring model of a Net Zero Water School". The school now operates independently of external tanker imports, having achieved full water self-sufficiency and water freedom. This project provides a powerful, replicable blueprint for leveraging combined civil infrastructure and digital water technologies in high-density urban educational environments.

The project's **most profound impact** is the creation of a young crop of water-resilient school children of ages 12 to 15 years. By involving students and faculty in the process, the initiative imparts essential lessons on conservation, recycling, and how to "harvest the skies and grow their water freedom", thereby training the children to be responsible water stewards for the future. This dual achievement of infrastructure resilience and environmental education makes the school a model for other educational institutions seeking long-term water security.

The school transitioned from a water-deficit campus to a self-sustaining micro-water system, eliminating dependence on external water for nearly half the year. The total net water demand is projected to drop from ~0.9 million L/yr to ~0.2 million L/yr, representing an 80–90% reduction. This Government High School in north Bangalore now stands as a replicable prototype for other educational institutions seeking water security and climate resilience in urban India.

Chandrashekar Hariharan

The writer is founder-trustee at AltTech Foundation and Prem Jain Memorial Trust, and a Senior Fellow at CII IGBC. As a green building pioneer and a Net Zero exponent, he currently mentors startups to harvest over 5 billion litres of low-carbon, low-TDS water every year for a variety of commercial and industrial projects. He can be reached at Hariharan@AltTech.Foundation

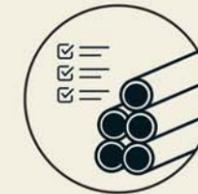


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Plug and Play Compact STP Systems and High Recovery RO Systems for High-Rise Buildings

- Arjun Bhattacharyya and Minu Singh



1. Introduction

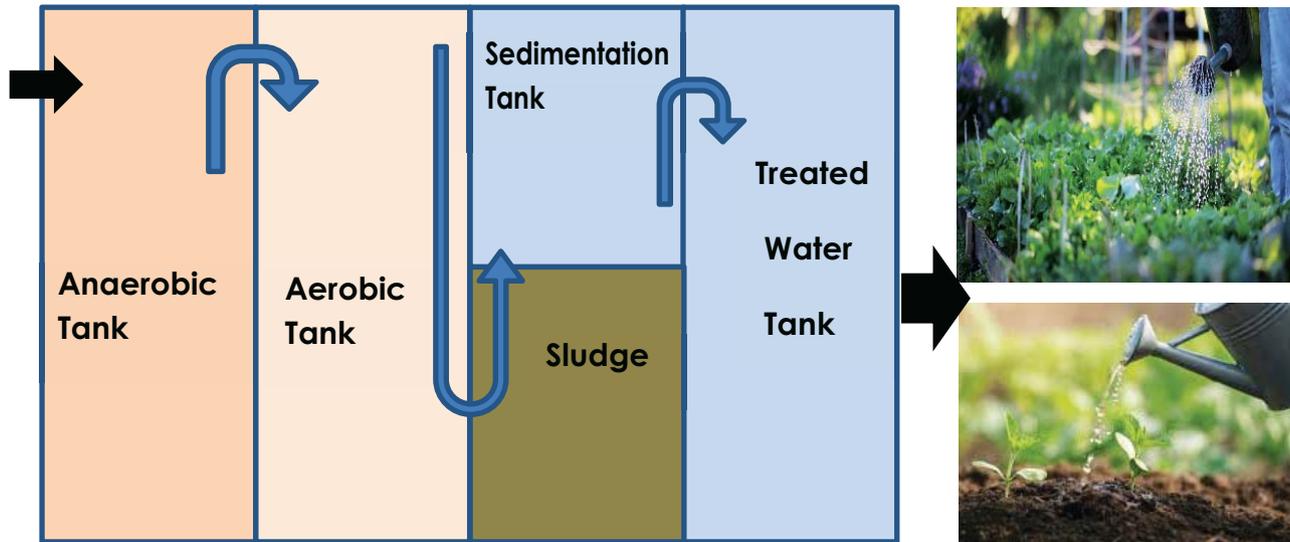
Rapid urbanisation and vertical development in Indian cities have significantly increased pressure on municipal water supply and sewerage infrastructure. Both residential and commercial buildings, particularly those with centralised HVAC and cooling tower systems, consume substantial quantities of potable water. In this context, the **National Building Code (NBC) 2016** and **CPHEEO** guidelines encourage on-site treatment and reuse of wastewater to reduce potable water demand.

This article discusses the growing need for quick **plug-and-play Sewage Treatment Plants and high-**

recovery RO-based reclamation systems for effective water recycling in tall buildings, with focus on rooftop HVAC cooling tower blowdown recovery and grey water and wastewater recovery and reuse.

2. On-site Sewage Treatment Plants (Compact STPs)

As per NBC 2016, Part 9 – Plumbing Services, all buildings generating wastewater shall make adequate arrangements for collection, treatment, and disposal or reuse of sewage. For space-constrained urban developments, compact on-site STPs are increasingly adopted.



