Why Digitalization is Imperative for Net-Zero Water Consumption

- Manasa S. Shastri

In today's rapidly evolving industrial landscape, technology has emerged as a pivotal force in driving efficiency, sustainability, and competitive advantage. Achieving net-zero water consumption is an ambitious goal for industries, but with digital water management, this endeavor seems more feasible than ever before.

An essential aspect of this pursuit is the measurement of Water Intensity per rupee of turnover. This metric quantifies the amount of water consumed in relation to a company's total revenue or turnover, providing valuable insights into how efficiently a company uses water in its operations. This assessment offers a glimpse into the company's environmental sustainability efforts and aligns seamlessly with the Business Responsibility and Sustainability Reporting (BRSR) framework introduced by the Securities and Exchange Board of India (SEBI). Under BRSR, the top 1,000 listed companies in India are mandated to disclose specific sustainability-related information, including water-related data, for each of their products. This underscores the crucial need for accurate and secure data regarding water consumption by industries that must align their reporting with BRSR, something that can be achieved through digital water management.

Adaptation through Infrastructure Optimization

One fundamental principle to consider is the adoption of technology that enhances efficiency and capitalizes on its benefits. However, for industries to fully harness these advantages, they must first establish a sustainable infrastructure capable of accommodating these technologies. The optimization of infrastructure makes organizations more adaptive, facilitating real-time data acquisition and informed decision-making.

Data-driven decision-making relies on collecting information about water usage, quality, and distribution through smart sensors, water meters, and more. Artificial intelligence (AI) then steps in to analyze this data, uncovering patterns, detecting leaks, identifying anomalies, and highlighting areas of excessive consumption. This data-driven approach optimizes water treatment and distribution, ultimately leading to a more sustainable water consumption pattern and reduced water usage.

The Internet of Things (IoT) also plays a pivotal role in promoting management and sustainable practices. IoT technologies enable real-time adjustments, improving water efficiency and ensuring controlled usage. Moreover, digitalization of water monitoring reduces the time and manual labor required for conventional processes in bigger facilities. This, in turn, allows professionals to concentrate on other critical tasks that require their expertise. Smart infrastructure, characterized by physical systems attached with sensors and meters connected to networks, is crucial for effective data-driven water management.

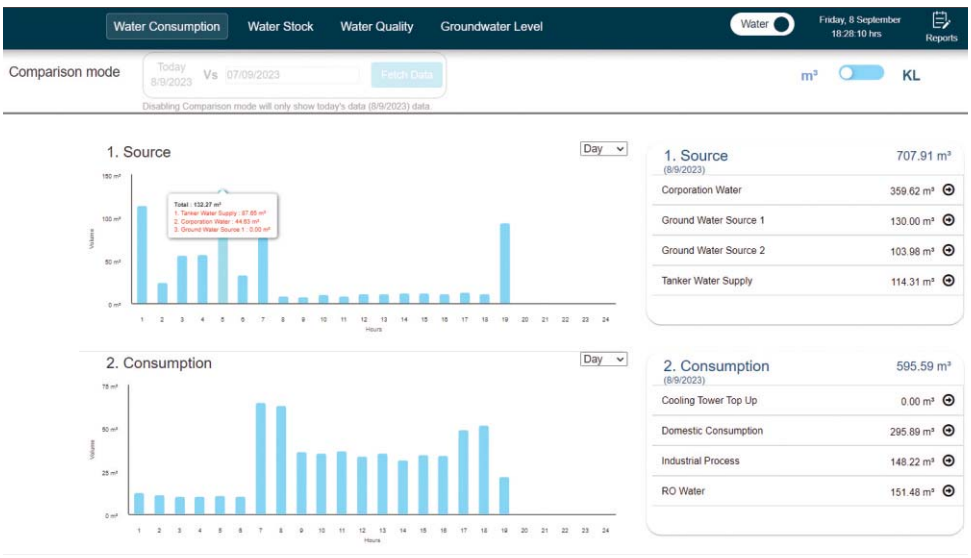
Smart water meter installation to monitor water consumption.

