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EAW EVERYTHING ABOUT WATER

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INDUSTRY LEADERS SHARE THEIR VIEWS

ON THE NEED FOR ADOPTING THE THREE R'S (REDUCE, RECYCLE AND REUSE)

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ACT NOW BEFORE IT GETS TOO LATE

Team Everything About Water

If we continue to use water, the way we do now, it will run out soon. To avoid such a scenario, adopt the three R's (reduce, recycle and reuse). Prominent leaders, from the industry, share their views on the matter.

Around 40-45 years when piped water supply to individual homes, more so in smaller centres, was not the general practice, water for domestic consumption, was collected from municipal taps, placed at strategic locations in the colony. The only tool/mechanism employed to clean the water, coming from the tap, at max was a thin cloth. At times the water so collected was boiled and cooled before being consumed and it was fine in those times.

Even 30-35 years ago, water collected for drinking purposes was largely from municipal taps that were present, at strategic locations, in the housing colonies, more so in smaller centres. At times, water was even collected from functional wells that were along the road.

In an interaction, the managing director and chief operating officer of a private bank, in India, had stated that personal finance is of interest of everyone but very few want to talk about it.

Of the four instances mentioned above, the first three, seem to belong to a different era. They speak of a time when drinking water was not sold in bottles, as it is today, and was freely available. The fourth instance mentioned above, to a great extent, is relate able to water as well. All of us use it, and that too on a daily basis, but how many of us talk about it, or even think about its state. The only times we do speak about water, is when the water coming from our taps, is dirty, or when the water supply gets hit. Irrespective of, in which season, anyone comes to our house or office, among the first things we ask the individual, is water. Isn't "would you like to have some water," among the first things we ask anyone who pays us a visit, irrespective of whether we know the person or not. That's the importance we give to water, in our lives and proudly call, the act of offering water, an act of kindness, in our culture. But how much importance do we give to water or care about it? That's something we need to give a serious thought to, and a long hard one at that.

Which sectors use the most water? Before dwelling into how we treat, water, a resource mother nature bestowed us with, it needs to seen, which sectors are the major consumers of water, more so, in India. According to a Press Information Bureau release, issued in 2013 around 78% of the total water reserve in India is used by the agriculture sector, followed by the domestic sector (6%) and the industry (5%). Even in a statement released in 2021, it was estimated that 85-90% of the available water was used by the agriculture sector. What needs to be seen that the biggest consumers of water, in India, are the agriculture sector and the domestic sector, which are largely unregulated.

The most abused natural resource. Of all the natural resources, that we can touch, feel and see, water and that too usable water would certainly be one of those that we abuse the most. At most times we take it for granted. Considering that the domestic sector is the largest consumer of water, after the agriculture sector, how many times have we as individuals made the effort to rectify a leaking tap? Or how many times have we turned the tap off either while shaving or brushing our teeth? Its only at times when water supply, at our homes, gets hit, do we get a faint idea of what life would be without water. There have been many instances, that too in the national capital, where residents, of a particular area, have staged demonstrations or even blocked roads when water supply in their area was hit for a few days. However, that anger and frustration, overflows only till the crisis exists and cools down when supply is restored. Infact it is only when common citizens are debarred from use of a resource, that they are used to, that their anger overflows. The situation is very different for the industry, which is the third largest consumer of water, in India,

WATER FACTS

1. Per capita water storage capacity in India is 225 cubic metre compared to 1200 cubic metre in China.
2. More than 60 percent of India's irrigated agriculture and 85 percent of drinking water supply is dependent on groundwater.
3. Effects of climate change like glacier melt, flooding and so on could affect India's difficult hydrology

Source: World Bank

after the agriculture and household sector.

The regulated sector. The third largest consumer of water, i.e. the industrial, sector, is governed by a number of rules and laws that speak on how they should treat the water that they discharge, after using it. A look at some of the provisions of law that deal with the manner in which the industry needs to treat wastewater, before discharging it.

As per the Environment (Protection) Act, 1986 and the Water (Prevention & Control of Pollution), Act 1974, industrial units are required to install effluent treatment plants (ETPs) and treat their effluents to comply with stipulated environmental standards before discharging them into river and water bodies. Accordingly, the Central Pollution Control Board (CPCB), State Pollution Control Boards/Pollution Control Committees monitor industries with respect to effluent discharge standards and take action for non-compliance under provisions of these Acts. Further, in compliance of the orders of National Green Tribunal (NGT) in Original Application No.673/2018 regarding rejuvenation of polluted river stretches in the country, States/UTs are required to implement approved action plans, including installation of wastewater treatment plants, for restoration of the polluted stretches in their jurisdiction as identified by CPCB and published in their report of 2018, within the stipulated timelines. As per the orders of NGT, regular review on implementation of action plans is undertaken in the States/UTs and also at Central level.

The role of the Government. Over the years, the Government, by way of formulating laws, has tried to lay down guidelines, largely for the industry, to control pollution of water resources. For the common man the Government does come up with plans to boost water resources, in the country, and also to create awareness about water. Some of the progarmmes run by the Ministry of Jal Shakti, largely to augment and conserve water are the Atal Bhujal Yojana and the Pradhan Mantri Krishi Sinchayee Yojayana. The Ministry of Jal Shakti took a nationwide campaign - "Jal Shakti Abhiyan-Catch the Rain" - with the theme *"Catch the rain, where it falls, when it falls"* to create water harvesting techniques across the country, that too with active participation, from the people. The campaign was launched by Mr Narendra Modi, Prime Minister of India, on 22 March 2021, on World Water Day. Among other things the programme focused on creating new and maintenance of old rainwater harvesting structures, revival of traditional rainwater harvesting structures like stepwells and so on.