2.1 Design Philosophy

The *plug-and-play* STPs are designed as **decentralised wastewater treatment systems**, typically installed at basement, podium, or service floor levels. These systems are engineered to:

- Treat domestic sewage generated from residential or commercial occupancy
- Produce treated effluent suitable for **non-potable reuse applications**
- Operate within limited footprints while ensuring ease of operation and maintenance

Typical treatment processes include –

a) Preliminary Treatment

- Coarse and fine screening
- Grit removal (where applicable)

b) Biological Treatment

Biological treatment is designed in accordance with CPHEEO-recommended aerobic processes such as:

- Extended Aeration
- Moving Bed Biofilm Reactor (MBBR)/ Fluidized media reactor (FMR)
- Membrane Bio-reactor (MBR)

These processes ensure effective removal of:

- Biochemical Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)
- Suspended solids
- Nutrients (with suitable process control)

c) Secondary Clarification / Solid Separation

- Clarifier or membrane separation
- Return and waste sludge management

d) Tertiary Treatment and Disinfection

- Pressure sand filtration/ membrane filtration
- Activated carbon filtration (if required)
- Disinfection (chlorination/ UV)

The standard treatment scheme can also be further refined with **Advanced Oxidation Process (AOP) systems, which is free from biological processes** and can be operated in flexible hours (as per sewage generation at source). AOP systems are particularly useful where sewage load is not uniform and need to work only during high occupancy times. This is typically seen in office where most occupants are available during daytime work hours on weekdays (5 x 8-hour basis). This has positive cost ramifications from both sizing and operating point of view where STP plants can practically run in instant on-off modes.

Compact STPs based on **Advanced Oxidation Processes (AOPs)** treat wastewater through chemical oxidation rather than biological degradation. Hydroxyl radicals generated using a controlled combination of oxidant, ozone, and ultraviolet irradiation oxidize organic pollutants responsible for BOD and COD directly into stable end products.

This approach offers key advantages for wastewater management at height:

- Stable treatment performance despite fluctuating inflow

- Ability to switch the system on or off during no-flow conditions
- Elimination of secondary sludge generation, reducing sludge handling and storage requirements
- More resilience to treat tough organics like detergents, soaps and cleaning agents.

These characteristics make compact STPs well suited for tall buildings with variable occupancy and drainage patterns.

2.2 Treated Effluent Quality

The treated effluent quality is designed in accordance with **CPHEEO recommendations for reuse**, and not as per IS 10500 (Drinking Water Standards). Typical applications include:

- Toilet flushing
- Landscape irrigation
- Cooling tower make-up water

A typical treated effluent quality for non-potable reuse is presented below:

- BOD: ≤ 15 mg/L
- TSS: ≤ 20 mg/L

❖ Key Highlights of compact plug-and-play STPs

- Single-tank configuration
- Reduces dependence on fresh water
- Factory-assembled **plug-and-play** unit for **fast installation** and start-up
- Low power consumption for **long-term operational savings**
- **Quiet operation (Silent operations)** with **minimal manual intervention for user comfort**
- Generates **good manure**, more availability of water for **irrigation & green belts**.
- Sustainable Green technology

3. Cooling Tower Blowdown in High-Rise Buildings

HVAC systems in tall buildings typically employ cooling towers for heat rejection. Cooling tower operation involves periodic discharge of concentrated water, referred to as **Cooling Tower Blowdown (CTBD)**, to control Total Dissolved Solids (TDS) and scaling.

CTBD is characterised by relatively stable flow and predictable water quality, making it a suitable candidate for on-site reclamation using membrane-based technologies.

4. High-Recovery RO-Based Reclamation

A **high-recovery RO-based reclamation system** can be positioned to recover usable water from cooling tower blowdown. The system design proposed here uses intelligent methods of reflux or in other words introduce partial recycle of reject back to feed with aim of maximising recovery and minimising reject volumes.

4.1 System Configuration

A typical CTBD reclamation system comprises:

- Pre-treatment (Clarification & filtration)
- Reverse Osmosis system operated at high recovery
- Final permeate storage for cooling tower make-up reuse

The RO permeate is reused as cooling tower make-up water, thereby reducing dependence on fresh potable water.

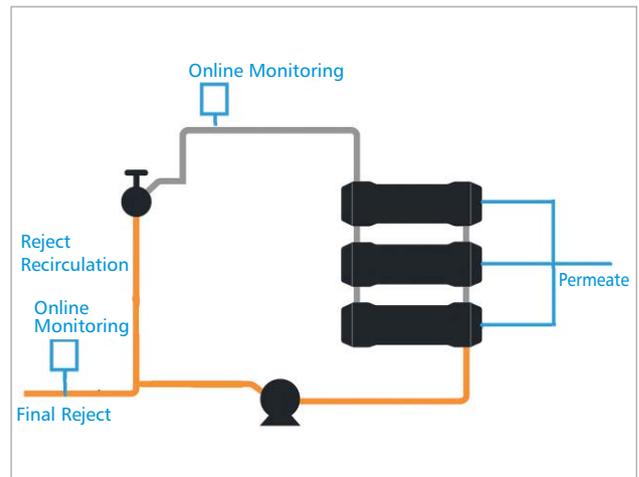


Figure: Typical Flow diagram for Reflux RO

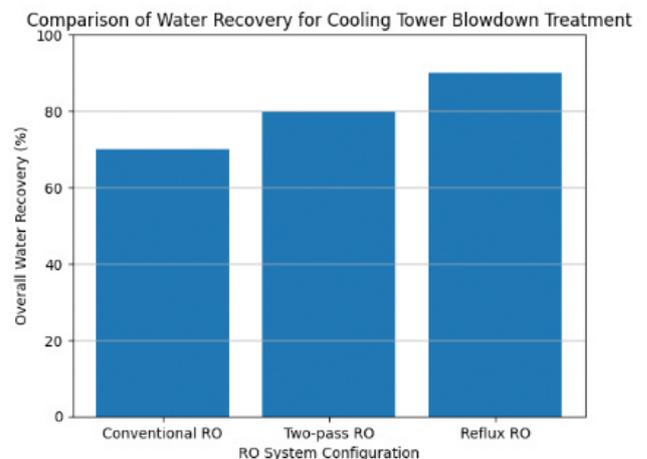


Figure: Comparison of Overall Water Recovery for Cooling Tower Blowdown Treatment

