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Non Revenue Water

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RENU TOMAR
(Editor-in-Chief)

DEAR READERS,
India and the millions of urban residents of the nation have been facing the issues of water scarcity for long. There are several complexities that require methodological approach to manage water resources cautiously at urban areas of the nation. Often the situation of water crises at such areas is the consequence of poor management rather than the issues of water scarcity.

According to a study, 55 Indian metropolitan cities are using the extent of non-revenue water (NRW) which is a critical indicator of urban water supply. Non-revenue water includes the physical and even the financial water losses which are not charged by the users in order to recover the expenditure incurred during the procedure of water procurement. In fact, around 40% of the water produced in the cities of India does not generate the revenue for the urban local bodies. The levels of non-revenue water (NRW) layw significant affect on the per capita water supply (PCS) and cost recovery (CR) of Indians water supply utilities. However, despite being one of the most significant aspects of water supply performance, NRW levels in Indian cities have remarkably high NRW levels. Thus, through this edition of our magazine, we will be laying focus on various aspects of non-revenue water, the emerging concerns, technological solutions to prevent or address non-revenue water issues across the nation and other significant water developments happening across the globe.

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Transforming India: Har Ghar Jal Mission Makes Tap Water A Reality for Crores of Households | Opinion

Written By: Sanbeer Singh Ranhotra
CNN–News18, SEPTEMBER 18, 2023, New Delhi, India

The Har Ghar Jal initiative is also proving to be a boon for crores of Indians, as it is saving them from a host of health risks. (Representational image: News18)The Har Ghar Jal initiative is also proving to be a boon for crores of Indians, as it is saving them from a host of health risks. (Representational image: News18)

With a budgetary outlay of Rs 3.6 lakh crore, the Har Ghar Jal mission is transformative in its impact and ambitious in its goals. As India gears up to celebrate the 8th edition of the National Water Week in November, it would be a good opportunity to highlight the achievements of the mission, while also deliberating on the challenges that exist and ways to overcome them.

Seventy–five years is a long time for a nation. It has been especially long for the crores of Indians who were kept deprived of basic necessities – without which the sustenance of life can be excruciating, if not impossible. Whether it be the absence of toilets in households, the lack of electricity connections and cooking gas, or the fact that crores of Indians did not have access to safe tap water for decades on end – lack of government intervention on all these fronts remains a blot on our nation's conscience. For years, successive governments failed to provide the most basic necessities to Indians who needed them the most. That is now fast changing. The buzz right now is around the Har Ghar Jal initiative – which is empowering crores of Indian households with tap water connections.

On the occasion of Prime Minister Narendra Modi's birthday, Uttar Pradesh set a new record – by providing new tap water connections to 1 lakh families. UP is already at the top when it comes to providing tap water connections to households that have never had one before. In the past three years, tap water connections have been provided to more than 1.6 crore households in rural Uttar Pradesh alone. However, Har Ghar Jal as a government intervention programme to provide tap water connections is registering fascinating results across the nation.

HAR GHAR JAL: CHANGING LIVES IN RURAL INDIA.

With a budgetary outlay of 3.6 lakh crore rupees, the Har Ghar Jal mission is transformative in its impact and ambitious in its goals. This mission aims to provide tap water connections to every rural household in India soon. Here are some fascinating numbers related to the programme.

- Of India's 19.3 crore rural households, only 3.2 crore had tap water connections in August 2019. This means India had a tap coverage of just about 17% prior to the launch of the Har Ghar Jal initiative.
- As of September 2023, over 13 crore households, or about 67% of the targeted households, have been provided with water connections.
- News18 had earlier reported how under the Har Ghar Jal initiative, India is installing one new water tap connection for rural households every second!
- India surpassed last year's record of tap installation within the first eight months of this year alone. A total of 2.16 new tap water connections were installed until August this year, compared to the 2.08 crore installed in the entirety of 2022.
- The Har Ghar Jal initiative is also proving to be a boon for crores of Indians, as it is saving them from a host of health risks. According to the government, in 2019, there were 14,020 habitations across six states that were affected or contaminated by arsenic. As of July 2023, that number saw a drastic reduction to just about 460 habitations across three states.
- According to a World Health Organization report, ensuring safe drinking water for all households in the country could avert nearly 400,000 diarrhoeal disease deaths. There is more. With universal coverage of safely managed drinking water in India, almost 14 million Disability Adjusted Life Years from diarrhoeal disease are estimated to be averted, resulting in approximate cost savings of up to $101 billion.

An often–overlooked aspect of the Har Ghar Jal initiative is how it is transforming the lives of women in rural India. Traditionally, the responsibility of fetching water in most rural Indian households fell on the shoulders of women, who had to often traverse significant distances for nominal volumes of water. This task would occupy a major part of their day. Today, with water tap connections fast spreading across the length and breadth of India, women no longer need to undertake arduous journeys, especially in the scorching heat of summer months.

Remember, this is happening in a country where successive governments failed to provide something as basic as a water connection to crores of households. Such was the institutional apathy towards Indians' most rudimentary requirements, that most people had lost hope, and almost normalised living in substandard conditions. No concrete homes, no toilets, no electricity, no cooking gas, and no water – this is what defined the lives of India's underprivileged rural class until recently. Ask them

how they feel about getting all of this simultaneously – in less than a decade since 2014 – and you will understand why Brand Modi remains unscathed among the most significant voter base of India.

TIME FOR GOVT TO DOUBLE DOWN ON HAR GHAR JAL MISSION

The Har Ghar Jal mission is not just about fixing taps and providing piped connections to households. The core of this initiative is, in fact, the determination to provide safe and hygienic water to all Indian households. So, to accomplish that, multi–crore water treatment plants are sprouting in almost all districts. While many believe that the government is simply laying pipes and providing tap connections in rural India, the reality is that the Har Ghar Jal initiative, along with its parent Jal Jeevan Mission is setting up intricate water storage and supply infrastructure in nearly every district of the country.

A survey by community social media platform LocalCircles this year showed that the number of Indians who believe that the quality of tap water they receive from municipal bodies is improving has gone up in the past year. 44% of the respondents said that their tap water is good or higher, up from 35% last year.

But the entire chain of water supply is still in need of significant upgradation. For example, the same survey found that even though the quality of water produced at filtration plants may be top–class, it deteriorates as it travels through the trunk mains to service reservoirs. 14% of respondents still rated piped water supplied to their homes as "poor" or "very poor". Only 3% of respondents said that they do not need to purify tap water before drinking it. A majority of them – nearly 72% – purify tap water with some sort of purifier. Now while purifying water at a household level is a good practice, there still remains a lot to be desired from the supply end in terms of cleanliness, safety, and hygiene.

So, one of the biggest challenges for the government is to ensure that the water being supplied is actually safe for drinking. For that, it must ensure the upgradation and constant upkeep of water storage and supply facilities at the district level.

Despite these challenges, the lengths to which the Har Ghar Jal initiative has gone in taking piped water connections to households is incredible. Water is a basic necessity required to uplift the most underprivileged and marginalised communities in rural India. As India gears up to celebrate the 8th edition of National Water Week in November, it would be a good opportunity to highlight the achievements of the Har Ghar Jal initiative, while also deliberating on the challenges that exist and ways to overcome them.

Karnataka CM, deputy CM to seek Centre's help on Cauvery water issue

By Arun Dev, Sep 20, 2023 01:01 AM IST

Shivakumar added he will be leaving for Delhi soon, where he plans to meet with all Members of Parliament, asking them to apply pressure on the central government, urging them to intervene in the matter.

Bengaluru: Karnataka deputy chief minister DK Shivakumar on Tuesday expressed the state's dilemma regarding the directive to release water to Tamil Nadu and called for the intervention of the central government.

The Cauvery Water Management Authority on September 18 asked Karnataka to continue releasing 5,000 cusecs (cubic feet per second) of water to Tamil Nadu for another 15 days.

"We are in a catch–22 situation. We do not have water, and still, we have to respect the decision of the authorities. But, we are appealing before the Supreme Court, and I am leaving for New Delhi," he said, speaking from his residence in Bengaluru.

The Cauvery Water Management Authority on September 18 asked Karnataka to continue releasing 5,000 cusecs (cubic feet per second) of water to Tamil Nadu for another 15 days, according to a statement released by the body after an emergency meeting in which both Karnataka and Tamil Nadu made representations.

"I will meet the Parliament members; we will also take a delegation to the Union Jal Shakti minister Gajendra Singh Shekawat, and we are also seeking time to meet Prime Minister Narendra Modi," Shivakumar added.

He said the dams are experiencing a severe lack of inflow. "We will plead with them to help us out and bail us out. There is no inflow to the dams, and we are finding it very difficult, and the central government has to help us out. The BJP should join us to save Karnataka," he said.

Shivakumar added he will be leaving for Delhi soon, where he plans to meet with all Members of Parliament, asking them to apply pressure on the central government, urging them to intervene in the matter. "We will bring the current situation to the attention of the Supreme Court," Shivakumar added.

Chief minister Siddaramaiah is also scheduled to hold a meeting in the

national capital today with all Members of Parliament and Union Ministers representing Karnataka. During the meeting, the chief minister will likely request Union Ministers and MPs from Karnataka to use their influence to seek intervention from Prime Minister Narendra Modi and the Government of India regarding the Cauvery issue.

He is later scheduled to meet several other Union Ministers during the visit, and his return journey has been kept ''open'' as per the communication from the CM's office.

Meanwhile, former chief minister HD Kumaraswamy of the Janata Dal (Secular) called on political parties in Karnataka, including the Congress, the Bharatiya Janata Party, JD(S), and Raitha Sangha, to work together to find a permanent solution to the issue.

"How long can we drag the dispute?" questioned Kumaraswamy and stated that "certain drastic steps are needed to take the Cauvery water dispute to a logical end," he said during a press conference in Bengaluru.

The JD(S) leader was unhappy over the order of the Cauvery Water Management Authority regarding its decision asking Karnataka to release 5,000 cusecs of water to Tamil Nadu for a fortnight without assessing the ground realities in both the States. "CWMA of issuing the order sitting in an air–conditioned room. What sort of Federal system is this?" he said.

Kumaraswamy said he had suggested to the State Government a month ago to wait for the Supreme Court's order before water was released to Tamil Nadu, but the State Government obeyed the order of CWMA and released water to Tamil Nadu. "What would have happened?" asked Kumaraswamy had the State Government waited for the order of the Supreme Court on water release to Tamil Nadu.

The former Chief Minister accused the officials concerned with the state water resources department of taking the River Cauvery dispute for granted and claimed that during the meeting on water release to Tamil Nadu, only a couple of them attended the meeting while about 15 officials from Tamil Nadu made it to the meeting. "It has been the difference between Karnataka and Tamil Nadu," observed the JD(S) leader.

While JD(S) called for unity, former chief minister Basavaraj Bommai of BJP on Tuesday said that the state government is committing mistakes repeatedly and putting the people of the state in a difficult situation. He said that if the state government is releasing water as per the orders of the CWMA, then there is nothing to argue before the Supreme Court.

He said that the state has filed an affidavit before the Supreme Court that it won't release the water after September 12. "They should be committed to it. The affidavit by the government carries a lot of weight, and now it is like the state government is lying before the Apex court," he told reporters at his residence in Bengaluru.

"The move by the government has put the farmers of the state and people in the Cauvery basin into a difficult situation. I have given my advice in the interest of the state. Those in power are responsible," he added.
He said that the government is not ready to take his party's advice. "The advocates always suggest releasing the water. We had changed it, and we did not release the water during the night. Once you are following the orders of CWMA, what is there to argue before the Supreme Court?" he asked.

Talking about the Congress government's plan to meet the PM, he said, "There is no meaning now in going before the Prime Minister. The dispute matter had come before the PM before 1990 and now there is no need for it. The state government is claiming that it is taking the delegation to the PM to mislead the people of the state."

He said that our advocates have to explain the existing situation of our dams and the proportion of utilisation of water by Tamil Nadu. "Unless it is done, the state won't get relief. The advocates representing the state have been there for a long time. They have worked during our time as well. We are ready to give advice but if the state government is not ready to take suggestions, what can be done," he said.

Responding to Bommai, Shivakumar said, "We will consider the suggestion by former CM Basavaraj Bommai regarding the Cauvery dispute. He had suggested stopping the water and pursuing the legal battle. We are going to court the day after tomorrow. We do not want to release the water, at the same time, we need to keep the order of the CWMA in mind."

"Let Bommai demand Prime Minister Narendra Modi to intervene by sidelining the politics. We will also consider Former PM HD Deve Gowda's proposal to go for the out–of–court settlement," Shivakumar added.

Assam's 'Bamboo Boat' Innovation: A Sustainable Game Changer in Water Transport

Reported By: Niloy Bhattacherjee, SEPTEMBER 20, 2023

Notably, it's the world's sole market–ready process for building modern,

safe, and leak–proof boats using bamboo as the primary building material.Notably, it's the world's sole market–ready process for building modern, safe, and leak–proof boats using bamboo as the primary building material.

What sets these Bamboo Boats apart is their ability to coexist harmoniously with nature. Unlike traditional wooden boats that necessitate the felling of trees, the Bamboo Boats leave no such ecological footprint.

In a groundbreaking stride towards sustainable water transport, the world is about to witness a revolution led by Assam's eco–friendly "Bamboo Boats." These innovative vessels promise to redefine the way we navigate waterways while championing environmental conservation.

What sets these Bamboo Boats apart is their ability to coexist harmoniously with nature. Unlike traditional wooden boats that necessitate the felling of trees, the Bamboo Boats leave no such ecological footprint. They are constructed entirely from locally sourced bamboo, harnessing the abundant bamboo resources of Assam.

Ravi Jyoti Deka, the visionary behind this initiative and the proprietor of Akvotransiro Tech Pvt Ltd, India's only startup dedicated to inland water transport and green water mobility solutions, explained the shortcomings of conventional wooden boats. "While Teak (Sal) wood boats are known for their durability, their source often remains dubious. These boats tend to accumulate water due to constant leaks, causing the wood to deteriorate, become pulpy, and gain unnecessary weight. This vulnerability often results in mishaps where these boats, designed to float, tragically sink," he said.

"Bhutbhutis," as the locals refer to country–made engine boats, and traditional wooden country boats have always been part of the local fabric. However, the emergence of Bamboo Bio–composite Sandwich technology, developed in–house, is a game–changer. This unique, versatile, and mold–free process leverages 85% bamboo, 10% polymers, and only 5% fiberglass to create modern boats that are robust and leak–proof.

Notably, it's the world's sole market–ready process for building modern, safe, and leak–proof boats using bamboo as the primary building material. These Bamboo Bio–composite boats boast a compressive strength of 130Mpa, weigh less than half the weight of their traditional wooden or fiberglass counterparts, and come at a cost only slightly higher than that of conventional wooden country boats.

Though commercial production of these boats is yet to commence, they have already garnered significant attention globally. Inquiries have poured in from countries as far–reaching as Switzerland, Ghana, Japan, and China, as well as from various Indian states like Maharashtra, Rajasthan, Karnataka, and Kerala.

Akvotransiro Tech has embarked on pilot production of Bamboo Composite boats, thanks to the collaboration with NECTAR (North East Centre For Technology Application and Reach). Further bolstering their efforts, the startup recently signed a Memorandum of Understanding (MOU) with IIT Guwahati's Technology Innovation Hub.

Together, they aim to construct an 11–meter multipurpose Catamaran using Bamboo Bio–Composite Technology. This ambitious project benefits from the design expertise and supervision of a Naval Architect from FAO (Food and Agriculture Organization, UN).

The startup's mission is multi–faceted. It seeks to rectify the glaring flaws and limitations within India's Inland Water Transport sector, bridging the gap between outdated government ferries and primitive wooden country boats.

Beyond that, Akvotransiro Tech is addressing the lack of affordable, sustainable, and modern eco–friendly boat–building methods in the country. Moreover, they are pioneering clean propulsion systems suited for India's shallow and silt–filled rivers, coupled with affordable and straightforward steering and reversing systems.

To achieve these objectives, the startup has developed a range of products and technologies in–house, many of which are patent–pending. These innovations are modern, straightforward, sturdy, and cost–effective, assembled from 100% Indian components. The ultimate goal is to make river transportation safe and efficient, transforming currently unnavigable water bodies into bustling water highways. Among their groundbreaking inventions is the Bamboo–Epoxy–Fiberglass composite boat–making method, yielding the world's greenest composite boats.

Their patent–applied–for Hydrofoil Reversing Rudder offers braking and reversing capabilities for small and medium–sized vessels with Inboard Engines, all at a fraction of the price. Additionally, they've tackled the perennial issues of OBMs (Outboard Motors) frequently failing in Inland waterways due to mud and silt clogging and the pervasive problem of petrol pilferage. They've devised the world's first Electric Swamp Drive boat motor, enabling boats to traverse the muddiest shallow water bodies, serving as an economical alternative to imported OBMs in deeper, clearer waters.

These Bamboo Boats stand as a testament to innovation, boasting durability akin to molded fiberglass boats.

"They are leak–proof, half the cost and weight of their counterparts, biodegradable, possess the lowest carbon footprint, and offer a sustainable solution. They have the potential to replace motorized country boats, functioning as small ferries and water taxis, supporting flood relief and rescue missions, bolstering tourism, and contributing to the fishing sector," he added. Despite successful pilot trials in the water bodies surrounding Guwahati, the road to commercial adoption faces challenges. Introducing new technology and the scarcity of nautical experts, especially within government departments, hinder progress.