But why are we focusing on adopting the three R's and that too now. A 2019 NITI Aayog report had stated that India is suffering from its worst water crisis in its history. The report further stated that almost 600 million of its people are deprived of water. It further added that 21 cities, which included the big cities like Bangalore, Delhi, Hyderabad and Chennai would have probably exhausted their groundwater resources in 2020. Well that did not happen, but the situation is grim. The reason for picking up this topic and dwelling on the importance of adopting the three R's is to create awareness about the topic so that we can conserve this bounty that mother nature has given us and be in a position to pass it on to the next generation.

We put forth a list of questions to leaders from the industry and let them share their views on the matter. We bring them to you on our 22nd Anniversary edition. Read on and please do get back with suggestions. Industry leaders who decided to share their views on the atter are as follows: **Anand Iyer, Country Manager, Forbes Marshall; Amit Vaidya, Director, India - Metrology Business, Xylem; Rangarajan Ramaswamy, Area Sales Director, Water Utility segment, Grundfos India; Dr Anil Kumar Mishra, Bacteriologist Quality Control Laboratory, Delhi Jal Board, Govt. of NCT Delhi; Dharmendra Pratap Singh, Head of Infrastructure Solutions and Senior Vice President, Voltas Ltd; Dr SK Jain, Chairman cum MD, Ground Water & Mineral Investigation Consultancy (GWMICC) Pvt Ltd; Dr Indra N. Mitra, Director - Technical and Project Development, Cambi India; Chrys Fernandes, India Business Head, DuPont Water Solutions; Ashish Rajendra Mishra, Senior Manager-Process, Lars Enviro Pvt Ltd; Abdul Rahman Mohammed, CEO, Sahara Industry, Syamal Sarkar (Ph.D.), IAS (R), Distinguished Fellow & Senior Director-Natural Resources and Climate Programme, The Energy and Resources Institute (TERI); Subhash Sethi, Chairman, SPML Infra Pvt Ltd and Mohammed Naser Azeez, MD, Aquality Water Solutions Pvt Ltd.**

1. HOW SEVERE IS THE STRESS ON WATER, AS A RESOURCE?

Abdul Rahman Mohammed (Sahara Industry): Water scarcity is for real and billions of people around the world are being affected by it. Lack of access to clean water is threatening lives across the globe. Going forward, this problem is expected to worsen largely due to the harmful effects of global warming, pressures of increasing population and increasing water pollution.

India is facing a difficult challenge to arrange for drinking water facilities for its 1.4 billion population. There are over 600 million people presently suffering from severe to extreme water stress. Many metropolitan and large cities, in the country, are facing difficult times and are staring

"NITI Aayog states that the a large number of Indians face high to extreme water stress and the country's dependence on its erratic monsoon, adds to this stress."

Amit Vaidya (XYLEM)

at a 'day zero' situation (Day Zero is the day when city's taps run completely dry, forcing people to stand in queues to collect their daily "quota" of water), in the near future. Ground water being limited, has declined to alarming levels whereas the surface water sources have been contaminated. Several large water bodies are so polluted that their water cannot be used for any useful purpose.

Amit Vaidya (Xylem): India is among the most water-stressed countries in the world with 18% of the world's population and only 4% of its water resources. NITI Aayog states that a large number of Indians face high to extreme water stress and the country's dependence on its erratic monsoon, adds to this stress. Climate change is one more factor contributing to this. By 2030, India's water demand is projected to be twice the available supply, implying severe water scarcity for hundreds of millions of people and an eventual 6% loss in the country's GDP.

Anand Iyer (Forbes Marshall): 70% of our Earth constitutes of water. The fact though is that only 3% of water on earth is termed as fresh and non-saline. Only 31% of the 3%, water that is non-saline, is accessible for our usage. Approximately 1.1 billion people today do not have access to clean water and approximately 2.7 billion people experience scarcity once a year. I need to mention here that 54% of India is under extreme water stress.

Dr Anil Kumar Mishra (Delhi Jal Board): Water is an essential and vital component of our lives and is required for performing a host of metabolic activities, in all types of living organisms (micro-organisms to higher plants and animals). Water is also important for the environment and it cools down the temperature, whenever it gets too hot and even helps in maintaining proper balance in the environment. In present scenario, water scarcity and its contamination (physical, chemical and microbiological contaminants) are major problem areas, not only in India but also across the globe. In the present scenario, due to rapid growth of population, urbanization, industrialization and agriculture activities, water resources are severely stressed and the gap between supply and demand (required for various activities like bathing, cooking, drinking, sanitation, irrigation, industries and so on) is increasing every year. In order to create awareness about the matter, directives/guidelines have been issued by various national and international agencies, that aim to sensitize towards conservation of water resources, the need to avoid polluting water bodies/ ground water, follow sustainable use of water and so on.