(The figure illustrates typical overall water recovery achievable using different RO system configurations for cooling tower blowdown treatment. Reflux RO systems demonstrate significantly higher recovery compared to conventional single-pass RO systems, resulting in reduced freshwater demand and lower blowdown discharge.)

❖ Key Highlights of Reflux RO

- Advanced single-stage membrane design achieving >90% water recovery
- Unique reject recirculation mechanism for maximum water utilization
- Continuous online monitoring of critical operating parameters
- Dedicated backflush and cleaning arrangements for enhanced system reliability
- Semi-automatic operation with simplified maintenance requirements



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4.2 Performance Benefits

- Reduction in potable water demand
- Lower wastewater discharge to sewer
- Improved cycles of concentration in cooling towers
- Optimised water footprint for high-rise buildings

5. Combined STP and CTBD Reuse Strategy

Integrating treated sewage reuse with cooling tower blowdown recovery creates a robust circular water management system within the building. Treated effluent from the STP can be utilised as partial cooling tower make-up, while CTBD is further reclaimed through RO-based systems.

Such integrated approaches are consistent with the intent of CPHEEO and NBC 2016 to promote decentralized wastewater reuse at source, particularly in water-stressed urban regions, and support long-term reduction in freshwater demand and wastewater discharge.



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Water Efficiency & Smart Plumbing Systems: Designing Buildings That Think



Part 1: From Water Blindness to System Intelligence

- Madhava Narasimha Murthy Nedunuri

Abstract

Townships today face a paradox. Water demand is rising, supply is unstable, and sustainability expectations are growing. Yet most developments operate without understanding how water actually behaves inside their own systems. Water efficiency is often pursued through low-flow fixtures or resident awareness campaigns, but these approaches address only symptoms.

The deeper issue is **water blindness**—the inability to see how much water enters a township, how it moves through the system, where it is lost, and how effectively it is reused.

This article introduces a system-level approach to water efficiency, where plumbing design evolves from mechanical distribution into an intelligent, measurable, and responsive ecosystem. It explains how visibility, data, and network logic form the foundation of truly sustainable township water systems.

Introduction

Water defines how residents experience a township—comfort, hygiene, safety, and liveability all depend on it. Yet while water is visible at taps and fixtures, its journey within a township remains largely hidden. Pipes, pumps, tanks, and valves operate continuously, often without feedback on how well the system is actually performing.

Traditional plumbing design focuses on fundamentals such as pipe sizing, pump capacities, tank volumes, and fixture flow rates. These are necessary starting points, but they assume predictable behaviour. Once a township becomes occupied, water demand changes. Morning peaks intensify, seasonal patterns emerge, pumps age, valves drift, and leaks develop silently. Without measurement and feedback, the system continues to operate on assumptions rather than reality.

True water efficiency does not come from restricting consumption. It comes from **understanding consumption and eliminating system-level waste**. That shift requires plumbing systems to mature from static infrastructure into living systems that observe, learn, and respond.