Bamboo, typically viewed as a low–cost construction material for houses and fences in Eastern India, sets a precedent for affordability. However, government apathy, reluctance to support indigenous technology, and corruption pose significant hurdles. The limited vendors for raw materials, coupled with long lead times, exacerbate the situation.

To navigate these challenges, Akvotransiro Tech has outlined a market strategy that emphasizes specialized vessels like Trimarans and Catamarans initially. Smaller boats will be produced solely for large orders, such as the Fishery Department's subsidy scheme for low–cost indigenous boats.

Later, the plan is to transfer small boat manufacturing to local boat builders through skill development training, technology transfer, design assistance, and raw material supply.

To date, the startup has successfully crafted four distinct models of boats using their groundbreaking Bamboo Bio–composite Technology. These models cover the entire spectrum of small river vessels, from a 2–person canoe for recreation and fishing to a 4–5 seat multipurpose boat, a 6–8 person ultra–shallow water boat for flood relief and patrolling, and an 18–20 passenger River Trimaran designed for ferrying passengers or tourist cruises.

The need for shallow water and mud boat propulsion units in the country has significantly impacted law enforcement and security agencies. Police and forest departments often resort to using rowboats for river patrolling.

Meanwhile, BSF personnel wade through knee–deep or even waist–deep mud in areas like Sir Creek and Crocodile Creek in the Kutch area or the Sunderban Delta marshes at the International border during low tide.

To address these challenges, Akvotransiro Tech has engineered a portable boat propulsion unit, building upon the proven Mud–Motor concept popular in the US and Russia. Instead of petrol engines, they utilize powerful and compact modern DC Electric motors, Controllers, and a Lithium–Ion Battery Pack.

These units are as user–friendly as OBMs, cost a quarter of the price of imported units, are significantly cheaper to operate and maintain, and are constructed entirely from Indian parts.

India stands as the world's second–largest producer of bamboo after China, with Assam leading the nation in bamboo production. The state boasts approximately 51 naturally grown bamboo species, deeply woven into the daily lives of its people. Bamboo finds application in crafting furniture, conducting rituals, and serving in various ceremonies, providing livelihoods for over half of the population.

Notably, bamboo also enjoys the status of a delicacy in the region. Bamboo shoots, a versatile ingredient, add a burst of flavor to authentic dishes prepared throughout the North–Eastern states.

This versatile ingredient can be consumed fresh, dried, or fermented. Pickles and curries made using bamboo shoots are delicious and also nutritious as the ingredient is low on calorie and sugar content while being rich in fibre.

The bamboo shoot is basically a new sprout of the bamboo plant which typically emerges in the spring season.

Bullish on India I Vishwanath Srikantaiah on Water Vision@2047 and every Indian's access to free, clean, drinking water

Clean water for all including humans for life and livelihoods and nature, free flowing rivers, clean lakes, pollution free oceans and full wells is Vishwanath Srikantaiah's vision.

BINDU GOPAL RAO SEPTEMBER 17, 2023

Water activist–educator Vishwanath Srikantaiah, founder, Rainwater Club and director, Biome Environmental Solutions, says one of the challenges for a civilised society or developed society is ensuring every individual gets access to clean water in their home 24x7 to have the benefits of health and hygiene, and India is far away from that.

Water activist and educator Vishwanath Srikantaiah, founder, Rainwater Club, director, Biome Environmental Solutions, and trustee, Biome Environmental Trust, who is also spearheading the Million Wells for Bengaluru campaign, decodes his vision for India in 2047 when every Indian should have access to free, clean, drinking water, and how to conserve freshwater which is finite. In an exclusive interview with Moneycontrol, he decodes his vision.

What is your vision for India on the theme 'Water'?

One of the challenges for a civilised society or developed society is making sure that every individual gets access to clean water in his or her home 24x7, so that they can have the benefits of health and hygiene. We are far away from that and while we are trying to get there, it is my vision that every home whether in urban or rural India, must get clean and safe water when you open the tap.

What are the various aspects that need to be addressed as part of this vision?
These aspects have been articulated as early as 1992 in what are called Dublin principles that have four principles and we need to act on that. The first principle is that freshwater is a finite and vulnerable resource and should be managed appropriately.

After showcasing vote power through massive turnouts, women closer to bridging representation gap After showcasing vote power through massive turnouts, women closer to bridging representation gap.

Bosch foresees a shift towards software–defined vehicles in India Bosch foresees a shift towards software–defined vehicles in India.

Why are power producers looking beyond turnkey contracts for new projects Why are power producers looking beyond turnkey contracts for new projects
The second part of the vision is water should be managed in a participatory fashion and all citizens, communities, and the state should be involved in planning, design and implementation and management of water.

The third aspect is that women are at the centre of water use, especially at domestic level. So, women should play the most important role in the participation in the planning, design, and implementation of skills.

And fourth is that water has a social value, but also an economic value. So, it has got a human rights component as well as an economic component. So therefore, water should be available for all irrespective of their affordability, but beyond a certain limit it should be priced so that it is used judiciously and conservatively.

Can you list what specific steps are required to achieve this vision?
The first aspect is to articulate the vision in policies at a National and State level. This is a comprehensive restructuring from the Government who will need to clearly articulate water policies with milestones and goals. Water is a state subject; therefore, the national water policy should be the guiding paper. But at the state level, every state based on its own characteristics should articulate a vision and goal with milestones.

Second, you should create the right institutions for governance which have adequate human resource capabilities. For example, in Bengaluru, the Bangalore Water Supply and Sewerage Board (BWSSB) should not just have engineers, but also hydrologists, hydrogeologists and people who understand the ecological role of water plus community organisers and social mobilisers who can reach out to vulnerable sections of the population with the right message. We need well rounded institutions capable of understanding water as a social, economic, and environmental code.

What are the potential challenges in achieving this vision?
The challenge is that there is a sort of a mismatch between the political democratic articulation for water and what is required in the long run. So, we fear pricing water at its true ecological cost while capturing the human right to water. We must recognise that we must get universal water for all and it should be free and accessible. But unless we price water correctly, we will misuse it and the institutions will not have the capability of investing in infrastructure to be able to get it to everybody.

Drinking water, water for food and for bathing should be free or very cheap, but the water used to wash automobiles and swimming pools should be priced so that the institution can collect, treat, and leave it into the environment for reuse without polluting it.

What are your suggestions to mitigate these challenges?
There is an urgent need to build the right institutions which can deliver design and solutions. The price for water in Bengaluru is 95 rupees per kilo litres. How many of us are willing to pay the true costs so that it does not pollute the environment? Because the affluent also get the subsidy, the poor don't get water. Everybody should have a universal connection to water and the first let's say 50 litres per person per day should be free. But beyond that 50, we must realise the value and we must pay for the pollution. The accepted principle is that the polluter pays so that the institutions can collect and treat it.

What kind of participation is required from the public to make this vision a reality by 2047?
The participation should start at a democracy framework of a Gram Panchayat at the village level where water is discussed at every Gram Sabha and at the city level at a Ward Sabha where the local problems including access to water, pollution issues, management of lakes and rivers, solid waste management, are discussed by the community and they agree on a plan to clean up their resources and make water available to all.

How do you think this will benefit the people?
Everybody knows the value of water once they run out of it and now that people are starting to realise and face the problem, this is a time for a conversation as to how do we create abundance. In the curve of a nation's history, you go through a development pathway. First, you lack finances to be able to invest in making sure that the environment is clean, called the Kuznets curve. At a certain point when development reaches a certain stage like we will reach in the next 10 to 15 years, we will have the funds to be able to invest in pollution control, pollution management as well as keeping the environment pristine. Right now, we are consuming the environment. We should start to conserve the environment and that phase will come with an extra equilibrium.

Anything else you would like to add?
We still do not realise that every individual action has an impact on water and we need to build that awareness amongst our citizenry especially the young people. The plastic chips packet you throw, the garbage you leave and even automobile emission has an impact on water. We should become aware of every activity we do and we have the chance and opportunity to do that.

Poor Hygiene, No Clean Water: New Threats To Morocco Quake Survivors

Over a week since a 6.8–magnitude quake devastated parts of central Morocco, many worry that the dire living conditions and poor hygiene spell new threats for the survivors.

September 17, 2023 10:42 pm IST

Morocco earthquake killed nearly 3,000 people

Amizmiz, Morocco: In her earthquake–hit Moroccan town, Zina Mechghazzi has improvised a sink by placing a pink bucket and a bar of soap on the dusty ground amid the ruins.

"I haven't taken a shower in seven days," said the woman from Amizmiz at the foot of the High Atlas range, about 60 kilometres (40 miles) southwest of Marrakech.

"I've only washed my armpits and changed my clothes."

Over a week since a 6.8–magnitude quake devastated parts of central Morocco, many worry that the dire living conditions and poor hygiene spell new threats for the survivors.

The disaster killed nearly 3,000 people and injured thousands more when it hit in Al–Haouz province, south of the tourist hub Marrakesh, on September 8.

Many survivors have stayed close to their ravaged villages and now sleep in improvised shelters and simple tents provided by Morocco's civil protection service.

Later, Mechghazzi was kneading dough to make bread, sitting on a stool next to a stove out in the open.

When she was finished, she washed the flour off her hands with untreated water from a dirty five–litre jug, shrugging that "we have to adapt".

With only a few houses left standing and habitable in Amizmiz, functioning bathrooms and toilets have become a luxury, and they are often overcrowded.

Mechghazzi pointed to an empty lot nearby where a stand of olive trees now provide the only, limited privacy as a child was relieving himself behind a tent.

– 'Rain and cold' –

During the day, temperatures in Amizmiz still top 30 degrees Celsius (86 degrees Fahrenheit), but nights bring biting cold and damp in the mountain area.

"Winter is coming, the situation is difficult, especially with the children," said Rabi Mansour, holding a four–month–old baby, her fourth child.

"Problems caused by rain and cold will be a challenge."

A pregnant woman, who only gave her first name, Hassna, and who is just days away from giving birth, said she was terrified.

"I never thought I would give birth in these conditions," she said.

"I don't have much water, it's hard to go to the bathroom, and I'd rather not even think about how I'm going to manage. It stresses me out so much."

A few tents away, first aid was being provided to people with injuries or sickness.

"We have a foot infection, a tooth abscess, a stomach problem, and others are here for medication," said one responder, working under an awning serving as a clinic.

For those villagers who were badly injured or disabled in the quake, the question of hygiene facilities and health services is especially important.

Said Yahia has been in a hospital in Marrakesh since he lost both of his legs, after a rock crushed them while he tried to save his son from their home.

"I live in a remote place in the mountains," he told AFP from his hospital bed, dreading the thought of going back home.

"I don't know what will become of me."

– 'Disease vector' –

Morocco is expected to request more aid soon from the United Nations to help it recover and rebuild, UN aid chief Martin Griffiths told reporters in Geneva on Friday.

An especially pressing need will be the provision of clean water, which was already in short supply in some areas before the quake.

Contaminated water is "a major vector of disease, with a whole range of water–related illnesses from diarrhoea to cholera," Philippe Bonnet, the

director of emergencies for French charity Solidarites Internationales, told AFP by phone.

Poor hygiene can also leads to skin problems, and the cold brings respiratory diseases like bronchitis, he said.

The charity has sent a team to Morocco with equipment to test the water, among other things.

Some latrines have already been constructed by organisations in Tafeghaghte, seven kilometres south of Amizmiz, and charities have said they may also send mobile latrines.

Philippe Bonnet stressed the urgent need for emergency latrines.

"If the water is unfit for consumption because the source has been contaminated, which is a risk with open–air latrines, the impact is very significant," he said.

(Except for the headline, this story has not been edited by NDTV staff and is published from a syndicated feed.)

IAEA, Japan Agree on Continuous Safety Review of Fukushima Water

Reuters, September 19, 2023

An aerial view shows the Fukushima Daiichi nuclear power plant, which started releasing treated radioactive water into the Pacific Ocean, in Okuma town, Fukushima prefecture, Japan August 24, 2023, in this photo taken by Kyodo. Kyodo/via REUTERS/File Photo/File Photo Acquire Licensing Rights.

TOKYO, Sept 19 (Reuters) – The International Atomic Energy Agency (IAEA) agreed with Japan on its continuous safety review of the discharge of treated water from the wrecked Fukushima Daiichi nuclear power plant, the IAEA said on Monday in New York.

Japan started releasing treated radioactive water from Tokyo Electric Power's (9501.T) Fukushima plant last month, sparking a diplomatic spat with China, Japan's biggest trade partner.

China's embassy in Japan has repeatedly said, most recently on Monday, that it was not invited to take part in the international framework to monitor the water from the Fukushima plant, which it calls "contaminated".

(This story has been refiled to correct the day from Sunday to Monday in paragraphs 1 and 3)

Girish Kale, Sales Director, Muncipal

Girish Kale is an experienced professional and well–known in Water and Waste Industry with more than 25 years of experience in Sales and Marketing. He has deep Domain Knowledge, and Strong relationships across different EPC's, Consultants in Municipal and Industrial Segment. He has handled different roles within Veolia Water Technology and Solutions mainly in Commercial & Institutional, Industrial and Municipal Segment. Currently he is leading Municipal business and Mega Projects business for Veolia Water Technologies & Solutions.

He has attended different leadership training within Veolia WTS. He was involved in preparing the White paper addressing "India's water crisis Policy" document for Veolia WTS.A Chemical Engineer by education he has completed Senior Management Program from IIM Calcutta.

Veolia's MBR Technology: Shaping a Sustainable Fertilizer Future

A study highlights that agriculture stands as the predominant consumer of freshwater resources, responsible for 99% of the world's consumptive (green plus blue) water footprint. Global freshwater reserves face mounting pressure with expanding populations, evolving dietary preferences, and growing biofuel demand.

In this context, the fertilizer industry assumes a pivotal role in ensuring global food security.

However, it tussles with serious hurdles in achieving sustainable production and the pressing requirement for responsible

wastewater management to safeguard water resources for future generations.

If a sustainable future is on the anvil for the fertilizer industry then it has to bet big on the membrane bioreactor (MBR) technology.

The Power of MBR–Based Technology

The Membrane Bioreactor, or MBR Sewage Treatment Plant (STP), represents a cutting–edge approach to wastewater treatment. True to its name, MBR seamlessly integrates two distinct technologies: membrane filtration and biological treatment.

At the heart of MBR's operational principle lies a clever fusion of membrane technology and biological treatment methods. This system's semi–permeable membranes, typically composed of micro and ultrafiltration materials, are fully immersed within aerated biological reactors.

This specialized filtration setup not only facilitates the extraction of high–quality sewage through the membranes but also removes the need for conventional sedimentation and filtration processes commonly employed in wastewater treatment.

Our focus has been on highlighting the practicality and benefits of sewage water reuse, made possible through the transformative capabilities of MBR technology.

How Veolia's MBR–based STP is Revolutionizing Wastewater Management for the Fertilizer Industry

In collaboration with external partners, Veolia has been at the forefront of driving sustainability initiatives in the fertilizers and chemicals industry. Our journey began in 2012 with exploratory discussions on the potential use of treated sewage water for industrial purposes, a step towards responsible resource management. This collective effort reached a significant milestone in 2019 with the commissioning of the second Sewage Treatment Plant (STP) at Trombay.

Since then, with unwavering support from our partners and customers, we have made noteworthy progress in shifting the mindset of industrial stakeholders. Our focus has been on highlighting the practicality and benefits of sewage water reuse, made possible through the transformative capabilities of MBR technology.

We are gradually witnessing the positive impact of this technology in two major ways:

1. Reduced footprint

The successful implementation of MBR technology for treating sewage water and its subsequent reuse in industrial processes has yielded positive ecological and demographic benefits. In urban centres like Mumbai, where population growth strains available land resources, one of the clients achieved a remarkable one–third reduction in land usage for one of their STPs through the adoption of Veolia Water Technologies & Solution's MBR technology.

The reduced footprint at their fertilizer unit also catalyzed Veolia Water Technologies & Solution's venture into mobile STP units as a plug–and–play model. These mobile STP units are now set up as pilot projects, allowing potential customers to gain hands–on experience with this efficient solution at their sites.

2. Salvaging ecological resources

With innovation as a primary driver of its sustainability initiatives, Veolia Water Technologies & Solutions has not only applied its successful case as a blueprint but also as a mission to revive and rejuvenate water bodies. In an era where climate change has caused a significant decrease in the size of over half of the world's large lakes and reservoirs since the early 1990s, Veolia Water Technologies is utilizing mobile units equipped with MBR technology to clean and revitalize ponds, lakes, and rivers in Indian urban centres like Mumbai.

Towards a Sustainable Future

As a major stakeholder in the agriculture sector and one of the major water consumers, the fertilizer industry is at the cusp of setting a path–breaking example in sustainability.

In the coming decades, the world's increasing need for fresh water will go hand in hand with rising demands for food, fibre, and biofuel crops. To address this challenge, it's vital to boost water efficiency in global agriculture and implement effective water reuse methods.

By reducing the amount of water needed for each unit of production, we can effectively lessen the strain on our limited global freshwater resources. This effort aligns well with the thriving global fertilizers market.