Abdul Rahman Mohammed
Founder & CEO
Sahara Industry

India is facing a difficult challenge to arrange for drinking water facilities for its 1.4 billion population. There are over 600 million people presently suffering from severe to extreme water stress.

Apart from the effects of pressures of an increasing population and rapid industrialization, on water, climate change too is creating additional stress on water resources. It has been seen that not only in India, but across the globe, there is a significant section of population that does not have access to sufficient quantity of potable and wholesome drinking water (as per norms), which results in many of them having health related complexities. More so these complexities arise because of different type of pollutants (physical, chemical and microbiological and so on) being present, in water, that they consume.

Ashish Rajendra Mishra (Lars Enviro Pvt Ltd): According to a recent report by the United Nations Environment Programme (UNEP), The world population is steadily inching towards 8 billion, and we're using the equivalent of 1.6 Earths to maintain our current way of life. Naturally, the ecosystems can not keep up with such humungous demands and, as a result resources and water, are fast declining.

Water availability per person is dependent on the population of the country, and for India, the per capita, water availability is declining as a result of the increasing population.

Reducing per capita water: The average annual per capita water availability in the years 2001 and 2011 was assessed as 1,816 cubic meters and 1,545 cubic meters respectively which may further reduce to 1,386 cubic meters and 1,167 cubic meters by 2025 and 2050, respectively. As per global standards, India is already in the water stress zone. If similar

conditions prevail and exploitation continues without proper action and control, 54% of the population, in India will face high to extremely high water stress, by 2030.

Chrys Fernandes (DuPont Water Solutions): 71% of our planet covered by water, and almost 97% of it is being covered by oceans, the balance is held in ice caps, glaciers, rivers, lakes, and groundwater. When we mention water scarcity, we are speaking of two different problems - ecological and infrastructural. Rising population, resource-intensive economic activities, agriculture, industry, and municipal requirements have increased six times in the last 100 years. Most noticeably, climate change is intensifying water scarcity, around the globe. The unprecedented number of droughts are not merely sub-Saharan or desert-specific problems anymore. According to a 2018 NITI Aayog report, India has become the world's largest extractor of groundwater, accounting for 25% of the total groundwater extracted globally. 70% of our water sources are contaminated and our major rivers are affected by pollution. We can safely say that India is suffering from its worst water crisis in its history. The stress on potable water is critical, affecting human health and development. The current situation is tricky, and inadequate water supply will put billions of people in a severe water crisis.

Dharmendra Pratap Singh (Voltas): Water is vital to our survival. However, demands of rapid industrialization and a growing population have put intense stress on water, leading to severe water scarcity. The previous two years have shed light on the value of clean water which was otherwise taken for granted, by most of us. While the emission of waste into water bodies by industries decreased significantly, leaving less water contaminated during the lockdown period, use of water in homes increased manifolds, as majority of the people were sheltered at home. In the present day, India is facing a severe water crisis. According to estimates, around 600 million people, in India, are facing extreme water stress. It is estimated that by 2030, 40% of India's population will not have access to safe/clean drinking water.

Amit Vaidya
Director, India
Metrology Business, Xylem

India is among the most water-stressed countries in the world with 18% of the world's population and only 4% of its water resources.

Dr Indra N. Mitra (Cambi India): Stress on water is for real both, in India and globally. There is enough water, both in India and globally, but it is not distributed evenly. While there are floods in some areas, there are also areas that suffer from drought. Water stress is created in areas with less water resources. So, what is needed is proper management of water. Economic growth, increasing population, lifestyle changes, urbanization and rapid industrialization are factors that contribute to demand for water demand and create water stress.

Mohammed Naser Azeez (Aquality Water Solutions): The stress on India's water sector can be gauged from the fact that, the country, has only 4% of world's fresh water resources to feed almost 18% of the global populations. If that is not enough, the limited water sources that we have on our disposal, about 70% of that has already been polluted. There are over 600 million people in the country currently facing severe water scarcity, and more than 50% of all households in the country do not have access to proper source of clean drinking water facilities. This is an additional stress on households, as people also have to stand in long queues to get drinking water, at many places.

Lack of access to clean water always has a greater impact on the poor. Not only is the water crisis increasing the vulnerability of the country's poor, it is also placing additional stress on an already overloaded health system. The average per capita availability of water has been reducing every year from 5,177 cubic meters in 1951 to 1,486 cubic meters in 2021 and is estimated to decline further to 1,191 cubic meters by 2050. The situation is further threatening with World Bank estimating that by 2030 India's water demand will outstrip supply by almost 50%, which is a significant challenge to address.

Rangarajan Ramaswamy (Grundfos India): As the world's largest groundwater consumer, India is experiencing sharp declines in groundwater levels, across the country. In February 2022, the government

70% of our Earth constitutes of water. The fact though is that only 3% of water on earth is termed as fresh and non-saline.

Anand Iyer (Forbes Marshall)

revealed that 30% of wells monitored by the Central Ground Water Board (CGWB) have seen groundwater depletion . This could further aggravate the water shortage issues in India.

Furthermore, pressures of a growing population and urbanization, in India, is also adding to the increase in demand for freshwater for domestic, commercial and industrial purposes. As per the United Nation's World Water Development Report 2022, close to 50% of the volume of water used for domestic purposes is groundwater. With increase in usage of water and current climate challenges, availability and security of water is being threatened by the hour. In order to avoid a drastic disproportionality in the demand and supply of water, we need to monitor water usage across all sectors.