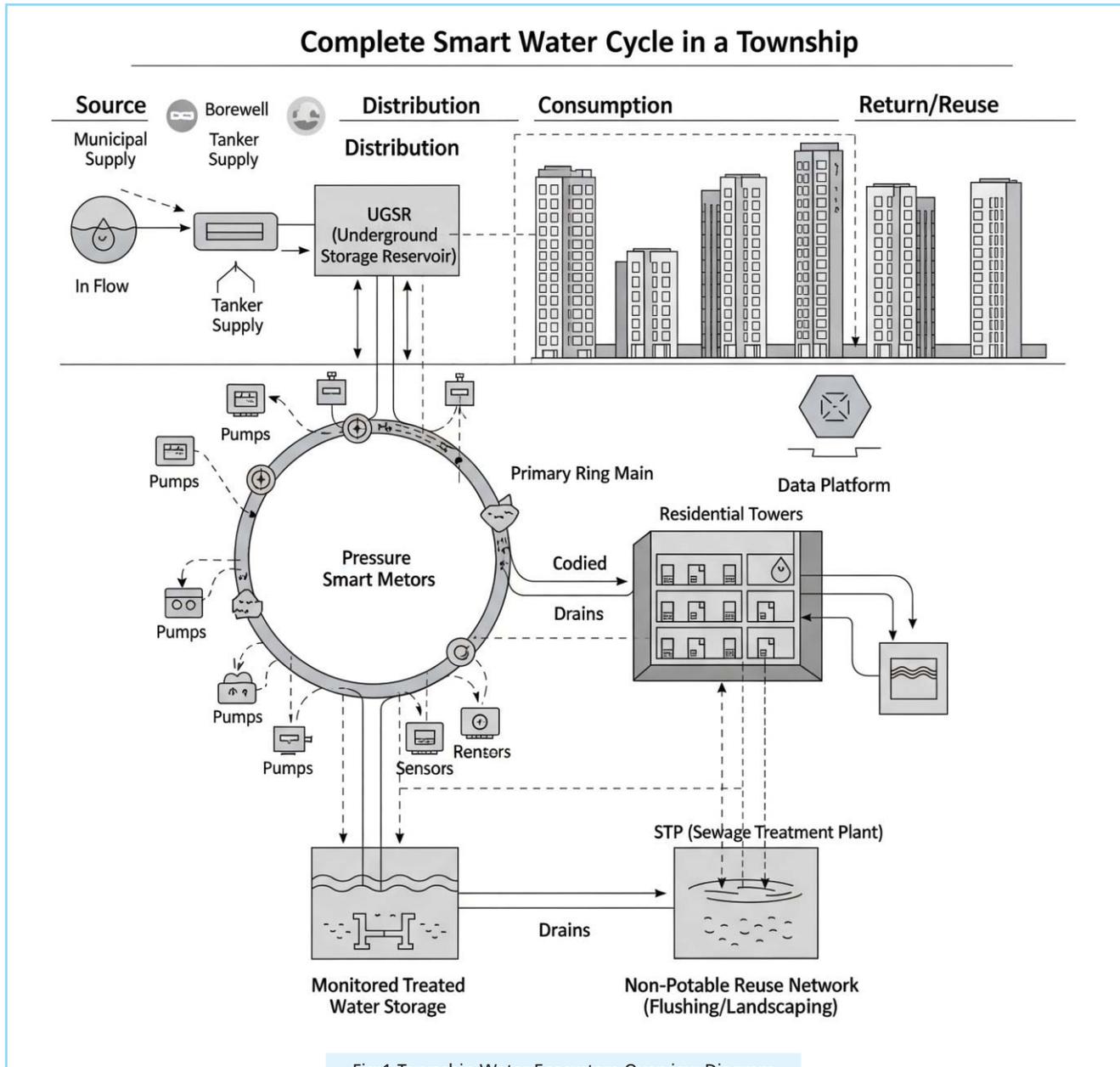


Fig:1 Township Water Ecosystem Overview Diagram

The Problem: Water Blindness

Water blindness is the condition where a township continues to supply water without understanding what happens to it. Water reaches homes, but the system cannot see where it goes, how much is leaking, whether certain towers are drawing disproportionately more, or whether treated water is actually being reused as intended.

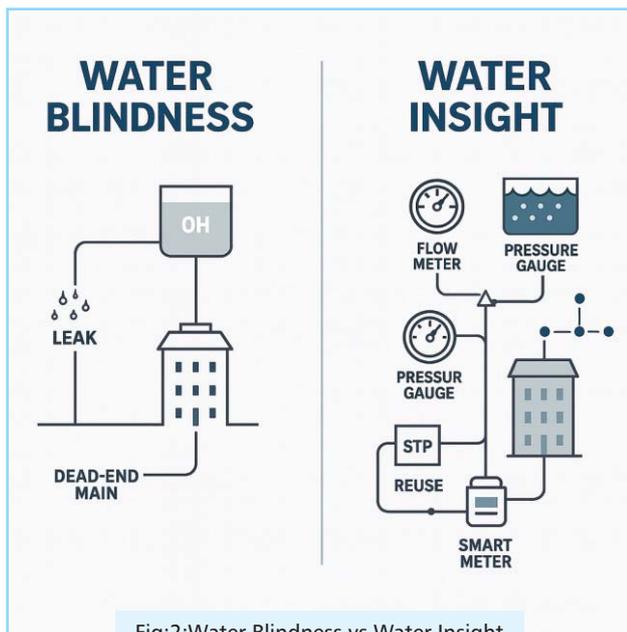
Most townships cannot answer questions such as:

- How much water did we receive today from municipal supply, borewells and tankers combined?
- How much of that water reached the overhead tanks?
- How much was lost in transfer, overflow or unnoticed leakage?
- Which blocks or towers consistently consume more water per household?
- How much treated water went into flushing and landscaping, and how much was simply discharged?
- Does night-time flow suggest hidden leakage in the network?



Without these answers, operation becomes reactive. Pumps run longer because “pressure seems low”. Tankers are ordered because “supply feels inadequate”. Leaks are attended only when they become visible or disruptive. STP reuse is mistrusted because residents cannot see consistent performance.

What appears as a consumption problem is, in reality, a **visibility problem**. A township that cannot see its own water behaviour cannot manage it efficiently. Water efficiency cannot begin until water blindness is addressed and that starts with measurement.



From Mechanical Plumbing to Intelligent Systems

A smart plumbing system is not defined by a single device or technology. It is defined by how information flows through the system. Measurement, feedback, and response are what differentiate an intelligent system from a purely mechanical one.

For townships, intelligence emerges when plumbing design reflects how water actually behaves from source to storage, through distribution, and finally to

consumption. This thinking can be understood through a layered framework that transforms plumbing from passive infrastructure into an active, responsive system. This is not about adding complexity, but about aligning system behaviour with how water is actually used.