A testament to this has been the successful commissioning of more than 22 million litres per day (mld) MBR–based Sewage Treatment Plant (STP) at one such fertilizer unit which at the given time was the largest project of its kind dedicated to sewage water treatment.

Since then, Veolia Water Technologies has also been ramping up its capabilities to meet the needs of its partners in the fertilizer industry.

Statistics estimate the market's value at USD 212.59 billion in 2023, with a projected growth to USD 262.41 billion by 2028. This intersection of agricultural demands and sustainable wastewater management underscores the necessity for innovative solutions like Veolia's MBR technology to tackle future challenges effectively.

The pressing question before us is whether we can all unite in our commitment to sustainably boost agricultural production by responsibly harnessing every drop of water within the fertilizer industry.

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Mr. Jitendra Katre

For over 10 years, Jitendra Katre has been working in development sector for various firms. He has years of experience in both the government and private sectors and has led the several highly esteemed Project in different Bilateral organisations. Jitendra hold Bachelor degree in civil Engineering from the University of RTMNU and is skilled in team building, strategic planning, project management, DPR preparation, Proposal Writing, Infrastructure planning, technical monitoring and evaluation. In his career performed the variety of Tasks like design and implementation of Water supply Projects, Water Resource Developments projects, Implementation of holistic WASH approach in Ashramsalas and wastewater management and Faecal Sludge management project in various geographic areas. Jitendra has a magnetic presence in the workplace and uses her positive attitude and energy to encourage others to work tirelessly towards success.

Non–Revenue Water

Introduction

Non–Revenue Water (NRW) is defined as the difference between the volume of water introduced into the Water Distribution System (WDS) and the volume of water billed to end–users (Frauendorfer & Liemberger, 2010). It is water that is produced and introduced into the water distribution system but is "lost" before reaching the end–users due to leaks, theft or wastage (Duffy, 2016).

According to the United Nations World Water Development Report 2019, the global demand for water is estimated to increase by 20% to 30% above current levels of water use by 2050. Given that climate change is expected to create additional pressure on water resources, it becomes imperative to better manage existing water resources by reducing losses. Reducing Non–Revenue Water (NRW) is a powerful demand management instrument for urban local bodies in decreasing stress on existing resources.

One of the major challenges facing water utilities is the high level of water loss in distribution networks. If a large proportion of water that is supplied is lost, meeting consumer demands is much more difficult. Since this water yields nonrevenue, heavy losses also make it harder to keep

water tariffs at a reasonable and affordable level. This situation is common in many Asian cities. "Non–Revenue Water" (NRW)—defined as the difference between the amount of water put into the distribution system and the amount of water billed to consumers—averages 35% in the region's cities and can reach much higher levels. NRW is a good indicator for water utility performance; high levels of NRW typically indicate a poorly managed water utility. In addition, published NRW data are often problematic, suspicious, inaccurate, or provide only partial information. Some utilities invent "creative" definitions of NRW, use wrong or misleading performance indicators, and fail to quote important information, such as average pressure and supply time.

Conversely, successful utilities actively address NRW by controlling physical losses, ensuring customer meter accuracy and making all efforts to keep the number of illegal connections within limits. Taking these measures can boost revenue by increasing the amount of water that can be billed while reducing wastage of the product. This increases profitability and improves the return on investment.

With larger profits, the utility can then reinvest retained earnings and improve its productivity. While the benefits of reducing NRW are well known, decades of effort have not delivered much improvement in the developing world. While there are many explanations and excuses, much of the failure is due to underestimating the technical difficulties and complexity of NRW management, along with the potential benefits of taking action.

Addressing NRW requires a comprehensive approach that combines infrastructure upgrades, advanced technology, improved management practices, and regulatory measures.

Understanding NRW

Non–revenue water refers to the portion of water produced and treated by water utilities that is lost or unaccounted for before reaching consumers. NRW is typically expressed as a percentage of the total water supply. It encompasses both physical losses (leakage from pipes and infrastructure) and commercial losses (water that is consumed but not billed due to factors like illegal connections, inaccurate meters, or administrative errors).

This not only contributes to a more sustainable and cost–effective water supply system but also minimizes environmental impacts and ensures consumers receive a reliable and consistent water service.

Causes of NRW

Leakage: Aging and deteriorating water infrastructure is a primary cause of NRW. Cracked pipes, corroded valves, and faulty joints can lead to water losses through leakage.

Inaccurate Metering: Faulty or inaccurate meters can result in underreporting of water consumption, leading to commercial losses for utilities.

Illegal Connections: Unauthorized connections to the water supply network, often in informal settlements or through illegal tapping, divert water without it being billed.

Water Theft: Deliberate tampering with meters and theft of water through various means contribute to NRW.

Inefficient Operations: Poor management practices, such as inadequate pressure management and inadequate maintenance, can exacerbate water losses.

Data Management and Billing Errors: Errors in customer billing, meter reading, and data management can result in unbilled water consumption.

Lack of Investment: Insufficient investment in infrastructure upgrades and maintenance can lead to increased NRW over time.

Impacts of Non–Revenue Water

High levels of non–revenue water (NRW) have significant financial implications for water utilities. When utilities produce and treat more water than they can bill for due to losses, it results in substantial financial losses. This is because utilities incur costs for sourcing, treating, and distributing water, including the energy and chemicals required in the treatment process, as well as ongoing maintenance and operational expenses. When a considerable portion of this treated water is lost before it reaches paying customers, it represents a direct financial burden. These financial losses can hinder a utility's ability to invest in infrastructure upgrades, maintenance, and improvements in service quality. Moreover, they may lead to increased water rates for consumers to compensate for the lost revenue, potentially burdening households and businesses with higher costs for water services.

The impact of NRW extends beyond financial losses and directly affects the availability and sustainability of water resources. Water is a finite and precious resource, and any loss of treated water exacerbates water scarcity issues. With growing global concerns about water scarcity and increasing demands for water resources, conserving water becomes paramount. NRW represents a wastage of valuable water resources that could otherwise be used for essential purposes, including drinking, agriculture, and industrial processes. In regions already grappling with water scarcity, addressing NRW is critical for ensuring equitable access to clean water for all and for sustaining ecosystems that depend on reliable water sources. Therefore, reducing NRW is not only economically prudent but also crucial for safeguarding water availability and sustainability.

Furthermore, the reduced service quality resulting from frequent pipe bursts and service interruptions due to infrastructure problems can have far–reaching consequences. It can lead to customer dissatisfaction and loss of trust in the utility, which may result in customers seeking alternative water sources or resorting to costly water storage and treatment methods. Additionally, service disruptions can have adverse effects on public health, especially in situations where access to clean and safe water is compromised. Therefore, addressing NRW is not only about conserving resources and reducing financial losses but also about ensuring the reliable provision of high–quality water services that meet the needs and expectations of consumers while safeguarding the environment.

Solutions to Address Non–Revenue Water

Investing in the rehabilitation of water infrastructure is paramount for maintaining the functionality and efficiency of water distribution systems. The infrastructure, which encompasses pipes, valves, and treatment facilities, undergoes wear and tear over time due to factors like corrosion and aging. Addressing this issue involves repairing and replacing these aging components, which not only conserves water but also reduces physical losses caused by leaks and breakages.

By investing in infrastructure rehabilitation, utilities can minimize the disruptive and costly repairs associated with frequent pipe bursts. This not only ensures a reliable supply of clean water to consumers but also extends the overall lifespan of the water distribution system.

Advanced metering technology is another critical component in the battle against non–revenue water. Traditional water meters are often prone to inaccuracies and tampering, leading to significant commercial losses for utilities. Implementing smart metering technology, including devices that can transmit real–time consumption data, enhances the accuracy of measuring water usage. Furthermore, these smart meters have the capability to swiftly detect unauthorized consumption or irregularities in water usage patterns. This early detection allows utilities to address issues promptly, reducing commercial losses, improving revenue collection, and ensuring consumers are billed accurately for their water consumption.

Pressure management within distribution networks is also pivotal for tackling non–revenue water. Maintaining the appropriate water pressure is crucial, as excessive pressure can stress pipes, resulting in leaks, while low pressure can lead to inadequate water supply. By optimizing water pressure through effective pressure management techniques, utilities can reduce leakage, conserve water, and prolong the lifespan of their infrastructure. This not only contributes to a more sustainable and cost–effective water supply system but also minimizes environmental impacts and ensures consumers receive a reliable and consistent water service.

Modern technology, such as acoustic sensors and satellite imagery, has revolutionized leak detection in the water sector. These tools enable utilities to identify leaks swiftly, often before they become significant problems. Early leak detection is vital for preventing water losses and minimizing the environmental and financial impact of leaks. By leveraging these technologies, utilities can proactively address leaks, reduce non–revenue water, and ensure a more efficient and sustainable water supply system.

Effective data management and billing systems are critical components of NRW reduction strategies. Implementing robust systems streamlines the tracking of water usage and billing processes, reducing administrative errors, ensuring accurate billing, and enhancing revenue collection. Efficient data management also supports better decision–making for utilities, enabling them to optimize operations, allocate resources effectively, and plan for infrastructure maintenance and upgrades.

Engaging with consumers is another essential aspect of addressing non–revenue water. Educating customers about water conservation practices, such as fixing leaky faucets and using water–efficient appliances, can lead to reduced consumption and less strain on the water supply system. Encouraging customers to report leaks promptly further contributes to NRW reduction, as timely repairs can prevent water losses and minimize service disruptions.

Regulatory measures play a crucial role in the fight against non–revenue water. Enforcing regulations against illegal connections and water theft acts as a deterrent, discouraging individuals or entities from accessing water without proper billing.

These measures help maintain accountability within the water supply system, support financial sustainability for utilities, and ensure that water resources are used efficiently and equitably.

Conclusion

Non–revenue water is a significant challenge for water utilities worldwide, with far–reaching economic, environmental, and social consequences. Addressing NRW requires a comprehensive approach that combines infrastructure upgrades, advanced technology, improved management practices, and regulatory measures. By reducing NRW, utilities can ensure a sustainable supply of clean water and mitigate the wastage of valuable resources, ultimately benefiting both consumers and the environment.

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Benefits of NRW Reduction

Mandarr Kkamthe

Senior Product Manager–Water at Asian Contec Ltd. (Stanlay)

I have been working in the water sector for 12 very fruitful years. I was previously associated with organizations like JUSCO,Suez Environnement, Vishvaraj Environment Pvt. Ltd., Siemens,GE etc. During this time,I achieved much in terms of expanding program offerings and enhancing the quality of existing Systems. Some of my main skills include the following:

- Expert in developing and implementing a strategy for program teams, as well as developing robust mitigation plans.
- Demonstrated ability to liaise with different engineering teams to increase system awareness.
- Able to report on system performance, and identify opportunities for continual improvement.
- In–depth knowledge of developing new programs to support the strategic direction of the organization.

Reducing Non–Revenue Water

The maximum leakage occurs in the water distribution system and house service connections which is around 80% of the total leakages in the system while the remaining percentage covers the loss at source, transmission system, treatment plants and service reservoirs. NRW is usually taken as the measure of efficiency of a water supply system.The reduction of NRW is a crucial step to improve the financial health of water utilities and to save scarce water resources. The percentage of physical losses is influenced not only by the deterioration of piped network, but also by the total amount of water used, system pressure, and the degree of supply continuity. The percentage of administrative losses depends on the degree of effort exerted in identifying illegal connections and in repairing meters. To a large extent, the level of NRW is an indicator of how well a utility is managed.Continuous supply system may result in increase in NRW; however, installation of district flow meters, functioning of domestic meters on consumer connections will indicate areas where quantum of NRW is high and efforts to minimize NRW can be concentrated

Impacts of NRW

In many water utilities, there are high levels of NRW which leads to low levels of efficiency in terms of financial economy and redressal of complaints. When a utility's product (treated water) is lost, water collection, treatment and distribution costs per unit of volume increases, water sales in terms of volume and amount decreases, and to resolve this situation substantial capital expenditure programs are often promoted to meet the ever–increasing demand. In short, the utility

enters a vicious cycle (Figure 1) that does not address the core problem. The challenge for these utilities is to turn this vicious cycle into a virtuous cycle (Figure 2), which will lead to low levels of NRW and therefore substantially improved efficiency.

Water Audit

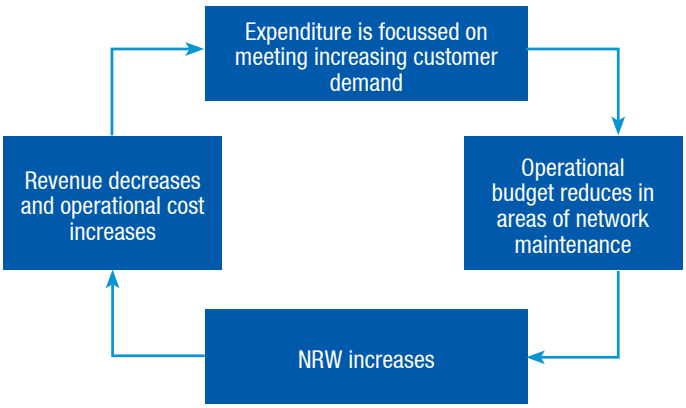
For effective control of water losses, NRW of every DMA is to be determined by dividing operational zones. A city is divided into number of operational zones (OZs) which are further divided into number of sub zones called as District Metered Areas (DMAs). Each DMA is then critically studied for different demand patterns, leakages and unaccounted for water. Thus, the problem is divided into sub–problems and effective control measures are taken to provide effective solution for each sub problem to solve the problem in total. Water audit identifies how much water is lost and the loss of revenue against the same. The objective of water audit is to help the utility select and implement programs to reduce distribution system losses. Water audits should be performed annually to help managers to adjust priorities, monitor progress, identify new areas of system losses, and establish new maintenance goals. A water audit followed by leak detection program can help water utilities reduce water and revenue losses and make better use of water resources.

These variations in night consumption can be observed and then can be identified and repaired. Reported bursts are visible leaks and are also removed in reasonable time by ULB.

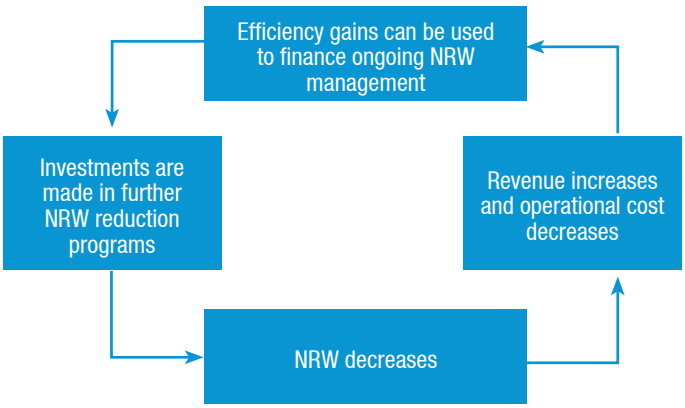
Computation of Nrw by Step Test

Step test is generally used to compute NRW within DMA. This technique, is usually undertaking during the night hours in order not to interrupt the regular supply of water to the customers. The minimum night flows are evaluated against expected and calculated legitimate usage within that DMA. If there is certainty that there is sufficient leakage for

NRW values generally increases with time. Operator should fix the Intervention limit.



Vicious circle of NRW



Virtuous circle of NRW

that DMA, Step Testing will be performed within that DMA to localize any leakage potential. After each section closure, re–evaluation of the recordable night flows is conducted to see if the amount of estimated leakage is found. This allows for quick and immediate decision making by the client in order to control the costs of the leakage survey. Estimated leakage potential within each isolated DMA and each subsection within that DMA will be known.

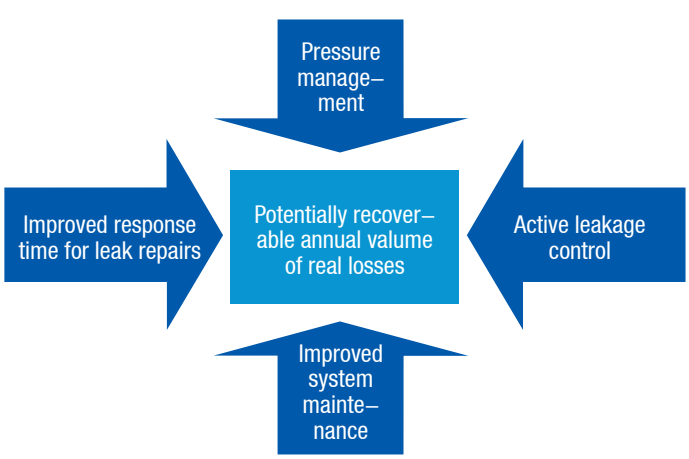
Methods For Reducing Unaccounted For Water (UFW)

1. By 100% Consumer Metering and Telescopic Tariff

100% Consumer metering and telescopic tariff based on volumetric measurement curbs wastage of water as excess and unnecessary consumption becomes costly for consumer. Thus, demand management is achieved which reduces NRW.

2. Leak Detection

The leak detection involves identification of actual leak points without carrying out any excavation. The main principle of these methods is to identify the location of each leak and magnitude of each leak's severity, expressed in liters per second, in buried pipes. The principle includes a generated noise from the point of leak in the buried pipelines.