Dr SK Jain (Ground Water & Mineral Investigation Consultancy): The stress on water is for real to an extent that 100-300% of water that is recharges is withdrawn. This has resulted in decline of water levels to the tune of 1-3 metres per year. This has rendered close to 21 cities of India on the verge of Day Zero.

Subhash Sethi (SPML Infra): Clean drinking water is a precious commodity. India which, historically had abundant water, is now facing a difficult task, as millions of its people do not have access to clean water supply. The average annual per capita availability of water has reduced by almost 70% in a span of seven decades, from about 5,177 cubic meters in 1951 to 1,486 cubic meters in 2021. This figure is further estimated to decline to 1,191 cubic meters by 2050. It needs to be noted that in the Water Stress Index 2020, India has been ranked in the 39th position among highest risk country, in the world.

NITI Aayog, the government think tank, has also flagged the distressing situation of freshwater availability, in the country. In its report, that was released in 2018, NITI Aayog has stated that 600 million people (43% of the country's population) is facing high-to-extreme water stress and over 50% of households do not have drinking water facilities on their premises, in the present day. The study by NITI Aayog also estimated that 40% of India's total population will have no access to drinking water by 2030. It also suggested that 11 of India's 20 largest cities like Delhi, Chennai, Jaipur, Ahmedabad, Indore, Kanpur, Lucknow, Hyderabad and Bengaluru are facing extreme water risks. In addition to the 11 cities, the report also made note of seven other big cities that were also at a high-risk level.

Around 65% of India's total water demand is met from groundwater sources, which play an important role in shaping the nation's economic and social development. However, one needs to remember that the groundwater, in the present day, is at a critical stress level, especially with increasing number of aquifers reaching unsustainable levels due to their over exploitation. Therefore, with the growing demand for water and depletion of the available resources, assured supply of good quality water is becoming a matter of great concern in the country.

Syamal Sarkar (The Energy and Resources Institute): Of the water resources, generated annually, the water that can be utilised beneficially is 1,123 billion cubic metre (BCM). The rest of the water cannot be used due to various limitations. Out of the available water resources 690 BCM of water resources are surface water and the remaining are ground water. India's storage capacity is substantially lower, than the available resources. This has resulted in high utilisation of ground water resources, in some states, due to inadequate surface reservoir capacity.

The demand for water demand comes from various sectors such as agriculture, industry, and domestic sector. About 80% of water is used by the agriculture sector, about 10% by the industry and balance by the domestic sector. There is a declining trend, in the availability of water, due to pressures from high population growth and rapid urbanisation. According to NITI Aayog 2019 India's water demand by 2030 will be twice

the available supply. In the agricultural sector, which uses significant water resources, there is low efficiency in the use of water. So is the case of low water efficiency in the industrial and the domestic sectors. India's recent programme such as "Make in India" to boost manufacturing, and India's water access programme such as "Har Ghar Jal" of the Jal Jeevan Mission which plans to provide 100% piped water connection to rural households by 2024, and will provide additional water in industrial sector, domestic sector respectively. Further, human induced climate change will put a lot of pressure on the hydrological cycle, impacting surface water availability and thereby stress on ground water resources, is now a reality.

2. DO THE THREE R'S (REDUCE, RECYCLE AND RE-USE) PROVIDE A VIABLE SOLUTION TO REDUCE STRESS ON WATER, AS A RESOURCE? IF YES/NO, PLEASE ELABORATE.

Abdul Rahman Mohammed (Sahara Industry): The concept of three R's has been more relevant for municipal solid waste management, for many years. However, the stress condition of fresh water sources has forced us to implement the three R strategy for liquid waste management as well. India has a big problem of accumulating wastewater, both from municipal and industrial sources, and turning this waste water, into a resource, for reuse has become a necessity, in the present day. An estimated 73 billion litres of municipal sewage is being generated by Indian cities along with another 14 billion litres effluent coming from the industries. A large part of this waste does not get treated and is discharged into water bodies. This wastewater can be turned into a resource with proper treatment. The concept of three R's will become more relevant and help in making this large quantity of water for reusable for irrigation and industrial purposes. If we are able to treat even the half the amount of the waste water that is generated and make it reusable, it will lead to substantiable easing of stress levels on fresh water.

Amit Vaidya (Xylem): Definitely. However, considering I am answering from the perspective of smart water metering, let me stress on the reduce bit. NRW or Non-Revenue Water can be from a leak that is not detected by the utility over time or a burst pipe that causes major damage to the infrastructure and low accuracy of water meters. While a United Nations, 2016 World Water Development report, estimates that about 30% of water is being lost through leakage globally, in India, this could be as high as 40-50%. You can imagine this water being saved significantly, if NRW is dealt with. And this will also reduce the demand for water, which will reduce the stress. Smart water metering can aid this.

Anand Iyer (Forbes Marshall): Reduce, recycle and reuse is the way forward. Lot of water is consumed for daily needs, usage of water, in industries, is another area where large volume of water is consumed. Optimum usage of water is the key to achieving reduction. Today, many industries are conscious of their water usage and are working towards reducing the same, recycling it and making the water reusable.

All the water boards and corporations are investing heavily to provide water to everyone and achieve this objective, large projects are being implemented that are designed on the principles of optimum usage, recycle and reuse. Many large sewage treatment plants (STPs) are already commissioned and many more are in the pipe line.