The Four-Layer Smart Water Framework (Overview)

Layer 1: Source & Storage Visibility

Townships typically draw water from multiple sources: borewells with varying yields, intermittent municipal supply, and tanker water during shortages. Without measurement at each source, dependency patterns remain invisible.

Source and storage intelligence uses flow meters and level sensors to answer a simple but critical question: How much water do we actually have today?

Layer 2: Distribution Awareness

Once water enters the system, distribution determines comfort and reliability. Looped ring mains, when combined with pressure and flow monitoring, provide balance, redundancy, and early warning of abnormal behaviour.

Distribution intelligence ensures that pumps respond to actual system demand rather than local pressure assumptions.

Layer 3: Consumption Visibility

Water efficiency becomes real only when consumption becomes visible. Zonal and flat-level metering transform water from a shared, invisible resource into a measurable service. Experience across townships shows that when residents see their actual consumption, usage typically drops by 25–40 percent, even without enforcement. Awareness, not restriction, drives behaviour change.

Layer 4: Return & Reuse Control (*introduced, detailed in Part 2*)

The final layer closes the loop by monitoring treated water reuse. While technically robust, reuse systems succeed only when performance is transparent and trusted—a subject explored in the next part.



The Four-Layer Smart Water Framework

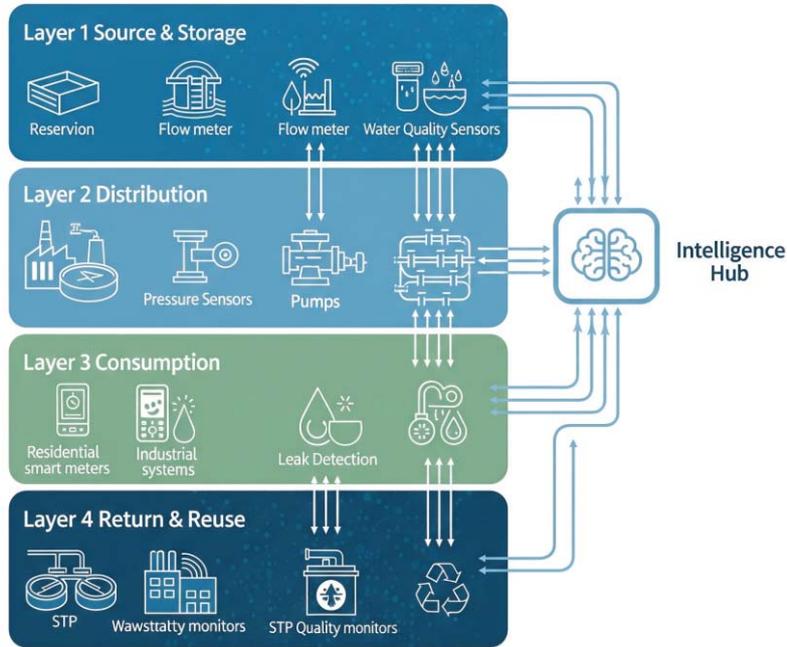


Fig 3: Four-Layer Smart Water Framework Diagram

Why This Matters

Without visibility, plumbing systems drift into inefficiency quietly. Pumps overwork, leaks persist unnoticed, reuse potential remains underutilised, and operating costs rise without a clear cause. Decisions become reactive, driven by complaints rather than data. With visibility, the same infrastructure becomes predictable, diagnosable, and adaptable. Problems surface early, performance can be tuned, and water efficiency shifts from intent to outcome.

A township does not need to consume less water by force. It needs a system that **wastes less water by design**.



Madhava Narasimha Murthy Nedunuri
FIE, Senior MEP Leader

Madhava Narasimha Murthy Nedunuri, FIE, is a senior MEP leader who has spent two decades shaping complex building environments across India. His career spans leadership roles at Urbanac Infra Projects, IL&FS Engineering, Shapoorji Pallonji, and HCC, where he led delivery of high-rise residential towers, hospitals, malls, data centers, townships, and large commercial developments. A Fellow of The Institution of Engineers (India), Chartered Engineer, PMP®, PMI-RMP, and IGBC Accredited Professional, he is known for uniting technical clarity with execution reality. His approach emphasizes design-to-site alignment, lifecycle-focused decision-making, and building strong second-line leadership rather than dependence on individuals.

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World Plumbing Day

11th March 2026



IPA Webinars in Regional Language

MALAYALAM

Organizer: Kochi Chapter and Trivandrum Chapter
Convener: Bijo K John, IPA Kochi
Date: 7th March 2026

TAMIL

Organizer: Chennai Chapter, Puducherry Chapter and Coimbatore Chapter
Convener: Dr S Virapan, Chairman, IPA Chennai
Date: 6th March 2026

KANNADA

Organizer: Bengaluru Chapter
Convener: Balkrishna Mehta, Chairman, IPA Bengaluru
Date: 20th March 2026

TELUGU

Organizer: Hyderabad Chapter and Visakhapatnam Chapter
Convener: Dr. Saandeevani Vajje, Chairperson, IPA Amaravati
Date: 21st March 2026

MARATHI

Organizer: Mumbai Chapter, Navi Mumbai Chapter, Pune Chapter, Nagpur Chapter, Nashik Chapter, Kolhapur Chapter, Goa Chapter.
Convener: Nilesh Gandhi, Chairman, IPA Pune Chapter
Date: 27th February 2026