Unlocking Efficiency: Digitalization's Competitive Edge

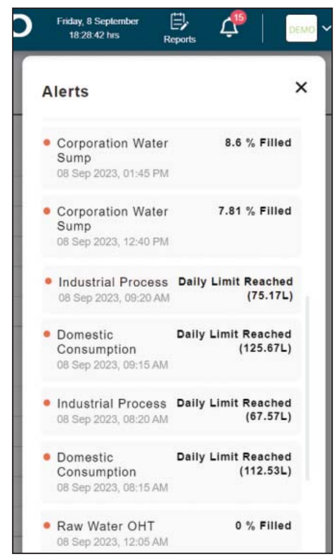
In today's competitive landscape, digitalization has become a race for companies striving to achieve greater heights. The post-COVID era has underscored the necessity of digital automation, remote monitoring, and data-driven forecasting. Traditional industrial processes have been disrupted by the integration of AI and IoT. Digitalization has forged new norms in business models, and embracing change is essential to stay relevant and competitive in the face of unprecedented challenges.

To have a smart digital water management system means to have access to all the data necessary to remotely monitor water consumption and have a unified dashboard that identifies anomalies, providing real-time insights. Powered by AI and IoT, smart digital water management softwares, , enables real-time monitoring to reduce water consumption.

This involveswireless data collection systems and cloud-based storage, replacing labour-intensive manual methods for water monitoring in large industrial facilities. prescriptive alerts facilitate the early detection of leaks and areas of excessive consumption, saving cost for industries. By installing and integrating digital water monitoring software with the industrial water lines can help to considerably conserve time, labour, and water resources.



Unified desktop interface of digital water monitoring software.



alert system to identify anomalies in water consumption and prevent wastage.

From Pledges to Action: A Net-Zero Imperative

Pledges to achieve net-zero water consumption must translate into tangible actions. The evolving environmental and social landscape demands that industries actively reduce their carbon footprint and strive toward net-zero emissions and water consumption. Not only does this lead to cost savings, but it also ensures compliance with government policies, organizational sustainability goals and global vision for a sustainable future.

In today's dynamic business environment, meeting strategic social and sustainability objectives is paramount. By integrating sustainable technology into their designs, industries can enhance climate change resilience and reduce risks.

Digital water management systems offer real-time monitoring and precise control of various water restoration and treatment processes, ensuring treated water meets quality requirements for reuse. Predictive analytics optimize treatment efficiency. Smart systems assess the performance of bioswales, permeable pavements, and stormwater management, informing maintenance schedules and effectiveness tracking. Digital sensors can monitor rainwater collection tanks, optimizing when to capture and release water. Analytics can provide insights into water storage and usage patterns.

Additionally, digital systems control the treatment and distribution of greywater, ensuring it meets quality standards and is used efficiently for non-potable purposes. Real-time data aids in detecting system anomalies.

In Zero Liquid Discharge (ZLD) systems, digital water management plays a critical role by monitoring treatment unit performance, ensuring efficient brine concentration and crystallization processes. Furthermore, it streamlines water audits by automating data collection and analysis, providing actionable insights for conservation efforts.

Storage tank level monitoring

The Data-Driven Advantage

Data technology is a powerful tool for companies seeking profitability while simultaneously advancing shared social goals. Data-driven automation enhances efficiency and reduces energy consumption. The insights derived empower industries to understand, monitor, predict, and optimize their performance.

Data security and integrity are paramount, as accurate results are vital for informed decision-making. Establishing benchmarks and thresholds helps identify ideal water usage and conditions that indicate excessive consumption, preventing any confusion in the process.

A Smarter Approach to Water Management

Integrating new technologies alone cannot guarantee positive outcomes in the quest for net-zero water consumption. However, when effectively combined with vigilant monitoring, well-thought-out strategies, proactive measures, and the adoption of water-saving and restorative practices, industries can steadily progress toward this ambitious goal.

A smarter approach to water management encompasses a range of initiatives, including rainwater harvesting, greywater recycling, the implementation of Zero Liquid Discharge systems, targeted leakage patching, and collaboration with water stewardship initiatives. These practices collectively form a comprehensive strategy for sustainable water management within industrial operations.

This strategic shift not only promises significant returns in terms of profitability but also makes a substantial contribution aligning with global sustainability goals. This can help in de-risking industries from the effects of the water crisis by making them water-positive entities through the power of AI and IoT, keeping up with the changing expectations in the business and global landscape. Embracing the digital era in water management is not merely an option; it has become a strategic imperative to pave the way for net-zero water consumption and a water-positive future.

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Manasa holds a master’s degree in journalism and communication from the University of Mumbai. Currently based in Bangalore, she is deeply committed to collaborating with organizations dedicated to creating a sustainable and regenerative future. Her focus is on raising awareness about FluxGen's role in mitigating climate change impact for industries, for she believes greater sustainability objectives can only be met through collaboration instead of competition. She can be reached on manasa@fluxgentech.com.