Flowchart for reduction in real losses of water

Leak Repair Program

Bursts can be identified by the variation in minimum night flow over longer period, say 180 days. These variations in night consumption can be observed and then can be identified and repaired. Reported bursts are visible leaks and are also removed in reasonable time by ULB. However, small leakages do not come to surface and cause increase in NRW and contamination. These invisible leakages appear and are known as background leakages. Unreported bursts can also be detected. since it is not removed, the losses are continued and again another unreported burst occur. When both the unreported bursts are removed, NRW level is brought down.

DMA Management;

As soon as DMA is established initial values of NRW, net night flow (NNF) should be recorded. NRW values generally increases with time. Operator should fix the Intervention limit. When NRW reaches this limit, the task of NRW reduction is taken up. NRW is lowered to its base level. As time moves on, value of NRW again increases. Operator has to again bring NRW to its base level. If frequency of intervention increases rapidly, then the pipe replacement should be made.

Conclusion

General Benefits of NRW Reduction

- Revenue improvement through lower losses & improved billing.
- Pressure improvement in the project area.
- Improved levels of customer service.
- Better knowledge and understanding of Network.
- Water quality risk reduced by monitoring leaks in the DMA's.
- Operation of system meets best international best practices.
- Total accountability of water in supply.
- Better understanding of free water usage and slum usage.
- Improved forecasting of demand and cost – improved asset management.
- The equitable distribution of water or system optimization.
- Reduced operational cost.
- Illegal usage can be tracked.

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Non–revenue water: a major challenge for water utilities

Non–revenue water refers to the water that is lost before it reaches the customer due to various factors such as leaks, theft, and metering inaccuracies. This problem is prevalent in many parts of the world, particularly in developing countries where water infrastructure is often outdated and poorly maintained.

Water is a precious resource, and ensuring its availability to everyone is crucial for sustainable development. However, the loss of water before it reaches the customer due to various factors such as leaks, theft, and metering inaccuracies is a major challenge faced by water utilities worldwide. This problem is referred to as non–revenue water (NRW), and it has significant economic, social, and environmental impacts.

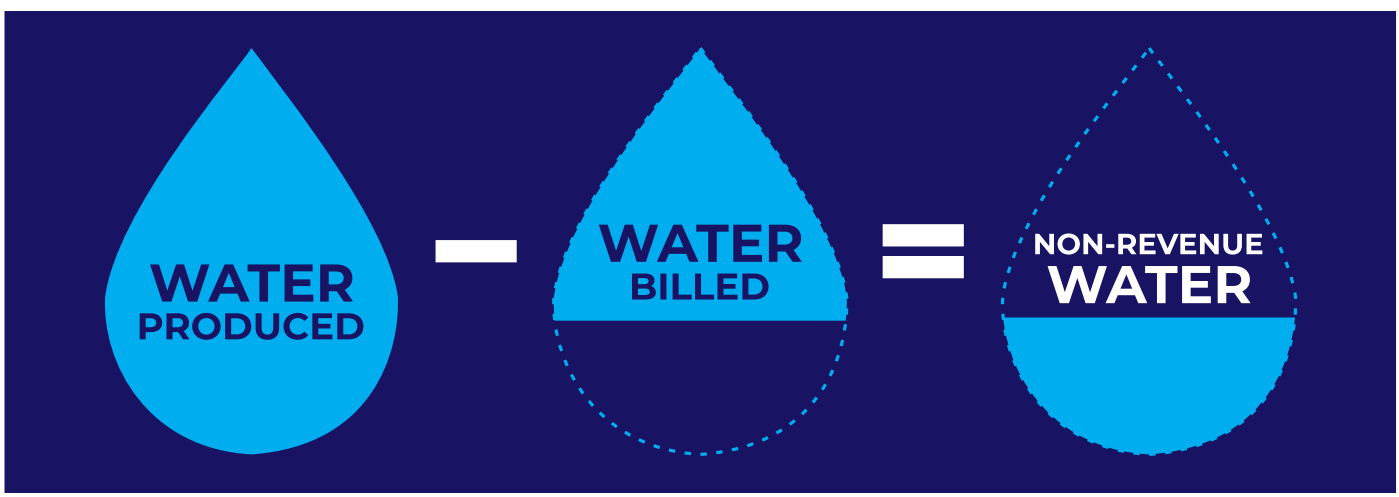
NRW is a global issue, affecting both developed and developing countries. According to the World Bank, the average NRW rate in developing countries is about 45%, while in developed countries, it is around 20%. The loss of NRW not only leads to a shortage of water supply but also results in financial losses for water utilities. The cost of producing and distributing water is high, and when a significant amount of water is lost, it can have a significant impact on the revenue generated by the utility.

Managing non–revenue water and reducing water loss through strategic efforts and advanced technologies.

Reasons for Non–Revenue Water:

- **Leakage:** Water leaks from aging or damaged pipes and infrastructure.
- **Unauthorized Consumption:** Water theft or illegal connections.
- **Meter Inaccuracies:** Faulty or inaccurate water meters.
- **Inaccurate Billing:** Billing errors leading to revenue loss.
- **Water Main Breaks:** Sudden pipe bursts or ruptures.
- **Inadequate Maintenance:** Poorly maintained water distribution systems.
- **Data Collection Issues:** Inefficient data collection and management.
- **Poor Infrastructure:** Insufficient or outdated infrastructure.
- **Pressure Management:** Inadequate control of water pressure.
- **Unmetered Usage:** Lack of meters in some areas.
- **Commercial Losses:** Businesses not billed accurately for water usage.
- **Water Quality:** Water quality issues leading to unusable water.
- **Theft and Vandalism:** Deliberate damage or theft of water infrastructure.
- **Lack of Monitoring:** Inadequate monitoring and control systems.
- **Natural Losses:** Evaporation and seepage in open reservoirs.

The causes of NRW are a lot and complex. They include aging infrastructure, inadequate maintenance, illegal connections, inaccurate metering, and inefficient billing systems. In developing countries, NRW is more often exacerbated by poverty, lack of investment, and weak governance.



The loss of non–revenue water not only affects the water supply shortage following also has economic consequences for water utilities.

Knowing about the cost of the distribution and supply of water is high and significant losses can impact their revenue.

Some points to reduce water loss and non–revenue water:

- Aim for efficient leakage recovery
- Divide the water network into sections
- Quick assessment and repair
- Monitor network activities
- Take control of the network pressure
- Use all the available data, and think smart
- Set an NRW limit, and follow up

For bringing economic sustainability of water, reduction in Non–revenue water is the must to be look forward for environmental and economic sustainability of communities.

■ Quality products and solutions

Managing non–revenue water and reducing water loss through strategic efforts and advanced technologies. Operating a water distribution network is no easy task. A network often covers an extensive area and a complex, hidden system of pipes, making it difficult to detect changes, damage or illegal connections. Managing water losses or non–revenue water in an open system is a challenging task due to the complexity of the pipe network, making it difficult to detect changes, damage, or unauthorized connections. As a result, a passive and reactive approach is often adopted, where action is taken only after the loss becomes visible or is reported.

High–quality products pay off in the long term:

If improvements in the water distribution infrastructure are to last in the long term and show an expected reduction in water loss, it is recommended to use high–quality components and products. Aspects to be considered when purchasing and installing new components include length and scope of warranty, Total Cost of Ownership, energy consumption as well as long–term reliability and accuracy.

To address this issue, water utilities need to adopt efficient water management practices and invest in modern technologies such as smart meters and leak detection systems. These technologies can help identify areas where water is being lost and enable utilities to take corrective measures promptly. For example, smart meters can detect leaks in real–time and alert utilities to take immediate action. Leak detection systems can also help identify hidden leaks that are not visible to the naked eye.

Globally, water scarcity already affects four out of every 10 people· By 2025, 1.8 billion people are expected to be living in countries or regions with absolute water scarcity, and two–thirds of the world population could be under water stress conditions. (UNESCO, 2012)

The country loses about 40% of its water supply due to non–revenue water, which amounts to approximately 50 billion cubic meters of water per year.

Some essential equipment and tools commonly used:

1. Leak Detection Equipment:
- Acoustic Leak Detectors
- Ground Microphones
- Leak Noise Correlators

2. Flow Measurement Tools:
- Flow Meters (e.g., electromagnetic, ultrasonic)
- Pressure Sensors

3. Water Quality Testing Equipment:
- Water Analyzers
- Turbidity Meters
- Chlorine Test Kits

4. Data Loggers and Sensors:
- Remote Monitoring Systems
- Data Logging Equipment
- SCADA (Supervisory Control and Data Acquisition) Systems

5. GIS (Geographic Information System):
- GIS Software for mapping and analyzing distribution networks.

6. Metering Infrastructure:
- Smart Water Meters
- AMR (Automatic Meter Reading) Systems
- AMI (Advanced Metering Infrastructure)

7. Pressure Management Devices:
- Pressure Reducing Valves
- Pressure Regulators

8. Pipeline Inspection Tools:
- CCTV Cameras for pipe inspections
- Pipeline assessment and condition monitoring equipment.

9. Water Loss Management Software:
- NRW Management Software
- Data Analysis and Reporting Tools

10. Training and Capacity Building Tools:
- Training programs for staff in NRW reduction techniques.

11. Maintenance and Repair Tools:
- Tools for repairing leaks and maintaining infrastructure.

12. Consumer Engagement Tools:
- Mobile Apps for consumers to report leaks or meter issues.

13. Water Auditing Tools:
- Water audit software and tools for assessing water losses.

14. GIS and Mapping Software:
- Geographic Information System for mapping and analyzing distribution networks.

Furthermore, educating customers about the importance of water conservation and the impact of NRW can also help reduce the problem. Customers can be encouraged to report leaks and other issues promptly, which can help utilities take corrective measures before significant losses occur. Water conservation measures such as rainwater harvesting, reuse of greywater, and efficient irrigation can also help reduce demand for water and thereby reduce NRW. In conclusion, NRW is a significant challenge for water utilities worldwide. By enhancing use of technology which will give modern solutions and practice best water management skills, high end improvement can reduce the loss of NRW and improve their financial performance while ensuring a reliable water supply for their customers. For bringing economic sustainability of water, reduction in Non–revenue water is the must to be look forward for environmental and economic sustainability of communities.

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Effective Water Source Management: A Sustainable Lifeline

Tariq Siddiqui
Chief Strategist, TS Advisory Services

He is the Chief Strategist of TS Advisory Services which works on the philosophy to evolve, adapt, and innovate as success means choosing to change for the better. He is responsible for evaluating, defining and developing measurable business and communication strategies for water companies. A doctorate in media, he has over 26–years of experience working with different sectors including water and wastewater.

Water, the elixir of life, is unquestionably one of the most vital resources on our planet, essential for all forms of existence on earth. Water sustains life, and its value cannot just be ornamental. It is the primary constituent of all living organisms, crucial for various processes such as hydration, sanitation, and food production. Beyond its direct importance for human survival, water also drives economies by supporting agriculture, manufacturing, and energy production.

With ever increasing population and intensifying climate change events, responsible and sustainable management of water sources has become an urgent necessity. The safety and sustainability of water sources are paramount, as it directly impacts our well–being, ecosystems, and economic progress.

Challenges to Water Source Management

Water resource management has far–reaching implications on every aspect of human life and the economy. With unsustainable use of precious water resources over the years, water scarcity has become a critical challenge, especially in India where almost half of the population facing severe stress. It is imperative to enhance its management for long–term sustainability. Managing water sources is a complex task with various challenges that need to be addressed to ensure the sustainable availability of clean and safe water. Some of the key challenges to water source management include:

Population Growth:

Over the past five decades, the global population has more than doubled, rising from 3.92 billion in 1973 to its current 8.04 billion. Although the growth rate has slowed down significantly, dropping from over two percent annually to less than one percent, the increasing population has substantially heightened the demand for freshwater. This exerts tremendous pressure

Dried Water Pond

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TS Advisory Service's commitment to water advisory reflects the dedication to promoting responsible water management practices and ensuring the availability of clean and safe water resources for communities and industries.

Fresh Water Reservoir

on existing water sources, resulting in their depletion and heightened competition for this vital resource. From an Indian perspective, the situation is particularly critical, with less than four percent of the world's fresh water sources catering to a population that accounts for nearly eighteen percent of the global total.

Pollution:

Industrial, agricultural, and domestic activities release pollutants into water bodies, exposing the quality of available freshwater. The contamination of water sources, such as rivers, lakes, oceans, ponds, groundwater, and even drinking water sources, by harmful substances or pollutants has been increasing. These pollutants can be in the form of chemicals, microorganisms, or other substances that alter the physical, chemical, or biological characteristics of the water, making it harmful or unsuitable for various uses, including drinking, commercial, and aquatic life.

The rampant wastewater discharge into water bodies in developing countries including India has become a big challenge. According to the Central Pollution Control Board (CPCB), the current sewage treatment infrastructure in India can only manage to process approximately one–third of the total daily municipal sewage output. An approximate estimate indicates that urban areas in the country produce nearly 80,000 MLD (million litres per day) of domestic wastewater, and a similar volume of industrial and other wastewater is also generated daily. The extensive discharge of untreated wastewater into water bodies has resulted in significant pollution of groundwater sources in various locations. This has led to the deterioration of some of the nation's prominent rivers, with either their disappearance or severe contamination that the water is unfit for any practical use.

Groundwater Depletion:

Over–extraction of groundwater for agriculture, industry, and domestic use has led to the depletion of aquifers in many areas. India is the largest user of groundwater, extracting an estimated 230 cubic kilometers of groundwater per year – over 25% of the total global groundwater usage. Almost 89% of the groundwater extracted is used for irrigation and the rest for domestic and industrial use. More than 60% of irrigated agriculture and 85% of drinking water supplies are dependent on groundwater.

Groundwater depletion in India is a serious issue. According to the Fifth Minor Irrigation Census, the groundwater level in India has declined by 61% between 2007 and 2017. It was further observed that more than 1,000 blocks in India have become water–stressed.

Around 65% of India's total water demand is being met from groundwater sources which plays an important role in shaping the nation's economic and social development. However, an increasing number of aquifers are reaching unsustainable levels of exploitation. If current trends continue, in 20 years, about 60% of India's aquifers will be in a critical condition, says a World Bank report.

India's northern and eastern states such as Assam, Punjab, Haryana, Delhi, Uttar Pradesh, Bihar, and West Bengal saw a rapid decline in usable groundwater in the past decade, raising

River: Valuable Resource of Water Supply

the risk of severe droughts, food crisis, and drinking water scarcity for millions of people. About 40% of India's population possibly would have no access to drinking water by 2030, as reported by the Niti Aayog.

A survey conducted by the Water Ministry in India have analysed 10,219 wells across several states to ascertain the groundwater levels; around 55% of them were showing fall in groundwater level.

Fall in Water Level in Wells

Tamil Nadu	76%
Punjab	72%
Kerala	71%
Karnataka	69%
Meghalaya	66%
Haryana	65%
West Bengal	64%
Delhi	62%

Aging Infrastructure:
The ageing water storage infrastructure is an emerging global risk. In their report in 2021, the United Nations University Institute for Water, Environment and Health (UNU–INWEH) provides an overview of the current state of the ageing of large dams. It highlights that tens of thousands of existing large dams have reached or exceeded an "alert" age threshold of 50 years, and many others will soon approach 100 years. The report further explores the emerging practice of decommissioning ageing dams, which can be removal or re–operation, to address issues such as ensuring public safety, escalating maintenance costs, reservoir sedimentation, and restoration of a natural river ecosystem. The recent flooding in Libya, that killed nearly 12000 people, deaths still counting, due to bursting of two dams after the heavy rainfall in the region could have been avoided if the dams were maintained properly.

In India, there are 5334 large dams, third largest number of dams in the world after the USA and China. The number is set to increase in the coming years as India constructs more dams to meet the rising demand for electricity and water. Over a thousand large dams will be roughly 50–years–old in 2025 and such aging structures pose a growing threat, according to a United Nations (UN) report which notes that by 2050, most people on Earth will live downstream of tens of thousands of dams built in the 20th century. Upgrading and maintaining such large number of aging water infrastructure is costly and logistically challenging.

Climate Change:
Altered precipitation patterns and rising temperatures due to climate change have led to shifts in water availability. Some regions are experiencing more prolonged droughts, while others face an increased risk of flooding. It has been affecting water resources in India, leading to shortage of water in several regions. The crisis has especially worsened in recent years due to climate change, which results in delayed monsoons, consequently drying out reservoirs in several regions. The consumption of water would escalate further with pressure from industrialization and urbanization. Climate change could lead to extreme weather events like floods, droughts, heavy rains, unseasonal rains, hail storms, etc., which have impacted the Indian economy adversely. Rising temperature are causing Himalayan glaciers to retreat, threatening the flow rate of the Ganga, Brahmaputra, Yamuna, and other major rivers; the drinking water supply of millions of people and livelihoods of farmers depend on these rivers.

Strategies for Water Source Management

Implementing effective water source management strategies is crucial for ensuring the sustainable availability of clean and safe water. Effective water source management requires collaboration, transparency, and a shared commitment among all stakeholders, ensuring that clean and safe water remains accessible for present and future generations. Some of the key strategies could be:

Conservation of Resources:
Water conservation is important for several reasons. Freshwater is a very limited resource, essential for human survival. It is also necessary to ensure continuous water supply to future generations, protect us from health hazards caused by water pollution, and keep water pure and clean while protecting the environment.