GUJARATI

Organizer: Ahmedabad Chapter, Vadodara and Surat Chapter
Convener: Nimish Mehta, Chairman, IPA Surat
Date: 10th March 2026

BENGALI

Organizer: Kolkata Chapter
Convener: Abhay Pasari, Chairman, IPA Kolkata
Date: 13th March 2026

HINDI

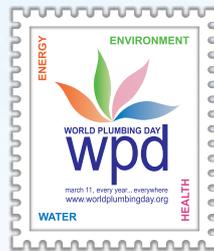
Organizer: Delhi Chapter, Raipur Chapter, Indore Chapter, Chandigarh Chapter, Jaipur Chapter, Lucknow Chapter
Convener: Kapil P Bairagi, Chairman, IPA Indore
Date: 20th March 2026



IPA Founders Day

11th March 2026

IPA Officials Meet on 11th March, 2026



World Plumbing Day

11th March 2026

Theme:

I Save Water: Shaping Tomorrow Through Responsible Use

Major Outreach Programs

-  **Painting competition for School Children** 01
-  **Recognition of Housing Societies** 05
-  **Free medical checkup for plumbers.** 08
-  **Poster competition** 02
-  **Plan awareness program for sight supervisors and site engineers. Felicitate a few good plumbers at site or during the seminar.** 06
-  **Blood donation camp for IPA Chapter Members.** 09
-  **Essay Competition** 03
-  **Hug a plumber/ Cake cutting** 10
-  **Model-Making Competition** 04
-  **Involve the municipal authorities in WPD CELEBRATION.** 07
-  **Chapter Level Webinars in Regional Language** 11

Theme

Shaping a Regenerative Built Environment Beyond Sustainability

4th February 2026, Bengaluru

Summit 2026 was successfully convened at the Sheraton Grand, Bengaluru, bringing together key stakeholders, thought leaders, policymakers, and industry experts from across the built environment ecosystem. The event served as a vital platform for dialogue, collaboration, and future-focused thinking on how India's infrastructure can evolve responsibly and resiliently.



Distinguished IPA Leaders Along With Esteemed Panellists During the Inauguration of IPA Summit 2026

The theme of the IPA Summit, **“Regenerative Built Environment: Beyond Sustainability – 2047,”** set a progressive tone for the discussions. Moving beyond conventional sustainability practices, the theme emphasized regenerative development—an approach that restores, renews, and creates positive environmental, social, and economic impact. With India’s vision aligned towards 2047, the event highlighted the urgent need to integrate innovation, policy, and technology to build systems that give back more than they consume.

The IPA Summit was followed by an engaging **panel discussion centred on the same theme** featuring distinguished experts from the industry. The discussion was led by Ar. Ravindra Kumar, Director–Design,

Venkataramanan Associates, Jagdish Nangineni, Managing Director, Sobha Ltd Ar. Anup Naik, Founder & CEO, Urban Frame Pvt Ltd, A.N. Prakash, A. N. Prakash Construction Project Management Consultants Pvt. Ltd., V. Gopal, Executive Director – Projects & Planning, Prestige Group, Ar. Chitra Vishwanath, Principal Architect & Managing Director, Biome Environmental Solutions, and Vivek Menon, CEO, Invicus. The panel explored practical pathways to achieve regenerative outcomes in urban development, water management, sanitation infrastructure, and building services. Key conversations revolved around climate resilience, resource efficiency, circular economy principles, and the role of the plumbing and water sector in achieving national and global sustainability goals.



L-R: Ar. Ravindra Kumar, Jagdish Nangineni, Ar. Anup Naik, A.N. Prakash, V. Gopal, Ar. Chitra Vishwanath, Vivek Menon



Esteemed panellists being felicitated during IPA Summit 2026



B O Prasanna Kumar, Past Chairman & NEC Member, IPA Bengaluru Chapter, Convener -IPA's Centre of Excellence Committee presenting the welcome note

A comprehensive virtual tour of IPA's **Centre of International Plumbing Practices (COIPP)**, Goa, was presented by **Chandra Shekhar Gupta**, National Vice President, IPA, along with **Dr. S. Virapan**, Chairman, IPA Chennai Chapter. The session offered in-depth insights into COIPP's infrastructure, global best practices, and its role in advancing professional excellence in the plumbing and water management domain.

An update on **Plumbex India 2026**, outlining its vision, scale, and what the industry can look forward to was delivered by **Mr. Balakrishna S. Mehta**, Chairman, IPA Bengaluru Chapter, along with **Mr. Satish Iyengar**, Vice Chairman, IPA Bengaluru Chapter, and **Mr. Venkatesh G. Prasanna**, IPA NEC Member.

IPA Summit 2026 successfully bridged thought leadership with action, setting the agenda for future industry initiatives and collaborations. By fostering meaningful conversations and unveiling key industry milestones, the summit reinforced the collective commitment towards building a regenerative, resilient, and future-ready built environment for India.



Gurmit Singh Arora, IPA National President, Chandra Shekhar Gupta, IPA National Vice President along with Rohit Srivastava – IPA Manager – Outreach, had a meeting with Isha Kaila, IAS, Joint Secretary & Mission Director for DAY–NULM (National Urban Livelihoods Mission) and PM SVANidhi, Ministry of Housing & Urban Affairs (MoHUA), Government of India.