Dr Anil Kumar Mishra (Delhi Jal Board): Yes. Three R's are a viable solution for reducing stress on water resources to a great extent. However, we can add two more R's to the three R's that we are speaking about, then it may be prove to be a more viable approach, for reducing stress on water resources. The two R's that can be added are:

1. Respect water and
2. Reserve water resources.

In India and across the globe, if we provide due respect to water and other natural resources, then we will never contaminate, waste or misuse the water, that is available to us. By adopting these principles (R's) we may overcome the problems that we face due to water scarcity and pollution.

Ashish Rajendra Mishra (Lars Enviro Pvt Ltd): Yes. The three R's (Reduce, Recycle and Re-use) are viable solutions to reduce the stress on

In the present scenario, due to rapid growth of population, urbanization, industrialization and agriculture activities, water resources are severely stressed and the gap between supply and demand is increasing every year.

Dr Anil Kumar Mishra (Delhi Jal Board)

water, both in the industry and among the public at large. Recycled water can satisfy most demands related to water, as long as it is adequately treated, to ensure that it confirms to a certain level of quality, and is appropriate for use. Reduction and reuse are the most effective ways, you can use natural resources in a sustainable manner, and protect them thereby helping the environment and save money, at a macro level.

Anand Iyer
Country Manager
Forbes Marshall

Today, many industries are conscious of their water usage and are working towards reducing the same, recycling it and making the water reusable.

Chrys Fernandes (DuPont Water Solutions): A legacy of innovation and a customer-centric approach has led us to create several technologies that can help reduce stress on water. We design and manufacture solutions to help our customers optimize water through purification, conservation and reuse. At the same time, we innovate these technologies to meet both our customers' and DuPont's sustainability goals - optimizing water more efficiently, using less energy, and reducing the carbon impact of safe water.

Our FilmTec™ Fortilife™ product family improves water efficiency by incorporating industrial users' membrane and element design innovations. This ensures the need to clean less, waste less, and recover more. Not only do our premium solutions are backed by decades of development and testing, but they can also provide significant return on investment (ROI) for customers. A textile plant in India, for example, piloted our minimal liquid discharge (MLD) approach to improve water efficiency. The plant witnessed increased production, a 75% reduction in cleaning costs, savings on energy cost savings by 10% and significantly longer element life.

DesaliTec™ Closed Circuit Reverse Osmosis (CCRO) process and software by DuPont, is another technology offering we have, that ensures high recovery of ~95%, lesser man-hours, and costs". CCRO, with its data-driven intelligence, is designed to automatically adapt to the changing flow rates, temperatures, fouling, and scaling conditions.

The MEMCOR® product line offers more than 1,000 microfiltration and ultrafiltration installations. Municipalities and industries utilize this membrane technology system in wastewater reuse, water treatment, RO pre-treatment, and industrial process water.

All our other range of solutions - RO, UV, UF, or desalination - work efficiently and economically, impacting communities globally.

Dharmendra Pratap Singh (Voltas): Scarcity of water has necessitated that it is recycled and reused, instead of over-utilizing groundwater. Intensified industrialization has put further strain on water and thereby aggravated its scarcity. Some industries, such as construction, textiles, paper, leather and steel utilize water in large quantities. While the Government and corporates are working together towards creating a more sustainable environment for future generations, it is extremely important to take wise and pragmatic steps to check any significant increase in consumption and cost of water. Further we also need to develop a robust plan which is sustainable that includes recruiting and providing the necessary training to personnel, in industries that consume high amounts of water.

Dr Indra N. Mitra (Cambi India): Yes, they are part of the solution but the complete solution. I would like to add two more M's - Management and Money - to the three R's. Proper management of water resources

Dr Anil Kumar Mishra
Bacteriologist
Delhi Jal Board

Rain water harvesting is a viable tool. For promoting its use, thematic parks, adopting various models and other themes that are required may be developed

is required and it requires proper investment (read money).

Mohammed Naser Azeez (Aquality Water Solutions): It is a fundamental right of people to have proper access to clean drinking water. But the reality is different and discussions around water resources and infrastructure increasingly emphasise the need to promote 'resilience' within water and wastewater systems. India is facing a dual challenge - declining water sources and accumulating volume of wastewater; and both of them need focus approach. The concept of three R's is not new and it has been in use for both, solid and liquid waste management, in developed countries, for a long time. I remember my stint with an international organization, in Dubai, over a decade ago where the concept of three R's was part of the planning process, for both kind of waste collected and to treat them accordingly for reuse.

India with severe fresh water scarcity is generating almost 90 billion litres of wastewater from domestic and industrial uses, per day and can use the concept to its advantage. Imagine that if this huge volume of wastewater is treated properly and used for irrigation and production facilities, we will be able to save this much of fresh water for potable purposes. It will largely help in addressing both the challenges effectively, while water stress can be managed in a better manner.

Rangarajan Ramaswamy (Grundfos India): According to the India Economic Summit, about 40 million liters of wastewater is discarded into rivers and other water bodies in India, most of it untreated. With use of advanced technology and sustainable governance, wastewater can be treated to cater to meet many of the country's needs of water. The principles of reducing, recycling, and reusing water can help control the use of water, avoid irresponsible extraction of groundwater, and free up fresh water for human /animal consumption. Treating wastewater produced by industries, commercial and residential buildings can reduce the burden on the available freshwater, thereby giving opportunity for groundwater to get replenished as well.