Freshwater accounts for only 3% of our surface water. And most of the fresh water on our planet is not available for use since it is locked away in various forms of storage. Such forms include ice, glaciers, and groundwater. Usable water is already a scarce resource in many parts of the world, becoming an increasing concern. Encouraging water conservation practices at the individual, community, and industrial levels are critical. This includes fixing leaks, using water–efficient appliances, and reusing treated wastewater for useful purposes.

Improved Infrastructure:
Investment in building robust and climate

resilient water infrastructure, such as dams and storage, water treatment facilities and pipelines, can help reduce water losses, improve water quality, reduce contamination, while also generating a number of economic, environmental, and social benefits.

Excellent water infrastructure helps keep the public safe from health problems that can arise due to a lack of it. While making water available for drinking and commercial activities, it also provides a lasting legacy to water utilities as it will serve future generations too.

Wastewater Treatment:
Ensuring that wastewater is adequately treated before being discharged back into natural water bodies is crucial to prevent pollution. In a circular economy, wastewater is treated and reused as a resource that can improve the availability of water for people, industries, and irrigation. Wastewater reuse can reduce the need for water withdrawals, while decreasing the volume of effluents discharged into water bodies. In India, only about one–third of total generated wastewater is being treated and reuse is almost negligible due to lack of implementing norms. The agriculture sector that uses 80% of fresh water mostly extracted from groundwater sources could be provided reclaimed water to reduce their dependence on freshwater sources.

Technological Advancements:
Technological advancements have brought about several innovations in water resource management. The use of Artificial Intelligence (AI), Internet of Things (IoT) sensors, and advanced meters enable water quality and quantity control as well as remote asset management and responsible water use.

Protection of Watersheds:
Preserving natural watersheds through reforestation and land–use planning can safeguard the quality and quantity of water flowing into reservoirs and aquifers. Watersheds provide important support in drinking water supply, water for agriculture and industries, offer opportunities for recreation, and provide habitat to numerous plants and animals. Unfortunately, various forms of pollution, including runoff and erosion, can interfere with the health of the watershed. Therefore, it is important to protect the quality of our watersheds.

Dam: Vital Water Storage Infrastructure

Climate Resilience:
Developing water management strategies with climate resilience are essential to ensure the availability of water resources in the face of climate change. Climate–resilient water management approaches such as adopting efficient irrigation practices and implementing water recycling systems, among other strategies are essential for mitigating climate change effects and protecting the ecosystems as well.

Fostering Transformational Change

TS Advisory Service is actively engaged in the field of water advisory, offering expertise and guidance in various aspects of water resource management, conservation, and sustainability. The services include a wide range of activities and initiatives aimed at addressing water–related challenges and optimizing water use across different sectors. The team of skilled professionals having diverse industry experience with a pragmatic approach to solving complex challenges provide strategic advice for water conservation and resource management, implementing sustainable practices, and assisting clients in navigating water regulations and policies. TS Advisory Service's commitment to water advisory reflects the dedication to promoting responsible water management practices and ensuring the availability of clean and safe water resources for communities and industries.

With a distinguished clientele consisting of prominent water companies in India, TS Advisory Services has established itself as a reliable partner in the water sector. The company has the honour of collaborating closely with well–known water firms, offering them specialized advice, inventive strategies, and customized marketing solutions. Drawing on extensive industry expertise and experience, TS Advisory Services is well–equipped to comprehend the distinct challenges and prospects encountered by water companies in India.

Way Forward:
Water source management is not just a matter of environmental concern; it is a matter of human survival and well–being. The challenges we face regarding water availability and quality require immediate attention and proactive actions at all levels. By embracing sustainable practices, conserving water resources, and adopting responsible policies and regulations, we can ensure that the lifeline of our planet remains intact. The time to act is now, as responsible water source management is not only a necessity but a moral obligation towards our planet and its inhabitants. It is our collective responsibility to protect and preserve our lifeline – water.

WATER DESALINATION: A GREAT HOPE FOR PROSPEROUS AND SUSTAINABLE FUTURE

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INTRODUCTION

Salinity of water has made > 97% of the water on earth unsuitable for human consumption. 99% of saline water is in the form of sea water and the rest in the form of saline ground water. Purification of this unsuitable saline water holds good promise to meet with ever increasing water requirement for human consumption, though the process of purification of saline water is expensive, energy intensive and often has adverse impacts on ecosystems. Despite these drawbacks, water desalination can be an appropriate technological choice when combined with various technological advancements that reduce adverse impact on environment vis a vis improve cost economics. Desalination does create an opportunity for coastal communities to access virtually unlimited freshwater sources.

Desalination – a process to remove salt and other constituents from saline water – is generally carried out by 2 basic methods:

- **Thermal process (Evaporation):** A method to obtain fresh water by condensation of vapor produced from evaporation of saline water.
- **Membrane Desalination:** A method to obtain fresh water by filtering saline water, under applied pressure, electric current or temperature, through a semi–permeable membrane through which saline water cannot pass. Reverse osmosis (RO) is the most widely used membrane desalination technology.

The third method of water desalination is based on the **Emerging & Hybrid technologies** that combine different processes together depending upon (i) purpose of desalination, (ii) kind of water available, (iii) size of the plant, (iv) cost and (v) environmental aspects.

All the above methods of Water Desalination result into generation of two main liquid streams: (1) a pure product water and (2) a high–concentration waste stream or brine.

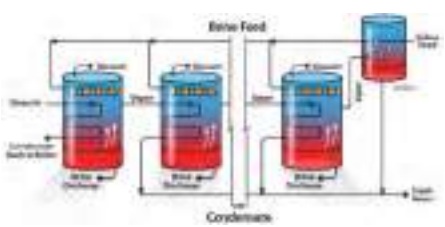
This paper is aimed at providing basic understanding of various technologies, advantages, challenges, opportunities, financial implications and cautions for considering implementation of Water Desalination plants.

THERMAL DESALINATION

These processes generally use heat to evaporate water, leaving dissolved constituents behind. The water vapour is then condensed and collected as product water. This simplest form of thermal processes is a phase change process in which water and vapour phases are involved.

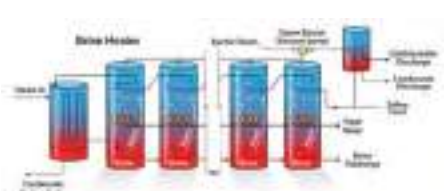
Among various thermal processes like Vapour Compression Distillation, Freezing, Crystallization, Salting out etc; 2 technologies named Multi–Effect Distillation (MED) and Multi–Stage Flash Distillation (MSF) stand out. The rest of the techniques have high capital and operational costs.

Multiple–Effect Distillation (MED): The MED process takes place in a series of 'effects', which are a kind of evaporators, and uses the principle of reducing the ambient pressure in different 'effects'. This process permits the water to undergo multiple boiling without supplying additional heat after the first 'effect'. The water enters the first 'effect' and is raised to the boiling point after being preheated in tubes. The evaporation and condensation are repeated from 'effect' to 'effect' each at a successively lower pressure and temperature. It is possible to achieve much greater efficiency in MED than in MSF.



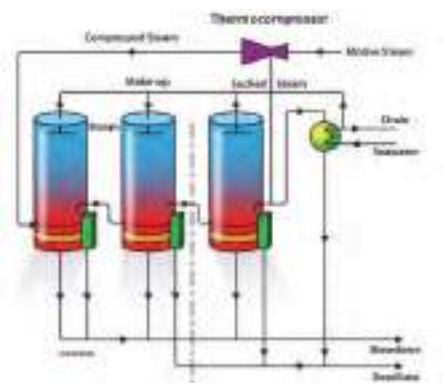
Multi Stage Effect

Multi–Stage Flash (MSF) Distillation: MSF distillation process is based on the principle of flash evaporation. The economy and energy efficiency of this process are achieved by regenerative heating where the saline water flashing in each flash 'chamber' or 'stage' gives up some of its heat to the saline water going through the flashing process. Different from the approach of raising the temperature, the MSF desalination process, thus, evaporates water by reducing the pressure in a series of low–pressure chambers. MSF can be operated at even greater efficiency by utilising the waste heat from an adjacent power plant.



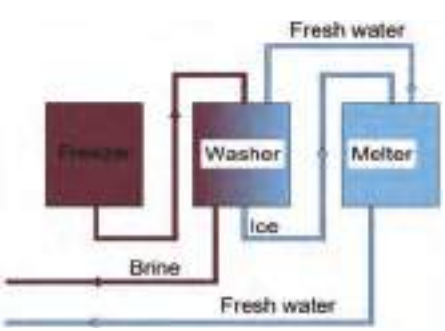
Multi Stage Flash

Vapour Compression Distillation (VCD): The compressor compresses the vapor taken from the evaporator and condenses it inside a tube bundle to give product water. The heat for evaporating the saline water comes from the compression of vapor. For smaller operations with volume needs of around 3000 M^3/day, vapour compression distillation (VCD) can be an appropriate thermal distillation option. VCD is a technically simple, reliable and efficient process that is popular for resorts, industries and work sites where adequate freshwater is unavailable.



Thermal vapour compression

Freezing & Crystallization (Cryo–desalination): It is also possible to desalinate water by freezing at temperatures slightly below 0° C. The salts are removed from salty water by the formation of ice crystals, which do not contain any salt. The process includes cooling of the water feed, partial crystallization of ice, separation of ice from saline water and melting of ice to produce fresh water. Difficulties in movement of solid and liquid phases makes this process complicated and is therefore not commonly practiced. However, in a cold climate, natural freeze–thaw cycles have been harnessed to purify water at costs competitive with RO.



Cryo desalination

MEMBRANE TECHNOLOGIES

Desalination technologies with phase changes (Thermal Desalination) are costlier affairs due to substantial energy requirements in terms of vaporization enthalpy of water. Adding to this, there are stricter regulations regarding greenhouse gas emissions. These factors have led to establishment of desalination plants that use membrane technology – a filtration operation through a semi–permeable membrane which retains the water with ions, and allows the passage of pure water molecules. The driving force in membrane–based technologies can be (i) an electrical potential, (ii) a concentration difference, (iii) a temperature difference or (iv) a pressure.

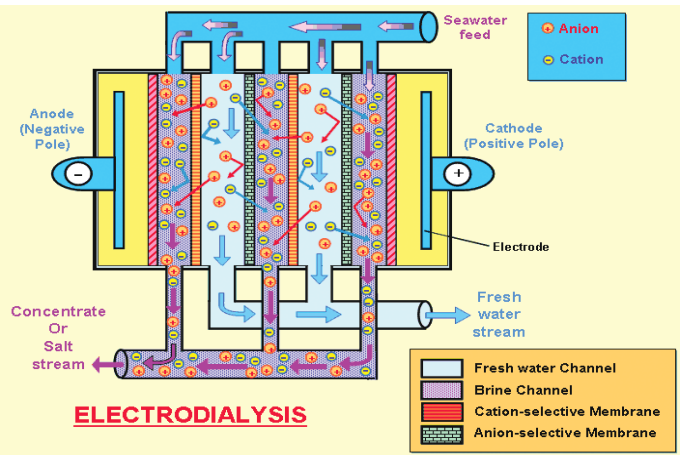
Different driving forces have led to establishment of different kind of membranes, viz.

- Electrodialysis (ED) and Membrane Capacitive Deionization (MCDI) – Electro driven membranes,
- Forward Osmosis (FO) – Concentration driven membranes,
- Membrane Distillation (MD) – Temperature driven membranes, and
- Micro Filtration (MF), Ultra Filtration (UF), Nano Filtration (NF) & Reverse Osmosis (RO) – Pressure driven membranes.

Before 15–17 years, Desalination process was dominated by thermal phase change technologies. However, last 12–15 years have been characterized by the increase in membrane–based desalination for treating sea water, brackish waters, tertiary wastewater, and saline surface waters. In view of high effectiveness, relatively lower energy consumption and lower costs compared to thermal phase change technologies, membrane technologies are used for almost 70% of desalination plants. Among membrane technologies, Reverse Osmosis (RO) is the most promising technology and the fastest growing technology in the world.

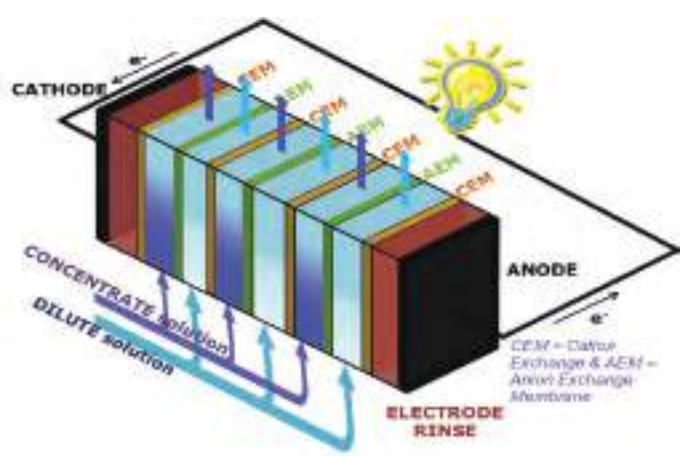
Electrodialysis (ED): Electrodialysis is an electrochemical process that uses a system of different chambers separated by ion selective membranes. Ions are driven by the potential generated by a direct electrical current

applied by electrodes immersed in saline water. The negative ions pass through the anion–permeable membrane and move towards the anode, whereas positive ions pass through cation–permeable membranes and move towards the cathode. Thus, ions are concentrated in some of the chambers, leaving desalinated water in others. ED is used for the wastewater treatment in the pharmaceutical, chemical, and food industries. The water recovery is higher than that of RO. Also, it does not call for pre–treatments or extensive post–treatment.



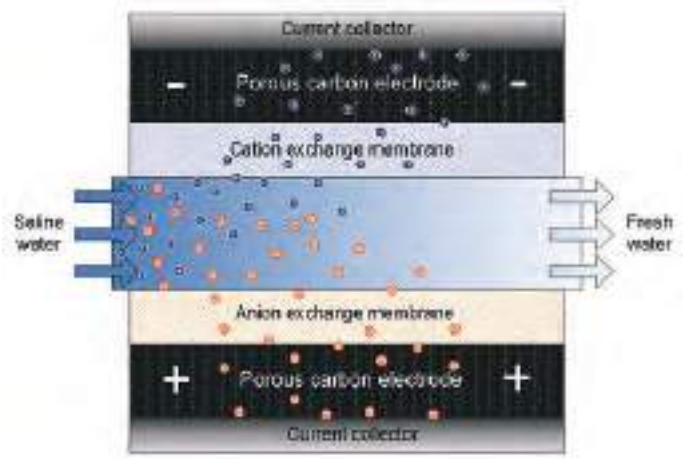
Electro Dialysis

Reverse Electrodialysis (RED): In this process, a salt solution and fresh water are held through a stack of alternating cation and anion exchange membranes. The chemical potential difference between salt and fresh water generates a voltage over each membrane. The process works through difference in ion concentration instead of an electric field, as in case of ED. RED has a good potential for industrial and domestic wastewater processes, desalination as well as energy recovery in RO / ED systems. RED is also applied for simultaneous generation of electrical energy, as well as energy storage leading to development of flow batteries. Large–scale RED industrial applications are economically not viable for natural waters as natural waters cannot generate sufficient power to run RED.



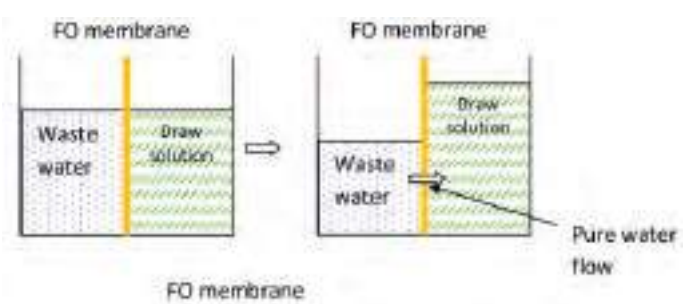
Reverse Electro Dialysis

Membrane Capacitive Deionization (MCDI): Membrane capacitive deionization (MCDI) cell compartment consists of two porous electrodes of commercial activated carbon fibre in parallel, wherein one is having anion–exchange membrane and the other is having cation–exchange membrane. Under an electric field between two porous electrodes, the cations and anions of water are removed by electrical migration. It is an energy–efficient and environment–friendly desalination technology. It is especially advantageous for treatment of low concentration salt solutions (lower than 5 g/L).