V. K. Chaurasia, Joint Adviser, CPHEEO, was also present in the meeting.

L-R: Isha Kaila, Gurmit Singh Arora, Chandra Shekhar Gupta, Rohit Srivastava, V. K. Chaurasia



L-R: Hemant Seth, Gurmit Singh Arora, Rohit Srivastava

Gurmit Singh Arora, IPA National President along with Rohit Srivastava, IPA Manager – Outreach, met Hemant Seth, Senior Director and Head – FICCI Water Mission.



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Ahmedabad Chapter

20 Glorious Years of IPA Ahmedabad Chapter Celebrations



The IPA Ahmedabad Chapter, successfully organized a grand event to celebrate the completion of 20 glorious years of the chapter on 20th December 2025, at Binori, A Boutique Hotel, Ahmedabad.

Minesh Shah, National Hon. Secretary, Apurva Shah, Chairman, IPA Ahmedabad Chapter, Harshal Parikh, Hon. Secretary, IPA Ahmedabad Chapter, addressed the gathering and gave a brief overview of the chapter's growth, contributions at the national level, and its role in strengthening the plumbing fraternity.

The event also featured a special technical session on "AI is Transforming the MSME Business" by Ajit Panicker, CEO – NOVA HVAC Systems India Pvt. Ltd. and Founder – Pureblu Technologies.

The event was generously sponsored by Astral Ltd. as the Platinum Sponsor, Euronics and Supreme Industries as the Gold Sponsor. The event received strong support from several professional organizations including FSAI, ISHRAE, ASHRAE, IIID, CREDAI, RATA, GICEA, and IIA, whose encouragement and cooperation contributed to the success of the event.

Ahmedabad Chapter



Harshal Parikh, Hon Secretary, IPA Ahmedabad Chapter along with Rakesh Parekh, Hon. Secretary GICEA, Apoorva Thakershy, Chairman, CSR Committee, GCCI and other members

The IPA Ahmedabad Chapter actively participated in the “I Save Water” Drive organized by the Gujarat Chamber of Commerce & Industry (GCCI) on 21st December, 2025, with the objective of promoting water conservation through the installation of water-saving aerators by replacing existing conventional tap aerators. The drive covered approximately 50 bungalows, during which more than 100 aerators were successfully replaced.

Harshal Parikh, Hon. Secretary, IPA Ahmedabad Chapter, explained in detail the various types of aerators, their functioning, and their role in effective water conservation. The drive also witnessed active participation from Rakesh Parekh from GICEA and Apoorva Thakershy from GCCI, whose involvement further strengthened the collaborative effort and outreach of the program.

Chennai Chapter



IPA Chennai Chapter launched student Chapter at Karpaga College of Engineering and Technology on 21st January, 2026. The installation was followed by a technical session, which included one hour of hands-on training on PPR pipes conducted by the KPT team.



Trivandrum Chapter



IPA Trivandrum Chapter conducted Skill Development Program on "Sewerage, Water Supply and Plumbing Items in Estimation" 15th January, 2026 at Kerala Water Authority Training Center, Trivandrum. The programme was handled by Er. K. Nandakumar, Chairman, IPA Trivandrum Chapter, Er. Shajeer Basheer, Hon. Secretary & MEP Consultant and Er. Asger A.S, EC Member & Plumbing Consultant and was attended by 42 engineers from Kerala Water Authority and Kerala State Housing Board.



IPA Trivandrum Chapter conducted awareness session on Rainwater harvesting - Importance & need on 22nd January, 2026 at Marian Engineering College (MEC), Trivandrum.



The IPA CET Students Chapter, Department of Civil Engineering, College of Engineering Trivandrum (CET), organized a Technical Session on Plumbing Systems on 19 January 2026. The session was led by Mr. Shajeer Basheer, Managing Director & Principal Consultant, Ace Consultants and Engineers, Trivandrum.



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Plumbex India acts as a dynamic hub where the latest products and technologies, from *sanitaryware and bathroom fixtures to pumps, pipes, valves, water filtration and treatment systems* are showcased to an audience comprising architects, engineers, real estate developers, and plumbing professionals from across India and

beyond. This comprehensive exposure helps accelerate the adoption of smarter, more efficient water and sanitation systems nationwide.

Events scheduled during the Plumbex India 2026–

Bathroom Challenge



The IPA Bathroom Challenge will be a live, skill-based installation competition, organized by the Indian Plumbing Association (IPA) in collaboration with IAPMO and IWSH. The challenge is designed to highlight excellence in bathroom and toilet installations, while promoting strict adherence to the National Building Code (NBC) and Uniform Illustrated Plumbing Code of India (UIPC-I) standards.

IPA Excellence Awards



IPA Presents Excellence Awards to leaders across three categories: Distinguished Leader, Outstanding Leader, and Emerging Leader

Architectural Based Design Competition 'Around the Drop'

A hands-on workshop designed to sensitise architectural students to water-based design thinking. The competition will inspire innovative and sustainable solutions by integrating water efficiency, conservation, and smart plumbing into architectural and engineering planning.