Dr SK Jain (Ground Water & Mineral Investigation Consultancy): Yes, the three R's do provide a viable solution to reduce the stress on water. When the three R's are implemented/practised properly it would amount

to less consumption of ground water, which in turn will help in reducing the stress on ground water.

Subhash Sethi (SPML Infra): Urban India was producing 72,360 million litres per day (MLD) of sewage, in 2021. The actual amount of sewage that was treated was only around 20,230 MLD, which is under 28% of the total sewage generated. Future trends suggest that by 2050, the urban population, in India, is projected to generate 120 billion litres of wastewater while the rural population would generate around 50 billion litres.

Increasing demand for water is putting tremendous pressure on water resources and to address this situation initiatives like innovative wastewater treatment, reclaim and reuse has become a necessity. The wastewater management concept endorses utilization of it as a by-product to the extent possible i.e. recycle, reclaim, re-use and recharge. Fundamentally, wastewater reuse has to take into consideration the rapidly shrinking fresh water sources, increasing water pollution, adverse impact on environment, and health risks associated with it.

The benefit of having a fresh perspective is looking at new ideas and adoption of modern technology to treat wastewater up to the level of complete reuse that can address the current challenges of fresh water scarcity. Government interventions at the national and local levels are needed to develop treatment facilities for wastewater reuse schemes. In India, irrigation is the largest user of fresh water and uses over 80% of the total water consumed. Industry, on the other hand uses 5% of the water consumed. Even if a friction of this fresh water consumption is optimised with reclaimed water, water stress in the country could be managed significantly.

Water availability per person is dependent on the population of the country, and for India, the per capita, water availability is declining as a result of the increasing population.

Ashish Rajendra Mishra (Lars Enviro Pvt Ltd)

Syamal Sarkar (The Energy and Resources Institute): Yes, the three R's (reduce, recycle and re-use) will provide a viable solution to reduce the stress on water, as a resource. In India the total volume of sewage, generated by households, in urban India, was about 61,000 million litres per day (MLD). The infrastructure that we have today, can only treat about 37% of the sewage generated. It also needs to remembered that 40% of the infrastructure, to treat sewage, is not fully operational. Current operational capacity, for collection and treatment, is about 22%, of which only a small proportion is reused. The balance of uncollected and untreated water, is released into water bodies and in the environment, leading to contamination and health concerns, in India. There is ample opportunity to recycle and reuse, the used water, in a big way, in the domestic sector, and in the industrial sector. This process (recycle and reuse of used water) will provide enhanced water security, health benefits, environmental benefits, social benefits, economic benefits and so on.

3. WHAT ARE THE KEY CHALLENGES FACED IN IMPLEMENTING THE THREE R'S AS MENTIONED ABOVE?

Dr Anil Kumar Mishra (Delhi Jal Board): Although, various Government/ private agencies have been issuing guidelines for implementation of the above-mentioned 3 R's (reduce, reuse, recycle) for reducing the stress on water resources, so that consumers may get sufficient quantities of potable and wholesome drinking water, as per their requirement and per capita water supply as per norms laid down by various Government and other related agencies. But I think that due to lack of proper involvement of consumers, their participation in all the activities, related to conservation of water like adopting measures to avoid polluting water, sustainable use of water resources and so on, the desired outcomes of the 3 R's may not achieved. Secondly, In India and across the globe, consumers are not desirous to use treated waste water, for any usage in the house, due to aesthetic or other reasons.

Ashish Rajendra Mishra (Lars Enviro Pvt Ltd): The first, issue is willingness. People are not willing to adopt the three R's until there is some form of pressure, on them, from an external agency or they see

11 MLD Decentralised Sewage Treatment Plant, Mira Bhayander, Maharashtra

more benefits, in abiding by these principles. The major challenges are capex, space constraints, unwillingness to implement and adopt new technology, getting skilled manpower for the job and most importantly, the mindset to adopt the three R's.

Dr SK Jain (Ground Water & Mineral Investigation Consultancy): One of the sectors that faces challenges in implementing the three R's is the agriculture sector, particularly in India. In the agriculture sector, adoption of better irrigation that promotes concepts like more corps per drop of water needs to be followed and promoted. Of the total water that is used in agriculture, for irrigation, nearly 70% is ground water. Thus, concentrated efforts need to be made by the government, non-governmental organisations (NGOs), and other agencies, to promote use of drip/sprinkler systems for irrigation and growing crops that require less water.

Syamal Sarkar (The Energy and Resources Institute): It is the responsibility of the industrial units and individual households, to recycle and reuse water, in a big way. The technologies, are available, and the government policy also calls for such recycle and reuse. What is missing, is that there is little incentive on such recycle and reuse, for such water users, in India. Take the case of Israel, where treated waste water is used for agriculture purpose. To this, there was initial resistance, from farmers, but the government promised 20% extra allocation of treated water, for every unit of fresh water allocation, they did not use. Such users were also promised that there would be no fluctuations on yearly basis, for water allotment. Pricing of water was also adopted. Such examples, of Israel, for use of reclaimed water should be considered, for use, in India.