Water auditing in the High-Rise Residential Building

-Dr. S. Virapan

INTRODUCTION:

The need of water in India is gradually increasing day by day and water shortages are happening due to less rainfall, drying up of different water sources and change in climatic conditions. Therefore, there was a need to analyze the water shortage situation for a client of residential building and we tried to find the root cause of the problem. The method used to analyze the uses of water was water auditing. Water auditing is a method of quantifying water flows and quality in simple or complex systems, with a view to reduce water usage. By carrying out water auditing it was found that the water was used in excess than it should have been used and losses were higher. Usually, a water audit should be carried out once a year to find out the leakages. This study helps to identify water usage and water wastage of high-rise residential buildings and can help the authorities to provide adequate amount of water to buildings, which can result in reduced water bills for the building and in water saving.

METHODOLOGY:

Water is the essential element for living beings. Water is used in various ways by humans like bathing, drinking, cleaning purposes, etc. India is a vast country and has a population of more than 130 crores and to provide clean water to everybody is a difficult task for the government. The per capita demand by the IS code 1172 for communities with population above 100000 is 150 to 200 litres per capita per day (LPCD) with full flushing system. Water auditing is only a practical way to ensure optimum use and less water wastage by the communities in high rise residential building. A water meter is provided to every building is a reading common to whole building and is billed accordingly. As water meter shows total volume of water used by the whole building, it lacks to inform per capita demand or even one household per day usage.

Table 1 Assessment of water requirement for residential units

(Source: Drafting guideline for water audit by Ministry of Water Resources, RD&GR Annex-C Number of persons / users in the residential unit)

Sr. No.	Fixture	Measurement of Water Uses per Residential unit					
		Rate of Discharge (litre/min)	Average Duration of Use (min)	Average Quantity per Use (litre)	No. of Uses (No.)	Total Daily Use (litre)	Per Capita Daily Water Use (litre)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Kitchen faucet						
2	Utility faucet						
3	Bathroom faucet						
4	Other faucet						
5	Shower						
6	Toilet						
7	Washing Machine						
8	Dish Washer						
9	Other or extra tap						
Total							

For calculation of the terms mentioned in the Table 1:

Rate of discharge:- The rate of discharge is to be calculated by using a measuring container and a stopwatch. Firstly, hold the container under each tap of the household then open the tap for exact 10 seconds and note the reading. After recording each tap reading multiply it by 60, what it does is it converts seconds to minutes and the reading will be in litres per minute.

Average duration of use per day:- Based on each household, but on the average of 4 to 5 people living in the house, the usage is recorded by enquiring the people as per each house, then take average for the building usage in minutes.

Average quantity per use:- This is recorded by considering number of works done by the people using specific tap. Firstly, list all the work that can be done by that tap on daily basis then calculate average by adding total daily usage of the tap and then dividing by the number of times it has been used.

Number of uses:- This can be recorded by number of times the work has been carried out by the tap.

Total daily use:- By multiplying average quantity per use and number of uses.

Average per capita daily use:- This can be calculated by dividing total daily use to the number people living in the house.

For firefighting water calculation IS code 3844 is to be used. For leakages calculating the number of fixtures leaking and how much drops of water per fixture per minute will give appropriate results. The water is also used outside the household like for washing cars, watchman bathroom, cleaning building floors so to be calculated by recording 7-day usage and taking average of it.

Collection of data is one of the important aspects to achieve the water audit. The auditing was initiated by calculating the population living in every house and number taps inside the household.

Tables 2 and 3 show the water usage per capita per daily usage in 1 and 2 BHK houses respectively.

Figure 2 is the pie chart representing the percentage of water used in 1 BHK houses according to table 2 and figure 3 is the pie chart representing the percentage of water used in 2 BHK houses according to table 3.