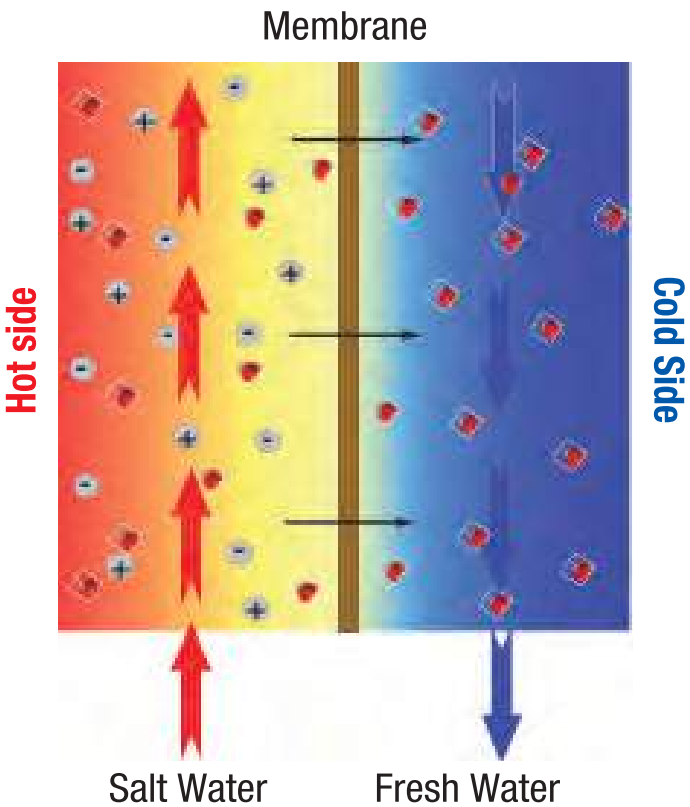
Membrane Capacitive Deionization

Forward osmosis (FO): Water molecules diffuse from the 'feed' (waste water) solution of higher chemical potential to a 'draw' solution of lower chemical potential. The driving force for mass transport across a semi–permeable membrane is coming from the difference in osmotic pressure between the 'feed' solution and a 'draw' solution, which is caused by the concentration of solutions. FO is one of the most promising emerging technologies for desalination and wastewater treatment operations. It also has the lowest environmental impacts among electrodialysis / reverse electrodialysis (ED/RED), and membrane distillation (MD).



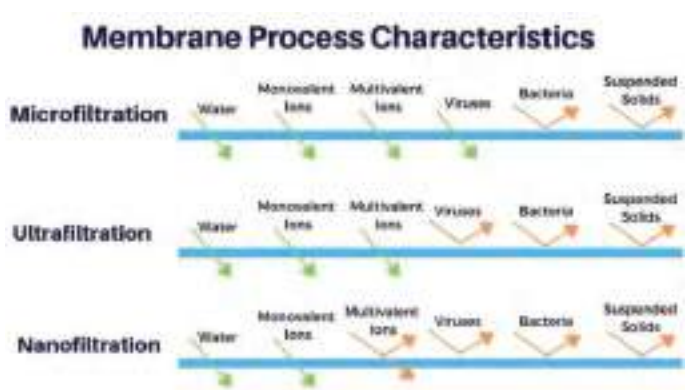
Forward Osmosis

Membrane Distillation (MD): Membrane distillation is a second–generation low–grade thermal separation technology having excellent performance for sea water desalination. The difference in vapor pressures caused by a temperature gradient across the membrane drives the diffusion of water vapor to the permeate side. Due to the membrane's hydrophobic properties, only the vapor can pass through its pores.



Membrane Distillation

Microfiltration (MF), Ultrafiltration (UF) & Nanofiltration (NF): These all are working on pressure – driven membrane technology. In this technique, pressure is used to drive water molecules across the semi–permeable membrane in a direction opposite to that they would naturally move due to osmotic pressure. A high–pressure pump raises the pressure of the feed water to the pressure appropriate for the semi–permeable membrane such that the osmotic pressure of feed water can be overcome. As a result, the water flows across the semi–permeable membrane in the reverse direction of the natural flow taking place during osmosis process. This leaves the dissolved salts behind with an increase in salt concentration of the feed water and passes pure water to the other side of the membrane.



Micro Ultra Nano Filtration

Microfiltration (MF): MF is widely used in concentrating, purifying or separating macromolecules, colloids and suspended particles from solution, therefore is a useful process in pre– and post–treatment in desalination process. The pore size of an MF membrane is in the range of 0.05 – 10 µm. It needs operating pressure below 2 bar.

Ultrafiltration (UF): This is useful for pre– and post–treatment of water. The pore size of UF membrane ranges from 10 to 50 nm, which falls between NF and MF. As the pore size is larger than RO and NF membranes, UF operating pressure is low and in the range of 2–5 bar.

Nanofiltration (NF): NF membranes cannot reduce saline water salinity to potable levels but they have been used to treat waters with salinities below 1000 mg/L, with high hardness levels, organic content and bivalent ions. Nanofiltration (NF) membrane has a pore size ranging from 1 to 10 nm and cut off ability between RO and ultrafiltration (UF).

Reverse Osmosis (RO): This is a key membrane technology in Desalination process, which is also based on pressure–driven membrane like MF, UF and NF. RO membranes have pore size of < 1 nm. Therefore, operating pressure of 60–70 bar is generally necessary for sea water. No heating or phase separation change is necessary in this process. However, pre–treatment of feed water is needed to eliminate undesirable constituents in the saline water, which would otherwise cause membrane fouling. As the water permeates through membrane, approximately 99.5% of the dissolved salts of feed water are removed and produces fresh water with minimal impurities. The concentrated stream from membrane – the Brine – is discharged after following guidelines to ensure minimal impact on ecosystem. The obtained water quality by RO process is relatively inferior (400 – 500 mg/L TDS) to thermal technologies (25 – 50 mg/L TDS). But RO water quality is generally acceptable for most agricultural, industrial, and human consumption applications.

The improvement in energy efficiency, more durable polymer membranes and pre–treatment steps have made RO a leading technology in desalination operations as, in many cases, RO is more economical than thermal methods. It also has high flexibility to work under different salinity conditions, takes up little space, and is easy to operate and automate.

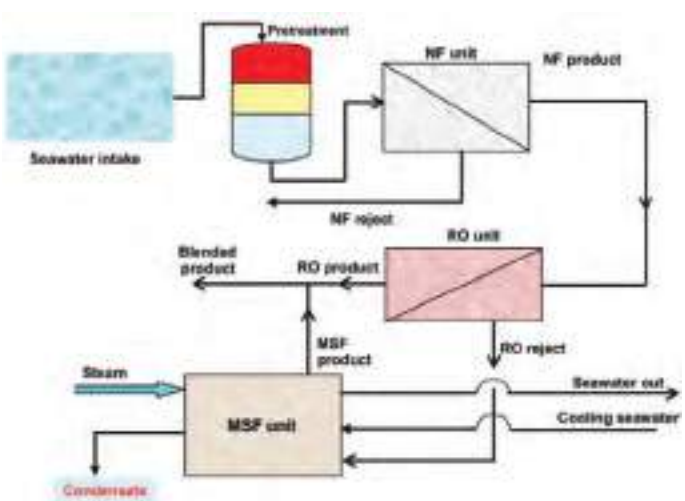
Reverse Osmosis principle

RO units are commercially available in varied sizes, from household applications with capacities of around 100 litres / day to around 1000 million litres / day (MLD) suitable for industrial and municipal use. This is currently the most reliable technology for saline water desalination at the lowest capital costs and lower energy consumption. It has, however, significant costs towards pre–treatment operations and membrane replacement. According to the water quality to be processed, RO operations are classified into brackish water plants (BWRO), with salinities between 500 and 10,000 mg/L and sea water plants (SWRO), with salt contents close to 30,000 mg/L. RO membranes have seen transformations from the initial asymmetric cellulose acetate (CA) membranes, followed by thin film composite (TFC) membrane, and now thin film nanocomposite membrane (TFN).

Advancements towards transfer of hydraulic energy from the brine to the feed water have reduced energy consumption of high–pressure pumps. Various other Energy Recovery Devices (ERD) have helped in significantly curtailing the costs of RO process.

Hybrid systems

Each of the membrane technologies employ different driving forces. They also have their own advantages and disadvantages. Therefore, hybridization of different membrane technologies can overcome limitations associated with the physical and economic nature of the separate processes. Adequate selection of the hybridization of different technologies leads to reduction in energy consumption and environmental impacts, increasing the efficiency of desalination processes.



Hybrid desalination plant

The hybridization of thermal systems with RO systems gained popularity rapidly due to their efficiency. MSF–RO & MED–RO hybridization is widely used in plants in the Middle East due to low fuel prices and establishment of thermoelectric plants, in which waste thermal energy and low–cost electricity are available. Hybridization of thermal desalination technologies with renewable energy sources is one of the trends in research and development.

FINANCIAL IMPLICATIONS OF DESALINATION

Main factors affecting the cost per M^3 of water include:

- Cost of energy,
- Scale of the plant, and
- Salt / TDS content of the source water
- Capital costs of construction

The operation cost of membrane desalination decreases sharply as the salt concentration decreases. Higher capacity plants have substantially lower costs. Costs, however, are very much site–specific and can vary widely.

SWRO plants of >10,000 M^3/day have been reported to cost in the range of 0.5 to 1.5 USD/M^3. Thermal methods of almost identical capacity plant could cost in range of 0.5 to 2 USD/M^3. Operating cost of BWRO plants of 10,000 to 50,000 M^3/day is reported to range from 0.25 to 0.5 USD/M^3, since TDS in feed water is drastically lower than saline water. The lower capacity BWRO plants (<1000 M^3/day) could cost from 0.75 to 1.25 USD/M^3. The operating cost indicated here are tentative and does not include cost of intake water, concentration discharge, capital and maintenance cost of plant and labour cost.

ADVANTAGES OF DESALINATION

- The front and foremost advantage of Desalination is that it can provide access to fresh water for potentially water stressed or arid areas since it helps converting abundant saline waters into fresh water of quality desired for various domestic and industrial applications.
- Desalination can help combating with reduced per–capita water availability due to short–term drought and longer–term climatic trends in parallel with population growth, land use change, and ground water depletion.
- Desalination can greatly aid to diversification of water supply and resilience to water quality degradation.
- Diversification of water supply can provide alternative or supplementary sources of water when current water resources are inadequate in quantity or quality.
- Desalination can also provide very pure water sources for industries like pharmaceuticals, if combined with post–treatment steps.

BARRIERS TO WATER DESALINATION

- The major barrier to current desalination processes includes costs, energy requirements and environmental impacts. The environmental impacts include disposal of the concentrated waste stream and the effects of intakes and outfalls on local ecosystems.
- The contribution towards increased greenhouse gas emissions could set back climate–change mitigation efforts.
- Brines are usually dispensed as discharges into surface and marine waters or in the sewage system causing change in salinity, pH, heavy metals levels in the marine environment. The brine also possesses other residual chemicals used in water pre–treatment

and post–treatment stages, such as anti–scalants, coagulants, flocculants, and halogenated disinfection by–products. All these chemicals have their own toxic effects on aquatic life.

- High salinity and brines generated increase the hydraulic pressure required to overcome the osmotic pressure difference between the feed and permeate in Desalination process. Energy cost, thus, becomes a major barrier.
- Scale formation of less–soluble salts on membranes calls for additional costs in RO systems.
- Other barriers include high fuel consumption, environmental impacts on air quality, abiotic depletion, acidification and eutrophication of waste receiving bodies, depletion of the ozone layer, photochemical oxidation and release of compounds toxic to humans and marine life.
- Precipitation of inorganic salts, accumulation of particulate material, and biofouling formation are the main causes of RO membrane fouling, increasing maintenance costs, making disinfection operations more difficult, and reducing their life time.
- Another major challenge with sea water reverse osmosis desalination (SWRO) is rejection of Boron, which is found relatively high in sea water. As Boron causes health problems in humans and plants, WHO recommends limit of 2.4 mg/L. Due to low retention of Boron by commercial RO membranes, Boron levels prescribed by WHO are sometimes not achieved, which necessitates post–treatment of the fresh water produced by RO, which can raise the cost of treatment by approximately 0.75 USD/M^3.
- Environmental impacts of the technologies used to fulfil energy requirement of RO system and noise pollution during operation and construction of RO plants are also barriers to use of this technology.
- To avoid brine disposal in sea, Saline solids are generated by evaporation of brine and used for sanitary landfills. Such activity can cause changes in land use and groundwater contamination due to leaching of ions.

OPPORTUNITIES & CAUTIONS

Desalination enables access to a nearly unlimited and stable water supply of water for households and industry. However, in view of various challenges and barriers, water desalination should not be considered a panacea of the water scarcity. In spite of the benefits offered by Desalination, it should remain the last resort, and should only be applied after having carefully considered cheaper alternatives in terms of supply and demand management. Wherever considered for implementation, desalination plants should be considered in water sectors that are functioning well, have well–defined water policy, well–characterized water resource availability, accurately estimated demand over a period of time, technical expertise, and relatively little waste and inefficiency.

The institutions, organizations and the governments must consider some very crucial and important points before pushing the efforts toward water desalination:

- It is essential to develop a clear water policy.
- An integrated water resources management (IWRM) approach should be followed to determine accurately the renewable freshwater resource potential, demand and consumption.
- Water desalination should be combined with other non–conventional efforts like reuse of treated wastewater, transportation of water across geographical boundaries, rainwater harvesting and creation of micro catchment areas.
- Conservation and water demand management should be considered in all sectors.
- Reduction of non–revenue water in piped systems, limited subsidies, and prevention of groundwater pollution should be effectively addressed.
- An abundant source of saline water and sustainable supply with low salt / TDS must be ensured prior to moving towards desalination.
- Should constantly strive for technological advances for reducing the economic and environmental impacts of desalination.
- Plant location should preferably be on a coastline with an adjacent facility for power availability for thermal desalination plants. The vicinity of a power plant can synergise the desalination since power plant yields abundant waste heat.
- Deployment of sustainable energy utilization and safe discharge methods should be ensured.

GLOBAL SCENARIO

Historically, Kuwait was the first country in the world to commission first distillation plant in 1951 to supply water for large–scale domestic use. As per estimate by International Desalination Association (IDA), there were almost 18,500 plants installed in around 150 countries to handle desalination of around 100 million M^3/day in the year 2017. The installed capacities have been raising year on year with ever–improving technologies. Currently, there are some 20,000 desalination plants in the world.

Approximately, 60% of the units take sea water as feed water, whereas almost 30% corresponds to brackish water. More than 60% use of Desalination technology is towards municipal purposes and around 30% for industrial use. Reverse osmosis (RO) is the dominant technology in membrane processes (70%), followed by multistage flash systems (18%) and multi–effect desalination (7%) of the installed capacity in large–scale desalination plants. Other membrane technologies such as Nano Filtration (NF) contributes 3% to desalination, while electrodialysis (ED) 2%, and reverse electrodialysis (EDR) 1%.

Almost half of the desalination plants are concentrated in The Middle East and North Africa, with North America having approximately 12% of the capacities. East Asia and the Pacific add up to approximately 18–20%. It is estimated that the world desalination market will grow at a speed of 9–10% in the coming years, most of which is likely to come from Europe, the Middle East, and Africa. In the Middle East, thermal desalination technologies continue to be overriding, due to their integration with power plants and useful life of more than 30 years.

From scale viewpoint, the large capacity plants are located in the Middle East.

- The Ras–Al–Khair plant of Saudi Arabia is considered to be one of the largest hybrid desalination plants of world. This 1036 MLD plant uses both MSF and RO technologies to produce fresh water and power in the tune of 2400 MW.
- Saudi Arabia's Shuaiba3 and JWAP plants handle 880 and 800 MLD water respectively.
- DEWA Station plant of UAE produces 636 MLD of potable water and is one of the largest power and desalination plants of UAE with a power capacity of >2800 MW.
- UAE's Fujairah plant has a capacity of 591 MLD, out of which 450 MLD is thermal plant and rest is RO plant. This plant produces 2000 MW power.
- While Ras–Al–Khair is the largest hybrid plants of the world, the Sorek plant of Israel is the largest membrane plant of the world, which handles 624 MLD water.
- Taweelah and Umm Al Quwain plants of UAE will be of 900 & 683 MLD capacities respectively.

It is believed that mega desalination plants in future will override Ras–Al–Khair plant, since Saudi Arabia is planning for a 1500 MLD plant. IDA believes that plants of such capacities will also come up in future in China, India and Abu Dhabi depending upon governments policies.

FUTURE RESEARCH AREAS & PROSPECTS

- Economies of RO desalination can be improved by use of renewable energy resources like Solar energy to facilitate direct evaporation and wind energy to supply electricity or mechanical power.
- Energy Recovery Devices for small–scale RO units can substantially save energy costs.
- The nuclear energy offers a higher energy density compared to other conventional and renewable energy sources.
- Desalination through carbon nanopores is a promising future technology for desalination.
- Ample research opportunities exist in new membranes development and hydrodynamics process to bring about solutions to some of the present technical problems.
- Other emerging technologies such as capacitive deionization, freezing, humidification – dehumidification, and use of gel hydrates for desalination have not reached enough maturity at this stage for extensive use. Promising future lies for these new age technologies.
- Development towards artificial intelligence can aid towards efficient design and management of desalination plants, increasing productivity, reducing errors, optimizing operating costs, and freeing human beings from carrying out repetitive tasks.
- Energy storage systems and automated decision–making for production based on real–time demand analysis holds high potential for the future of the desalination industry.
- Research towards achievement of Zero Liquid Discharge and Minimal Liquid Discharge will boost membrane desalination.
- Conversion of brines into valuable products will be crucial to reduce environmental impacts.

CONCLUSION

The population and economic growth, increased need of fresh water as well as deterioration of conventional water sources have put a great pressure towards fulfilment of good quality water for domestic and industrial consumptions. Therefore, Desalination of sea and brackish water has shown a significant increase in recent decades.