4. WOULD YOU LIKE TO SHARE YOUR SUCCESS STORY OF IMPLEMENTATION OF THREE R'S?

Dr Anil Kumar Mishra (Delhi Jal Board): Delhi Jal Board adopted the principle of 3 R's and established recycling treatment plant in many of its water treatment plants (WTPs), for reuse of waste water of WTPs. This recycled water has been used for rejuvenation of water bodies, irrigation of plants and trees in parks and road verges, in thermal power plants, for irrigation of crops and so on. Delhi Jal Board (DJB) also started various schemes that were required for promotion of rain water harvesting and other such type of technologies that may improve the quality and quantity of surface, as well as ground water.

12.5 MLD Effluent Treatment Plant, Bahadurgarh Industrial Area, Haryana

Ashish Rajendra Mishra
Sr. Manager - Process
Lars Enviro Pvt Ltd

We need to retain rainwater from the roof tops and be able to make good of the surface runoff.

Ashish Rajendra Mishra (Lars Enviro Pvt Ltd): Reduce, reuse and recycle principles are seldomly practiced, in industries, even if they are financially viable to implement. A brewery in Tamil Nadu overcame this inertia and set up a Zero Liquid Discharge (ZLD) plant while adopting wastewater recycling. It also embraced principles of reduce and reuse, to decrease pollution load drastically. Biogas produced was effectively being utilized in the canteen kitchen and for power generation. This article unfolds the success story from concept to commissioning stage, typical problems encountered, and its remedy, and also shares a cost-benefit analysis of the investment made by the factory. The beer makers, in this case, adopted physical treatment followed by a 2 staged biological treatment, wherein the anaerobic stage (it is a biological process where micro-organisms degrade organic contaminants in the absence of oxygen) was followed by an extended aeration process (is a method of sewage treatment using modified activated sludge procedures. It is preferred for relatively small waste loads, where lower operating efficiency is offset by mechanical simplicity).

The biologically treated wastewater was further subjected to tertiary treatment (is the final stage of the multi-stage wastewater cleaning process) to make it fit for the membrane filtration process. Further, ultra-filtration (UF) and reverse osmosis (RO) were employed to produce treated wastewater that was fit for reuse, especially as makeup water (simply refers to water that is added to plant processes to compensate for losses) for cooling the tower and for usage in other low-grade processes, in house. The discharge from RO was sent to multiple effect evaporators (MEE). Biogas produced from the anaerobic stage was utilized for power generation. Mineralized biological sludge was used as a soil conditioner cum manure to develop a green belt, on the campus.

Many in-plant control measures were undertaken to reduce the pollution load of wastewater and attempts were made to match the global benchmarks for water consumption.

This case study shows that the generated sludge, from the brewery process, is utilized as a by-product and the process also focuses on wastewater treatment. The processes employed, in the above-mentioned case study, reflects the efficiency of the process employed the brewery in treating wastewater, in phases like physico-chemical, anaerobic, aerobic ultrafiltration, RO and evaporation showing high total suspended solids (TSS), total dissolved solids (TDS), chemical Oxygen Demand (COD) and biological oxygen demand (BOD) removal. The overall treatment process showed good results. Every treatment phase of this effluent treatment process (ETP) has its unique removal capacity, and the treated water of ETP met the effluent discharged standards of the World Health Organization (WHO) and Bureau of Indian Standards (BIS) and also fulfils the three R concept of reduce, reuse, recycle and comes under zero liquid discharge.

Ultra Filtration Systems

Dr SK Jain (Ground Water & Mineral Investigation Consultancy): The example that I can remember of is that of Hero MotoCorp, Haridwar where the entire runoff is diverted to an artificial recharge reservoir with 10 systems of injection wells. This project is recharging ground water of the order of around 4,44,054 m3/annum within and outside the plant premises. This is against the withdrawal of water to the tune of approximately 2,11,360 m^3/annum.

Syamal Sarkar (The Energy and Resources Institute): In India, used water is often used in wet lands, as it assists in maintaining ground water and sub-surface water levels, and acts as a means of water storage. It also provides a natural habitat for plants and animals. In East Kolkata wetland, West Bengal, which is also a Ramsar site, provides a good example of how to treat municipal sewage, of Kolkata, in a natural manner and to use the naturally treated water for fishing and other beneficial uses.

The average annual per capita water availability in the years 2001 and 2011 was assessed as 1,816 cubic meters and 1,545 cubic meters respectively which may further reduce to 1,386 cubic meters and 1,167 cubic meters by 2025 and 2050, respectively. As per global standards, India is already in the water stress zone. If similar conditions prevail and exploitation continues without proper action and control, 54% of the population, in India will face high to extremely high water stress, by 2030.

Ashish Rajendra Mishra (Lars Enviro Pvt Ltd)

5. ARE THERE ANY ALTERNATE SOLUTIONS OTHER THAN THE THREE R'S THAT CAN HELP MITIGATE STRESS ON WATER THAT WE CAN USE? ALTERNATIVELY, WOULD YOU LIKE TO ADD ANY FURTHER ASPECT TO THE THREE R'S?