Table 2. Water requirement in 1 BHK household.
Number of persons / users in the residential unit = (24 people)

Sr. No.	Fixture	Measurement of Water Uses per Residential unit					
		Rate of Discharge (litre/min)	Average Duration of Use per day (min)	Average Quantity per Use (litre)	No. of Uses (No.)	Total Daily Use (litre)	Average Per Capita Daily Water Use (litre)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Kitchen Faucet	10.8	90 to 120	60	4	240	60
2	Water Purifier (RO) Tap	4.5	180	13.5	1 to 2	13.5 to 27	6.75
3	Washing machine Tap	10.8	50	70 to 140	1 to 2	140 to 280	35
4	Shower Faucet	11	60	50	4 to 8	200 to 250	50
5	Bathroom Tap	9	30	10	4	30 to 40	10
6	Toilet Flush tank	18.93	60	12	8 to 10	96 to 120	24
7	Wash Basin Tap	10.8	50	3	32	96	24
TOTAL							209.75

Table 3. Water requirement in 2 BHK household
Number of persons / users in the residential unit = (56 people)

Sr. No.	Fixture	Measurement of Water Uses per Residential unit					
		Rate of Discharge (litre/min)	Average Duration of Use per day (min)	Average Quantity per Use (litre)	No. of Uses (No.)	Total Daily Use (litre)	Average Per Capita Daily Water Use (litre)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Kitchen Faucet	10.8	90 to 120	60	4	240	60
2	Water Purifier (RO) Tap	4.5	180	13.5	1 to 2	13.5 to 27	6.75
3	Washing machine Tap	10.8	50	70 to 140	1 to 2	140 to 280	35
Bathroom-1							
4	Shower Faucet	11	60	50	4 to 8	200 to 250	50
5	Bathroom Tap-1	9	30	10	4	30 to 40	10
6	Bathroom Tap-2	9	0	0	0	0	0
7	Toilet Flush tank	18.93	0	0	0	0	0
8	Wash basin Tap	10.8	30	3	20	60	15
Bathroom-2							
9	Shower Faucet	11	0	0	0	0	0
10	Bathroom Tap-1	9	30	10	4	30 to 40	10
11	Bathroom Tap-2	9	0	0	0	0	0
12	Toilet Flush tank	18.93	60	12	8 to 10	96 to 120	24
13	Wash basin Tap	10.8	20	3	12	36	9
TOTAL							219.75

Number of people / users =(2 People)

Sr. No.	Fixture	Measurement of Water Uses per Residential unit					
		Rate of Discharge (litre/min)	Average Duration of Use (min)	Average Quantity per Use (litre)	No. of Uses (No.)	Total Daily Use (litre)	Average Per Capita Daily Water Use (litre)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Watchman Bathroom	18.93	60	20	6 to 8	140 to 160	80
2	Water Basin Tap	10.8	15	2	4	8	4
3	Fire Fighting hose	450	-	-	-	-	-
4	Common Water Tap	11	120	260	1	260	260
TOTAL							344

Firefighting hose: - 9 kgf/cm^2 pressure and 450 litre/min rate of discharge was calculated

1. LOSSES CALCULATION

No. Of flats = 19
No. of faucets = 5 (number based on observed leakage per house)
No. Of drips per minute = 2
Volume of drip = 0.33ml
No. Of drips in 1 litre water = 3000 drips
No. Of drips per day in 1 tap = ?
1 min = 2 drips
60 min =120 drips
1 day= 120 × 24 = 2880 drips
No. Of drips per day in 5 taps = 2880 × 5 = 14400 drips
No. Of drips in 19 flats per day = 14400 × 19 = 2,73,600 drips
Water wasted in(litre) per day = Total no. Of drips ÷ no. Of drips in 1 litre
= 2,73,600 ÷ 3000
= 91.2 litres
Total volume of water waste in a month = 91.2 × 30 = 2736 litres

For building:

Taps in building for public use like car washing, watchman's toilet and gardening, washing hands:
No. Of taps = 4
No. Of drips per minute = 10
No. Of drips per day in 1 tap = ?
1 min = 10 drips
60 min = 600 drips
1 day = 600 × 24 = 14400 drips
No. Of drips per day in 4 taps = 14400 × 4 = 57600drips
How water wasted in(litre) per day = Total no. Of drips ÷ No. Of drips in 1 litre
= 57600÷3000
= 19.2 litre
Total volume of water waste in a month = 19.2×30 = 576 litres
Total water waste per month = Houses + Building
= 2736 + 567
= 3303 litres per month

CALCULATIONS FOR 1 BHK AND 2 BHK:

The final calculations done for 1 day water usage by whole building is,

- House calculation: - For 1 BHK
  Number of houses = 5
  Total number of people = 24
  Per capita demand × Number of people = 209.75 × 24 = 5034 litres per day.
- House calculation: - For 2 BHK
  Number of houses = 14
  Total number of people = 56
  Per capita demand × Number of people = 219.75 × 56 = 12306 litres per day.
- **Building calculation: -**
  Total number of water = (bathroom=160 litres)+(washbasin=8 litres) + (car washing=260 litres)
  = 428 litres per day
  So, the total number of litres per day can be calculated as = For 1 BHK + For 2 BHK + Building
  = 5034+ 12306+ 428
  i.e., Total water used in litres per day by the building = 17768 litres per day
- **For 30 days water usage will be: -**
  Total water used by the building × 30 days = 17768 × 30 = 533040 litres per month
  + Losses per month = 3033 litres per month
  + Cleaning whole building once a week = 200 litres × 4 = 800 litres per month
  = 536873 litres per month

As per the analysis the total water usage for a month is 5,36,873 litres.

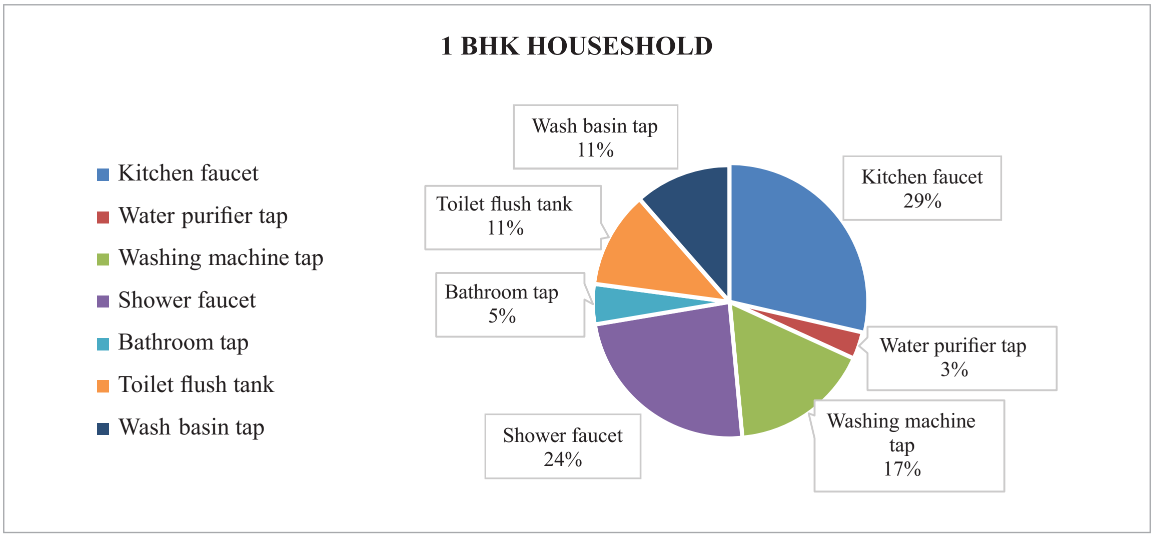


Figure 2: Pie-chart representing per capita demand in 1 BHK.