Among desalination technologies, RO is the most advanced technology due to its relatively low energy consumption, flexibility, ease of operation, economy of operation and high efficiency. On the other hand, membrane permeability loss, fouling, and requirement of high operating pressures for desalination of high salinity water are some of the technical limitations. RO desalination is a knowledge, technology, and energy intensive process. Brine disposal, noise pollution, impacts on the marine environment, and generation of GHGs are some of the environmental difficulties of this technology. However, advances in new membrane materials, improvements in high pressure pump efficiency, and development of energy recovery devices (ERD) have pushed implementation of RO process. A multidisciplinary vision and on–going research are crucial aspects for industrial implementation and future growth of water desalination technologies for a prospective and sustainable future.

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REDUCE THE TREATMENT COST IN RO BASED ZLD SYSTEM IN TEXTILE INDUSTRY BY INCORPORATING PRO–XS1 NF MEMBRANES

By Yasuhiro Tomi, Manikandan Vasudevan

> Reduce the operating cost of textile dyeing process by recycle and reuse the salt solution from waste water

The Problem

Textile manufacturing involves the production or conversion of textile fiber through a defined process which includes sizing, desizing, scouring, bleaching, mercerization, dyeing, printing, chemical finishing, etc. The wastewater from the textile processes contains high TSS, fibers, TDS, BOD, COD, Color, starch, alkalis, and bleaching compounds. Because of their composition and variability, industrial wastewater is some of the most challenging water to treat for reuse.

But in regions experiencing extreme water stress, industries that had previously performed minimal treatment before discharging their wastewater are now being forced to use membranes to reclaim and reuse 100% through a ZLD process. Depending on the type of textile being processed, effluent TDS can be in the range of 8,000ppm to 12,000ppm. COD levels can be in the range of 2,000 mg/l to 3,000 mg/l and BOD is in the range of 1000 to 2000 ppm and Sulphate is in the range of 3000 to 5000ppm.

Depending on the textile processing capacity, the effluent treatment plant capacity is in the range of 500KLD to 4KLD and Multiple small textile unit in one region send their effluent to a Common Effluent Treatment Plant or CETP. Total CETPs in Tirupur textile belt are treating 100 MLD of wastewater and achieving ZLD.

About Hydranautics

Since our founding in 1963, Hydranautics has been committed to the highest standards of technology research, product excellence and customer fulfillment. Hydranautics entered the Reverse Osmosis (RO) water treatment field in 1970 and is now one of the global leaders in Integrated Membrane Solutions. Hydranautics became a part of the Nitto Group in 1987. Nitto is Japan's leading diversified materials manufacturer. The group offers over 13,000 high value specialty products worldwide including optical films for liquid crystal displays, automotive materials, reverse osmosis membranes for desalination and transversal drug delivery patches.

As leaders of high quality membrane solutions, we believe our commitments extend beyond manufacturing and selling our products. Our skilled staff of technicians, engineers and service professionals assist in designing, operating and maintaining a robust, reliable and efficient membrane system to meet your requirements and exceed your expectations.

The wastewater entering a wastewater treatment plant will undergo numerous pretreatment steps before going to the multistage RO to reduce the TSS, Color, Hardness, COD and BOD. At a minimum, the wastewater will undergo primary clarification, biological treatment, clarification, chlorination, dechlorination, softening and ultra–filtration for suspended solids removal.

After the multistage RO and other membrane–based processes recover 85% to 90% of the waste water, the remaining 15% to 10% will be treated through an evaporator and crystallizer to convert to solids. Earlier the recovered solids from evaporator is disposed in secured land filling because of high colour and mixed salts and also the challenges in the evaporator operation are more maintenance and frequent shutdown due to more number of rotating equipment and heavy scaling and higher power consumption, so evaporator operating cost is expensive and more than 6 to 8 times higher than RO membrane operational cost.

Evaporators consumes 20–25 kWh of power per m^3 of water treated and crystallizers consumes 52–66 kWh of power per m^3, but reverse osmosis system consumes at 1.5 to 6.0 kWh/m^3. Unfortunately, the current technology for treating the last portion of the RO brine before the evaporator is limited, costly, and requires high maintenance. A more efficient Nano filtration process was incorporated before thermal process to separate the sulphate stream and reduce the load on the thermal process.

The Solution

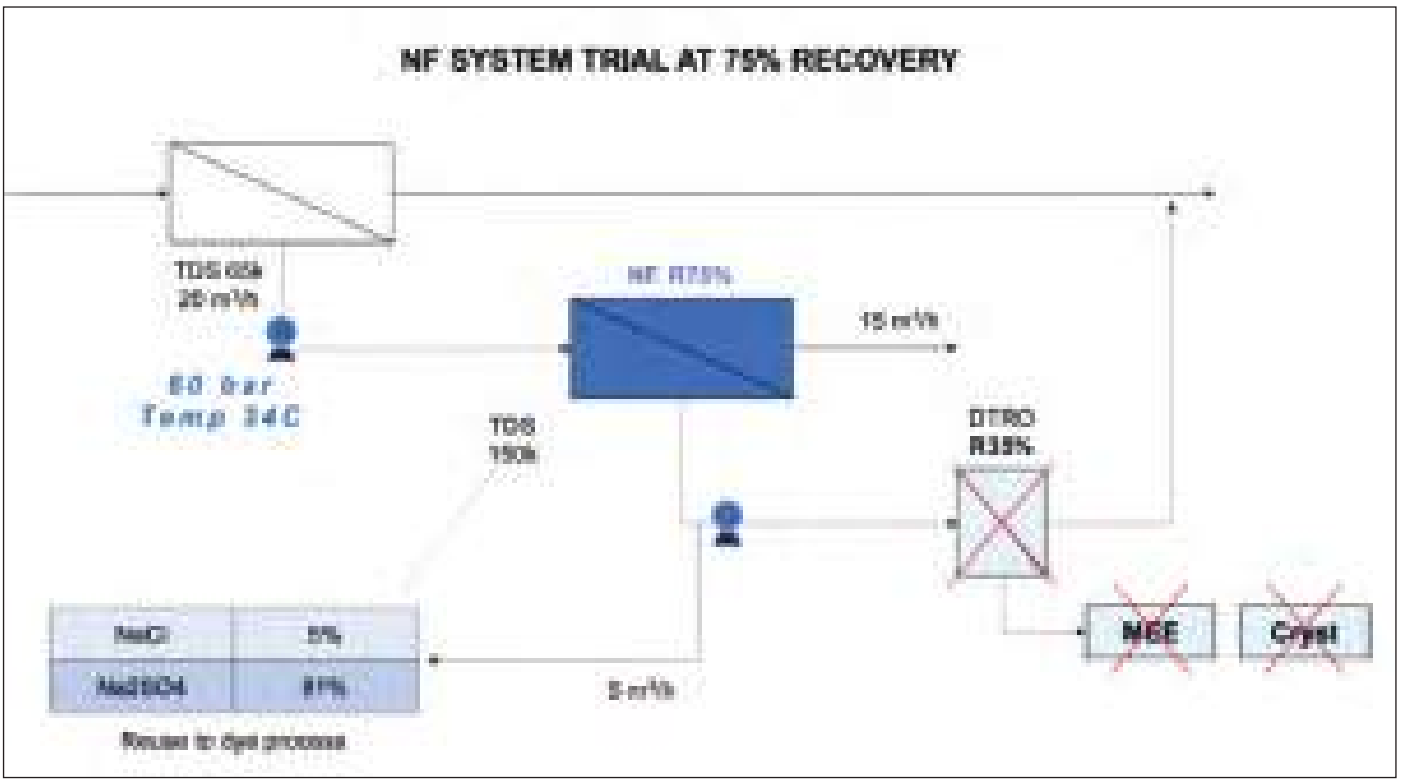
Multi–stage RO systems is concentrated the reject based on the limitation of maximum feed pressure and Salt saturation limit and fouling tendency. The existing systems is five stage RO system and concentrating the TDS to about 65,000 mg/l. RO reject contains 30000 mg/l of sulphate , 2500 PtCo of colour,2000 mg/l of COD and 150 mg/l of total hardness. To separate the sulphate for reuse in dying process, Hydranautics developed a new, Nano filtration membrane, PRO–XS1, that can operate up to 82.7 bar (1200 psi) at 25 C. This allows to concentrate the TDS up to 150,000 mg/l or higher.

To demonstrate the feasibility of this new Nano filtration membrane PRO–XS1 for study the maximum possible separate the sulphate salt solution from existing RO reject in the textile processing unit, Hydranautics proposed to replace the RO membrane to NF membrane(PRO–XS1) in 5th stage RO for avoid the capital cost and conduct the study. 5th Stage RO plant is having five elements long 3 vessels with 20m^3/h feed capacity of plunger pump system which was used to conduct the trial of PRO–XS1.

Study done using 15 Nos PRO–XS1 NF membranes installed in three pressure vessels in parallel.

This plant operated continuously at 50% recovery because of single stage system and achieved 95,000mg/l of TDS in the NF reject which is more that 95% of sulphate salt contribution. The Dying process is required 140,000mg/l solution for better colour absorption, so partially treated in MEE to increase the concentration as per the dying process requirement and reduced the treatment cost around 20% of earlier treatment cost.

Arranged the reject recirculation line to demonstrate to operate at 75% recovery. 65,000 mg/l of TDS of RO reject water concentrated to 1,57,000 mg/l of TDS at 75% recovery and recommended to install second stage of NF system for continuous operation to save 85% of exiting treatment cost by reduce the evaporator operational hours, reuse the salt solution and avoid the raw material cost of buying Globar salt. The existing 5th stage RO system was converted to a nanofiltration



system which operated at a feed flow of 20 m^3/h, a flux of 19 LMH and a recovery of 50%. An additional vessel was added to reduce the flux to 13 LMH to minimize the fouling from organics and TSS. The Customer is planning to further increase the capacity to 40 m^3/h using two more stages of PRO–XS1.

Parameter	Feed (ppm)	Perm. (ppm)	Conc. (ppm)
TDS	65,500	22,200	157,000
TH	140	8	560
Cl	8,933	9,926	4,963
SO4	31,860	2,400	96 g/l
COD	2,620	400	9,600

The Impact

After existing multi–stage RO, incorporated the NF system, so we can further reduce the flow to the evaporator and crystallizer by 50% to 80% because only NF permeate can be treated in the thermal process, so the corresponding reduction in the size of the evaporator/crystallizer will reduce both capital cost and operating costs. Assuming the thermal, originally designed to treat 10 m^3/hr were reduced in capacity by 50% to treat only 5 m^3/hr.

Assuming evaporator operational cost is INR 350/m^3; operating 300 days/year; 20 hours/day, the total operational cost would be INR 21,000,000/year for 10 m^3/h flow rate evaporator system. Assume that NF recovery is 50%, then saving will be maximum 50% from the total evaporator operational cost by using PRO–XS1 NF membrane which is INR 10,500,000/year. PRO–XS1 NF plant operational cost is INR 35~45/m^3, so additional cost for operating NF system would be INR 2,700,000/year, So total saving is INR 7,800,000/year which is less than one year of return of investment and apart from that solid disposal cost is saved and raw material cost also saved.

Treating and reclaiming textile wastewater is both challenging and costly, especially when seeking to achieve zero liquid discharge (ZLD). The overall cost of textile processing was reduced at one plant by installing the innovative, PRO–XS1, membrane after a multistage RO to recover raw material from the textile waste water. By using PRO–XS1, the customer was able to separate the sulphate salt solution and further concentrate the solution to a level that meets the dying process requirements. Using PRO–XS1 also reduced the waste stream flow to the evaporator and crystallizer. At the same time, a colorless sodium chloride solution was recovered from the PRO–XS1 permeate and sold as a valuable byproduct. This study successfully achieved 157,000 mg/l of TDS in the PRO–XS1 reject while operating at a maximum feed pressure of 60 bar at 34C. Pretreatment before the NF was crucial for reducing fouling. The use of the PRO–XS1 in the ZLD process reduced the total water cost at the 2 MLD textile plant by $107,000 per year. The PRO–XS1, with its ability to run at pressures up to 83 bar, can be used on any high sulphate stream to increase the salt concentration and reduce treatment cost.

THE UNSEEN CHALLENGE OF NON-REVENUE WATER AND HOW LIQUICLEAR IS CHANGING THE GAME

Introduction

The term Non-Revenue Water (NRW) has increasingly become a subject of concern for water utility companies and policy-makers alike. NRW is the water that is lost before it reaches the end-users, resulting from leaks, theft, or meter inaccuracies. These losses are not just a financial drain; they represent a critical sustainability challenge. As the industry seeks solutions to reduce NRW, technologies like Liquiclear's LDI and LDISF water softening systems are playing an ever more essential role. This article explores how these technologies offer a balanced approach to water treatment, focusing on both efficiency and sustainability- critical factors in reducing NRW.

The Many Facets of Non-Revenue Water

NRW comprises three key areas: real losses, apparent losses, and unbilled authorized consumption. Real losses occur due to leaks, ruptures, and overflows. Apparent losses are a result of theft or meter inaccuracies. Unbilled authorized consumption, while not a 'loss', consists of water that is provided for free for public services. Each type of loss requires targeted solutions for effective reduction.

Traditional Responses: Not Enough

Traditional methods for reducing NRW often involve significant investment in infrastructure upgrades and tighter regulatory controls. However, these approaches are not only expensive but also require a long lead time to show significant results. Furthermore, they do not tackle the problem at its root, instead offering only symptomatic relief.

LDI: An Efficient and Sustainable Solution

What sets Liquiclear's LDI technology apart is its capacity to drastically reduce water wastage—by 80% compared to Reverse Osmosis (RO) systems. This is a quantum leap in efficiency and directly addresses the issue of real losses in the NRW equation. Its technology ensures that nearly every drop of water processed is usable, hence reducing the amount of water that needs to be produced in the first place.

LDISF: The Next Step in Water Softening

Beyond LDI, Liquiclear also offers its fully automatic LDISF system for water softening. Traditional water softening methods often result in high levels of water wastage due to the need for regular backwashing and regeneration cycles, not to mention the use of salts and resins. LDISF's groundbreaking approach eliminates these inefficiencies. It's a plug-and-play system that requires minimal user intervention, allowing for more precise control and less waste.

Low-Maintenance, High Impact

What adds another layer of efficiency to Liquiclear's offerings is their exceptionally low maintenance requirements. Traditional water treatment methods require frequent membrane replacements, not only incurring extra costs but also contributing to apparent losses due to service disruptions. Liquiclear's membrane-free nature and minimalistic design translate to higher reliability and lower operational costs over time, which is a win-win for utility companies and consumers alike.

Sustainability at its Core

Moreover, Liquiclear's systems are designed with a sustainability-first approach. Not only do they conserve water, but they also function with minimal energy requirements, contributing to reduced carbon footprints and positioning Liquiclear as a leader in environmentally friendly water treatment solutions.

Conclusion

Addressing the multifaceted challenge of Non-Revenue Water requires not just innovation but a paradigm shift in how we approach water management. Liquiclear's LDI and LDISF systems offer this new perspective: they are part of a comprehensive solution focusing on both efficiency and sustainability.

By aligning innovation with customer needs and environmental stewardship, Liquiclear's solutions are well-positioned to lead the industry in tackling the issue of Non-Revenue Water, presenting an option that is not just beneficial to the bottom line but is also integral to a sustainable future for water management.

NSF Certifies Indofil as the First Client in India to NSF Guideline 533

CONTACT: Stina Liang – media@nsf.org

New Delhi, India (September 11, 2023) – NSF, the leading testing and certification organization in the water industry, announced today that Indofil Industries Limited, a research–led and fully integrated Chemical Company, has earned certification to NSF Guideline 533 for its KM40, KM355S, KM455 and KM455L impact modifier products. With this, Indofil Industries Limited becomes NSF's first client in India to receive this certification and the first client globally to have an impact modifier certified to NSF Guideline 533. This certification demonstrates that their ingredients have been evaluated for health effects and are safe for use in drinking water products.

Founded in 1962, Indofil Industries Limited is headquartered in Mumbai. It has a diverse portfolio, offering products in industries including: leathers, coatings, textiles and plastics chemicals/additives. Indofil operates its facility in Dahej, Gujarat, providing a comprehensive range of products, including acrylic impact modifiers, acrylic processing aids, and medium to high molecular weight acrylic processing aids.

"We are honored to be the first company to earn this certification in India. Utilizing the highly respected NSF mark will increase our competitiveness in the worldwide market and demonstrate our commitment to quality and safe drinking water," said Dr. Atchutuni Rao, Director at Indofil.

Launched in January 2023, NSF Guideline 533 covers ingredients such as resins, stabilizers, carbon black, lubricants, solvents, and colorants used in CPVC, PE, Nylon, and other materials. It expands NSF's certification offerings to include ingredients used in drinking water products further strengthening NSF's commitment to addressing the safety and quality of drinking water products.

Certified ingredient manufacturers can use the dedicated NSF mark to demonstrate that their product meets the NSF Guideline 533 requirements as reviewed by a third party.

"We are proud to certify Indofil as the first client to the NSF 533 guideline in India," said Jyoti Bhasin, Managing Director of APAC and ME, at NSF. "This simple process saves ingredient manufacturers time and money. Ingredient manufacturers who earn NSF Guideline 533 certification can earn more recognition with drinking water product manufacturers worldwide by having their ingredients listed on NSF's official website. We anticipate more ingredient suppliers will follow suit in manufacturing safer ingredients."