The **Indian Plumbing Association (IPA)** invites built environment professionals from across the country to participate in **Plumbex India 2026**, scheduled from **16th to 18th April 2026** at the **Bangalore International Exhibition Centre (BIEC), Bengaluru**, and join the collective effort towards building a water-secure and sustainable future.

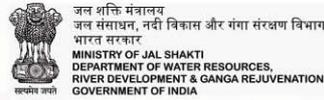


Aditi Mishra

Executive - Content Writer & IPT Editorial
Indian Plumbing Association

Aditi Mishra is a Content Writer at the Indian Plumbing Association and a member of the Indian Plumbing Today (IPT) editorial team. She plays a key role in managing and coordinating editorial content, showcasing strong publishing, editing, and content curation skills. Blending creativity with strategy, she delivers impactful content across print and digital platforms. With a background in English (Hons) and an MBA in Marketing, she brings more than four years of professional experience spanning content creation, editing, and communication strategies. She can be reached at ipt.ipahq@indianplumbing.org

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Know Your Chapter Chair

Kapil Prakash Bairagi
Chapter Chair
IPA Indore Chapter



Kapil Prakash Bairagi is a Principal Consultant and Founder of HydroGen Next Global Pvt Ltd, with 15+ years of experience in MEP and firefighting designs. He oversees national and international business and technical advancements.

1. What inspired you to pursue a career in plumbing, water management, and sanitation?

Fortunately, I started my career as a water audit site engineer in Mumbai under the Maharashtra Sujal Nirmal Abhiyan. I was working with a private firm as an employee. This role required me to travel extensively to different cities and villages across Maharashtra, where I observed the ground reality of water supply and drainage issues. Later, I continued my career in the same field, which inspired me to pursue and continue my career in PHE and its engineering.

2. As Chapter Chair, what leadership priorities guide your work in strengthening plumbing and sanitation practices?

As a Chapter Chair, I would be-

- Encouraging adoption of latest plumbing codes, standards, and technologies to ensure safe and efficient water management.
- Organizing workshops, seminars, and training programs for professionals to enhance their knowledge and skills in plumbing and sanitation.
- Raising awareness about the importance of proper plumbing and sanitation practices among the community, policymakers.
- Building partnerships with government agencies, industry stakeholders, and community organizations to drive positive change and improve plumbing and sanitation infrastructure.

3. What key challenges currently impact the plumbing, water, and sanitation sector in India?

Water Scarcity and Quality:

A recent example is the potable water contamination in Indore, which was life-threatening. Existing water infrastructure in India is often inadequate, with old pipelines, treatment plants, and storage systems that are prone to inefficiencies and wastage. Many water supply systems in India are defunct due to a lack of maintenance, and operation and maintenance cost recovery is low,

making it challenging to sustain these systems. India generates a significant amount of wastewater, but only a small proportion is treated, leading to environmental and health concerns. Climate change poses a significant threat to India's water security. The water sector in India requires significant investment to address existing challenges, but funding is often inadequate. Changing water-usage behaviour and promoting sanitation awareness are crucial to addressing the sector's challenges.

4. What guidance would you share with young professionals entering the plumbing and water sector?

The first thing I would like to inform them is to understand the importance of water and sanitation from all perspectives. Once this understanding is clear, any civil or mechanical engineer can build a career in this sector. One must learn the basics of hydraulics and design by practicing and working with experienced professionals who have been in the field for many decades. Do not just do your job and finish your work; treat this career as your duty towards society and yourself as well.

5. What focus areas would you like IPA to strengthen in the coming years related to water and sanitation?

Sewer systems and their proper disposal, sewer treatment processes, and basic education on Public Health Engineering (PHE) should be introduced at the primary, middle, and high school levels.

6. How important is education and skill development in this field, and how is IPA contributing to capacity building and professional training?

Due to the lack of adequate education and skill development in this field, the country continues to face challenges in establishing robust PHE infrastructure. However, the Indian Plumbing Association (IPA), as a nationally respected professional body, plays a significant role in addressing this gap. Through its training initiatives and by empowering its regional chapters, IPA actively facilitates education and skill-development programmes for local plumbers, PHE engineers, and other related professionals, as required.

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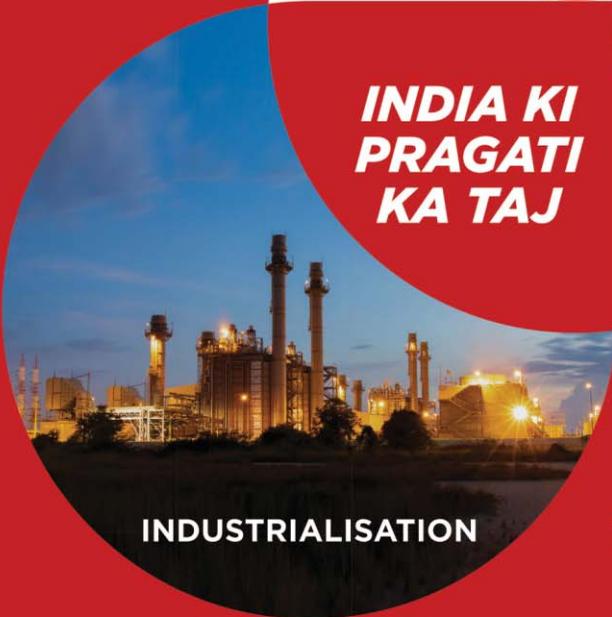
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