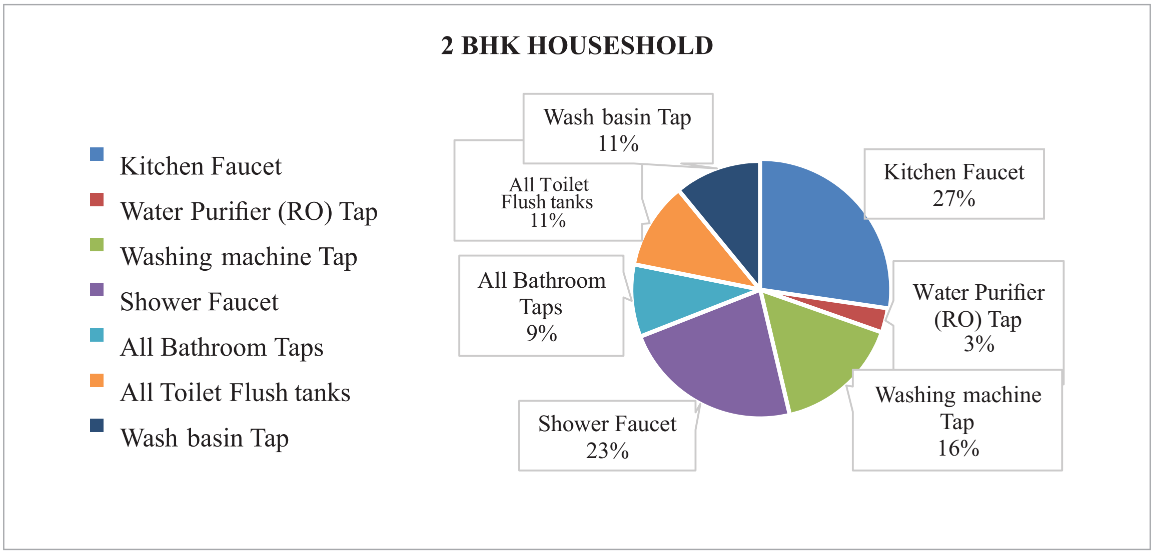


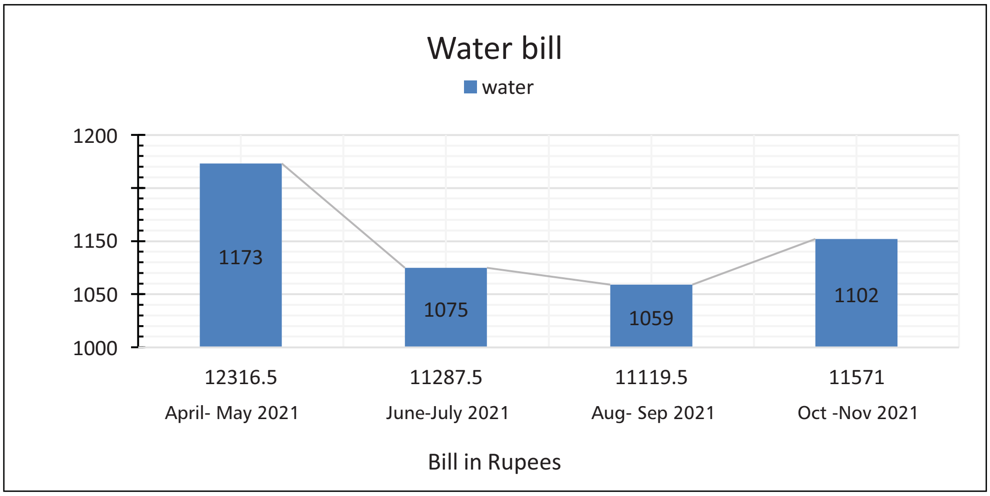
Figure 3: Pie-chart representing per capita demand in 2 BHK

FUTURE REQUIREMENT:

To calculate this the trend of last 8 months bill was taken and given below:

Table 5. Water Bill

Months	Quantity used in Cubic meter	Billed amount in Rupees
April-May (2021)	1173	12316.5
June-July (2021)	1075	11287.5
August-September (2021)	1059	11119.5
October-November (2021)	1102	11571



CONCLUSIONS:

As India is facing water shortage for the entire population, uneven rainfall is just adding up to this problem and due to this small factor like auditing that needed to consider are getting neglected. The water auditing for every building should be done every year and the authority should provide that much amount of audited water so that there will be less water wastage and the additional water can be directed to useful/necessary places.

After doing water auditing in one of the buildings taken into consideration it was calculated for the monthly water requirement for the building of the previous year and future water requirement for the same month of the next year.

Observations were as follows:

The water authority provides clean water to the building still all houses uses Reverse Osmosis purifier which wastes more water than ultraviolet purifier, for cleaning vehicles pipe hose was used directly used, leakage per house were minimum because of renovation and repairing work of the building was done in the year 2020, Covid 19 pandemic has very much affected water usage per house as people wash hands, clothes and some take bath twice a day to maintain cleanliness, the criteria of 145 litre per capita per day is an ideal condition which cannot practically be followed by urban area households as they willing to pay high water charges and the building under study did not had plants or any other modern amenities like swimming pool, water bodies etc.

Thus, study done in residential block gives exact idea of the water usage and other authorities could follow this method so that they can divert the saved water to the water deficit areas to save water and water bills in turn.

Note: Thanks to Prof Khutlej Gurav and team for accepting to use his paper with few changes for the benefit of the IPA members.

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Sanvir Associates, Chennai which offers end-to-end solution Mechanical, Electrical and Public Health Engineering services for a wide range of building and water projects. Dr. S. Virapan holds a B. Tech in Civil Engineering and M. Tech in Environmental Engineering. He has received a P.hD in Civil Engineering. He has 30+ years of experience including being the **COO** of CTPL, 2 decades stint in the Construction business of L&T. He can be reached on virapans@gmail.com.