For more information on obtaining NSF Guideline 533 certification for your ingredients, please visit the NSF website (www.nsf.org).

About NSF

NSF is an independent, global services organization dedicated to improving human and planet health by facilitating standards development and providing world–class testing, inspection, certification, advisory services, and digital solutions to the food, water, health sciences, and consumer goods industries. NSF operates in 180 countries and is a World Health Organization (WHO) Collaborating Center on Food Safety, Water Quality, and Medical Device Safety.

NSF's Water Division provides risk assessments, testing, inspection, and certification services for the water industry from source to tap. NSF facilitated the development of the American National Standards for all materials and products that treat or come in contact with drinking water to help protect public health and the environment and minimize adverse health effects. In 1990, the U.S. EPA replaced its own drinking water product advisory program with these NSF standards.

About Indofil Industries Limited

INDOFIL INDUSTRIES LIMITED, established almost six decades ago, headquartered in Mumbai, is a research–led and fully integrated Chemical Company and has emerged as a successful and vibrant enterprise, riding high on a simple philosophy of retaining loyalty and enlarging the fold of satisfied customers.

Operating from its state–of–the–art facility in Dahej, Gujarat, the company offers a comprehensive range of products including Acrylic Impact Modifiers, Acrylic Processing Aids, and medium to high Molecular Weight Acrylic Processing Aids. These additives play a vital role in both rigid and flexible PVC applications, encompassing diverse uses such as window and door profiles, pipe and fittings, medical compounding, and wood–plastic composites.

The vision of INDOFIL is equally simple – to focus on specific opportunities, drive growth and enhance value for esteemed customers. It has a highly skilled and successful sales team that believes in learning and working with the customers as partners – thus developing the products and services around core issues, to meet their future needs.

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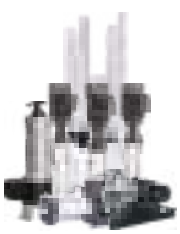

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Hon'ble Chief Minister of Tamil Nadu

Thiru M. K. Stalin

laid the Foundation Stone for Southeast Asia's Largest Desalination Plant

The 400 MLD Desalination plant to be executed by the Joint Venture comprising VA TECH WABAG and Metito

August 21, 2023: As a momentous stride towards enhancing water security and ensuring a steadfast supply of clean drinking water for the people of Chennai, Hon'ble Chief Minister of Tamil Nadu Thiru M. K. Stalin, laid the foundation stone for the 400 MLD Perur SWRO Desalination Plant. The event was attended by distinguished guests including Thiru. K. N. Nehru, Hon'ble Minister for Municipal Administration, Urban and Water Supply, Thiru Shiv Das Meena, I.A.S., Chief Secretary, Government of Tamil Nadu, Thiru D. Karthikeyan, I.A.S., Principal Secretary – Municipal Administration, Urban and Water Supply, Thiru R. Kirlosh Kumar, I.A.S., Managing Director, CMWSSB, Mr Rajiv Mittal, Chairman & Managing Director – VA Tech WABAG Limited, Mr Philip Johnson, Metito Projects Director, and other dignitaries from Govt. of Tamil Nadu, CMWSSB, JICA, WABAG, Metito and Project Consultants. This ground–breaking event emphasizes the resolute commitment of the Government of Tamil Nadu under the visionary leadership of the Chief Minister towards ensuring water security for Chennai.

The project marks a collaborative effort between the Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) and a joint venture led by VA TECH WABAG (WABAG) and Metito Overseas Limited (Metito) and Japan International Cooperation Agency (JICA).

The Design, Build, Operate (DBO) project includes the entire spectrum of project development – from design and engineering to procurement, construction, installation, testing, and commissioning. Post successful completion WABAG will be responsible for 20 years of Operation and Maintenance (O&M).

The cutting–edge desalination process includes Lamella Clarifiers, Dissolved Air Flotation System, Gravity Dual Media Filters, Reverse Osmosis, and Re–mineralization. The state–of–the–plant will produce 400 million liters of potable drinking water every day, which will subsequently be distributed to the residents of South Chennai by CMWSSB.

Commenting on this monumental achievement, Mr. Rajiv Mittal,

Chairman and Managing Director, VA Tech WABAG, Said, "We are glad to be part of the Govt. of Tamil Nadu's sustainable initiatives for ensuring water security for Chennai City through using innovative water solutions. With completion of the project, Chennai will emerge as the Desalination Capital of India, with producing over 750 million liters of desalinated water every day out of which WABAG's contribution will rise to an impressive 70%. The 400 MLD SWRO Desalination Plant will stand as a testament to ingenuity, innovation, and a shared vision for a more sustainable and resilient future for the city and the state. The undertaking of this project underscores WABAG's dominant position in the global desalination market."

Highlighting the importance of the project, Fady Juez, Metito Managing Director said, "It's an honor to develop this landmark desalination project alongside our partner WABAG in India. The world is facing significant water scarcity issues, and the need for climate resilient, sustainable water infrastructure is critical. India in particular is a region of high stress due to various factors and securing 400 million liters of desalinated water daily, is inherently aligned with our founding principles of Impact, Sustainability, Innovation. The Indian Government has been promoting various adaptation and preservation strategies to manage water resources more effectively and this project promoted by CMWSSB in cooperation with JICA will be a benchmark project for, Chennai, India, and the entire Southeast Asia water scene. We look forward to applying our high value engineering and integrating the latest technologies to ensure optimum performance and world–class quality output."

About WABAG:

WABAG is a global leader in the water industry backed by rich experience spanning over 99 years. Being a pure–play water technology multinational, WABAG offers a complete range of technologies and services for Total Water Solutions in both Municipal and Industrial sectors. With over 1,600 water professionals, spread over 25 countries in 4 continents, WABAG is touching millions of lives every day. WABAG has built over 1,400 municipal and industrial plants in various geographies across the globe over the last 3 decades, with customized solutions matching to its customers' needs. WABAG is a complete life–cycle partner for building water and wastewater infrastructure covering Design, Engineering, Supply, Construction, Installation, Start up and Long–term Operational Management across various business models. With passion for innovation, WABAG is continuing its Research and Development initiatives from dedicated R&D centers located in Europe and India, and possesses over 125 IP Rights. WABAG's vision is aligned to the UNSDGs and ESG with special focus on conservation, optimization, recycling and reuse of resources, directed at addressing water challenges across the world. WABAG is thus one of the world's leading partners for investments in a future that is worth living.

For Further information, please contact: Mr. Nilamani Satapathy, Corporate Communication
VA TECH WABAG LIMITED I Tel: +91 44 6123 2949 I Email: Nilamani_Satapathy@wabag.in

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3rd September 2023, Sun, 12–10 am
Venue: Olcott Memorial Higher Secondary School, New No.2, (Old, 28, Besant Ave Rd, Besant Nagar
Chennai, Tamil Nadu.
https://ipaneerathon.com/

Desalination & Industrial Water Management
12th–13th September 2023
Venue: Le Meridien New Delhi, Le Meridien, Windsor Pl, Connaught Place
New Delhi, Delhi

Water Expo – Hyderabad 2023
21st–23rd September 2023
Venue: HITEX Exhibition Center, at Khanammet, Hyderabad, Telangana

IPA Neerathon 2023 – Ahmedabad
5th October 2023, Sun, 5 am
Venue: Sabarmati River Front, Event Centre Block A, Ahmedabad
https://www.townscript.com/e/ipaneerathonahmedabad

Renewable Energy India Expo
4th – 6th October, 2023
Venue: Greater Noida, India
https://renewableenergyindiaexpo.com/

IFAT India
17th–19th October 2023
Venue: BEC Mumbai, Bombay Exhibition Centre, NESCO, Goregaon
Mumbai, Maharashtra
https://www.ifat-india.com/

India Water Week
10th–14th October 2023
Venue: Vigyan Bhavan, Maulana Azad Rd, Rajpath Area, Central Secretariat
New Delhi, Delhi

Waptema Water Expo – Lucknow
7th–8th November 2023
Venue: Indira Gandhi Pratishthan, Kathauta Chauraha Rd, Vibhuti Khand, Gomti Nagar
Lucknow, Uttar Pradesh
https://waptema.in/

Water Expo – Bengaluru
22nd–24th November 2023
Venue: BIEC Bengaluru International Exhibition Centre, Bengaluru, India
https://10times.com/water-today-s-water-expo-bengaluru

India Water Expo 2023
Wed 20th–22nd December 2023
Venue: Chennai Trade Centre, Ramapuram, Nandambakkam, Tamil Nadu

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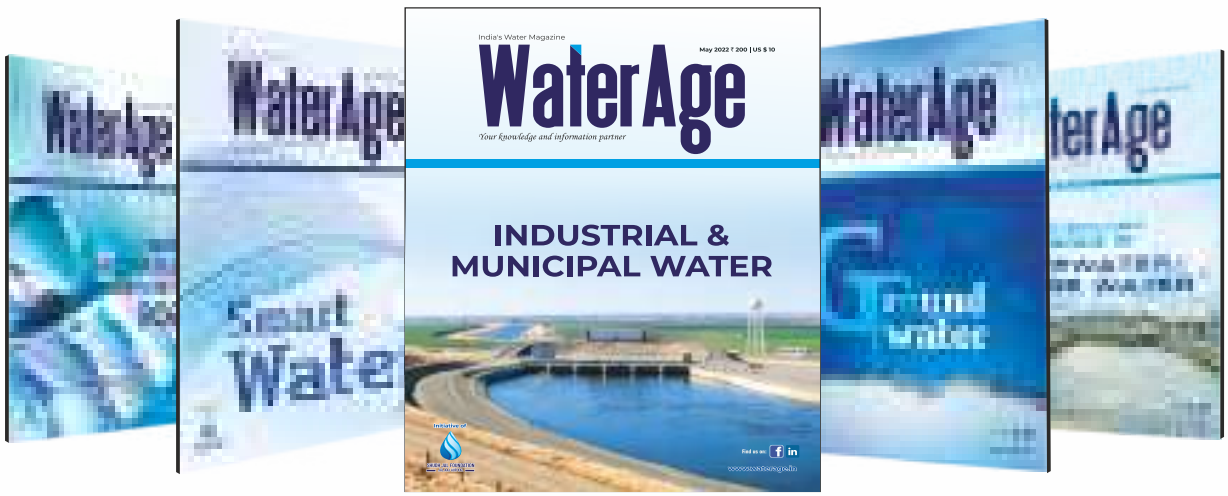

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J al J eevan Mission – Kasaragod district–W SS to Trikaripur and adjoining Panchayaths Construction of I ntake well cum pump house, substation, 35.0 MLD wate r tre atme nt plant, Supplying and laying pumping main and allied works.

Tender Bid Submission Date:
23 September 2023

TID:64047676 I Kerala, India
Approx value: INR 26.44 Cr
Kerala Water Authority

J J M PHASE 2– 2021–22 W SS to Desamangalam, Varavoor, Erumapetty, Kadangode, Velur, Choondal, Kandanassery Panchayath– Construction of 40mld Wate r Tre atme nt Plant– General Civil Work

Tender Bid Submission Date:
18 September 2023

TID:64164823 I Gujarat, India
Approx value: INR 13.13 Cr
Ahmedabad Municipal Corporation

Operation and Comprehensive Maintenance of 850 MLD (650 MLD+ 200 MLD) Wate Treatment Plant at Kotarpur for 36 Months.

Tender Bid Submission Date:
25 September 2023

TID:63991974 I Tamil nadu, India
Approx value: INR 8.78 Cr
Ramanathapuram Municipality

Construction of Additional Drinking Water Treatment Plant in Summer Storage Reservoir in Palani Municipality

Tender Bid Submission Date:
29 September 2023

TID:64164843 I Gujarat, India
Approx value :INR 6.94 Cr
Ahmedabad Municipal Corporation

Operation and Comprehensive Maintenance of 400 MLD Capacity Jaspur Wate Treatment Plant for 36 Months.

Tender Bid Submission Date:
25 September 2023

TID:64342050 I West bengal, India
Approx value :INR 24.30 Lac
Zilla Parishad

Drainage for transportation of waste wate r from a group of villages to a common treatment unit by Construction of changing room, community hall, passenger waiting shed as part of river development within Ganga riparian Nowpara Masunda GP Ranaghat–I.

Tender Bid Submission Date:
27 September 2023

TID:60215263 I Delhi, India
Delhi Jal Board

Design, Construction, I nstallation, Testing, Commissioning, Trial Run, DLP and Operation and Maintenance of 15 MGD (68.10 MLD) Waste wate r treatment Plant, Sewage Pumping Stations at Hiranki and Zindpur, allied Rising mains and Treated Effluent line a.

Tender Bid Submission Date:
03 October 2023

TID:63546609 I Haryana, India
Rail India Technical And Economics Service Limited

Engagement of I ndividuals and / or Firms for Providing Services of Experts in the fields of Solid Waste, Used Waste water, Procurement and Design and Standard Specifications.

Tender Bid Submission Date:
31 March 2024

TID:63412409 I West bengal, India
Kolkata Metropolitan Development Authority

Development of I and D Network and STP with Waste wate r Treatment Facility on a DBOT Model for Chakdah Municipal Area in Nadia District, West Bengal with 15 Years Operation and Maintenance Period under Namami Gange Programme.

Tender Bid Submission Date:
22 September 2023

TID:64346781 I Uttar pradesh, India I

Department Of Empowerment of Persons With Disabilities Supply of Bio Culture for waste wate r treatment (Q3) Qty: 70

Tender Bid Submission Date:
23 September 2023

TID:64340899 I Gujarat, India I Approx value :INR 840.00 Cr
Ahmedabad Municipal Corporation

Design, Build and Operation of new 375 MLD se wage tre atme nt plant and upgradation of the allied infrastructure including three terminal sewage pump station/s with operation and maintenance for 10 years

Tender Bid Submission Date:
31 October 2023

TID:64425988 I Gujarat, India I Approx value :INR 840.00 Cr
Ahmedabad Municipal Corporation

Design Build and Operation of new 375 MLD se wage tre atme nt plant and upgradation of the allied infrastructure including three terminal sewage pump station/s with operation and maintenance for 10 years at Vasna for the city of Ahmedabad Gujarat

Tender Bid Submission Date:
31 October 2023

TID:64086196 I Gujarat, India
Approx value: INR 141.72 Cr
Baroda Mahanagar Seva Sadan

Engineering, Procurement and Construction of New 100 MLD Se wage Tre atme nt Plant at Sherkhi (W ith 10 years O&M).

Tender Bid Submission Date:
18 October 2023

TID:64292090 I Karnataka, India I
Approx value :INR 36.02 Cr
Bangalore Water Supply And Sewerage Board

Work of Design, Engineering, Construction and Commissioning of 10 MLD Capacity Sewage Treatment Plant and Pumping Main at Smv Layout Ramasandra Upstream of Kommagatta. Work of Construction of 11.5 Ml RCC GLR.

Tender Bid Submission Date:
13 October 2023

TID:63432591 I Tripura, India I Approx value : 25.61 Cr
Urban Planning And Development
Design Build Operate of Se wage Tre atme nt Plants along with Co treatment of used water and Septage with 5 years of Operation and Maintenance in three towns Udaipur Belonia and Melaghar of Tripura 2nd Call

Tender Bid Submission Date:
22 September 2023

TID:64253893 I Jharkhand, India I Approx value :INR 4.28 Cr
Nagar Palika Parishad
Construction & Commissioning of Fecal Sludge Tre atme nt Plant of Capacity 15 Kld at Bishrampur Town (Jharkhand) Followed By Operation and Maintenance I ncluding Desludging Operations for 5 Years.

Tender Bid Submission Date:
18 September 2023

TID:64285759 I Jharkhand, India I Approx value :INR 4.28 Cr
Urban Development And Housing Department
Construction & Commissioning of Fecal Sludge Tre atme nt Plant of Capacity 15 KLD at Bishrampur town (J harkhand) followed by Operation and Maintenance including desludging operations for 5 years.
Tender Bid Submission Date:
20 September 2023

TID:63593004 I West bengal, India Kolkata Metropolitan Development Authority
Survey, design, drawing, construction, testing, commissioning with 5 (five) Years of Operation & maintenance of Fecal Sludge Tre atme nt Plant (FSTP) of Capacity 50 KLD at Burdwan Municipal Town for Pollution Abatement of River ganga.
Tender Bid Submission Date:
29 September 2023

TID:63820819 I West bengal, India Kolkata Metropolitan Development Authority
Survey, Design, Drawing, Construction, Testing, Commissioning with 5 (Five) Years of Operation & Maintenance of Fecal Sludge Tre atme nt Plant (FSTP) of Capacity 50 KLD at Burdwan Municipal Town for Pollution Abatement of River Ganga (4th Call). (520)
Tender Bid Submission Date:
29 September 2023

TID:63682941 I West bengal, India Kolkata Metropolitan Development Authority
Survey, Design, Drawing, Construction, Testing, Commissioning with 5 (Five) Years of Operation and Maintenance of Fecal Sludge Tre atme nt Plant (FSTP) of Capacity 50 KLD at Burdwan Municipal Town for Pollution Abatement of River Ganga (4th Call).
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