Amit Vaidya (Xylem): The three R's are the standard when it comes to reducing water stress. Let me elaborate on smart water management and its ability to provide unprecedented amounts of real-time insights into water usage and how it can also help in mitigating water stress. Data and analytics are a key for utilities and policy makers to take the right decisions. With smart water management, utility operators can get immediate feedback on the success of water conservation efforts undertaken by the consumers. When it comes to informing policy decisions, this is a huge benefit. Utilities can also make smart decisions on supply by increasing supply at a time when its relevant, as per the data received, and lower the supply or even introduce differential pricing to ensure effective usage by consumers. This can further help salvage the situation that we are currently in.

Anand Iyer (Forbes Marshall): An alternate way, apart from the three R's, to reduce the stress on water, is to stop drawing ground water. Ground water levels, in many places, have depleted. This is adding to the stress on the environment. There are regulations put in place by the central ground water authorities for ground water usage. Rain water harvesting in Urban area is also helping the cause. The government has taken up many projects for making water available to all and in the remotest of the places.

Chrys Fernandes
India Business Head
DuPont Water Solutions

The technology to reclaim drinking water from sewage water exists - and except for the stigma of using sewage water, there is nothing wrong with using water that has been reclaimed.

Pollution is another area which adds to the stress. Many industries are having Zero Liquid Discharge (ZLD) plants installed. These are important initiatives which will help to reduce stress on water.

Dr Anil Kumar Mishra (Delhi Jal Board): Rain water harvesting is a viable tool for reducing stress on water resources. For promoting its use, thematic parks, adopting various models related to rain water harvesting and other themes that are required may be developed, in different parts of India and across the globe. One such

thematic park has already developed in Bangalore, in the name of "Sir M. Visvesvariah rainwater harvesting theme park." Establishment of such parks does a couple of things. First it makes the citizens aware of the technology and also provides then information about the new technology and its concepts. When citizens, consumers and even students see the advantages of such technologies, in front of their eyes and are even able to get all the information, that they need about it, in a single place, then chances are high that they adopt it in a much better manner in their houses or housing societies or even in their surroundings. Adoption of such technologies results in improvement of underground water quality as well as major augmentation in its quantity.

Ashish Rajendra Mishra (Lars Enviro Pvt Ltd): Yes, along with the three R's, we can adopt a holistic approach with respect to our natural resources like rivers, lakes, and forests. We need to retain rainwater from the roof tops and be able to make good of the surface runoff. We have to conserve our resources, focus on biodiversity, and utilization of green energy.

Chrys Fernandes (DuPont Water Solutions): As I mentioned earlier, 97% of the water on earth is held by oceans and seas. To give some perspective, the saline water, in these oceans and seas, makes up for around 1,386,000,000 km3, and human beings, on average, use 150-200 liters per day, which is 0.0002 km3. Currently, we are using less than 2% of all the water that is available, on this planet... Imagine if there was a way to use the balance 97%?

In the last 30 years, the cost of desalination has halved, and today, over 300 million people get water from desalination plants. Our innovation, DuPont Seawater Reverse Osmosis (SWRO) membrane, brings together our experience in membrane chemistry and element design to deliver reliable, high-quality performance while extending membrane life and reducing the lifecycle costs of operations.

Dharmendra Pratap Singh (Voltas): Recharging groundwater is the first step that can be done towards ensuring overall conservation of water. Conducting a hydro-geological study (the study of the area of earth that deals with the distribution and movement of groundwater in the soil and rocks) is vital to understand the best means to recharge groundwater. Additionally, sustainable harvesting, deepening of wells, desiltation (to remove suspended silt/sediments from a water body) of streams, area treatment of soil and afforestation are all methods that will help to recharge groundwater. Realizing this, Voltas has designed its CSR efforts for drought prone areas. Sustainable development is the precursor to all CSR projects of Voltas. After deliberating various approaches for all the strategic interventions, the company decided to adopt an approach of Engage, Equip and Empower. The CSR policy of Voltas which reflects this approach, is further firmed up to ensure that its ethos is inter-woven across all its interventions.

Dr Indra N. Mitra (Cambi India): There are some more solutions, in addition to the three R's. Please do remember that below mentioned solutions are not alternatives, to the three R's.

1. As mentioned earlier, there is enough water but proper management, of the same, is required, for equitable distribution of water.
2. Use of water efficient technologies. Technologies that consume less water need to be used.
3. Agriculture/irrigation consumes more than 80% of usable water. Since, irrigation consumes a huge amount of water, special attention should be given to this area. Improvement in water efficient irrigation processes such as drip irrigation, will reduce water consumption. Also, properly treated wastewater from treatment plants can be used for irrigation.
4. Reducing leakages in water distribution system.
5. Metering and levying charges on water use. This will drastically reduce water consumption and wastage.

Rangarajan Ramaswamy (Grundfos India): We need to ensure that water is not wasted during distribution through leakages. In order to control and monitor water utility in India, smart metering can be adopted across the country. Smart water meters log-in daily consumption data, leakage, tamper, and reverse flow periodically to reduce non-revenue water (NRW). Today, the market offers ultrasonic meters for water metering, which allows for digitally connected networks to help local bodies monitor extraction of water. This can ensure better usage of water.

Another impactful solution to restore freshwater, in India, is by conserving natural waterbodies such as lakes, ponds, and rivers. As primary

The previous two years (read the covid years) have shed light on the value of clean water which was otherwise taken for granted, by most of us.

Dharmendra Pratap Singh (Voltas)

600 KLD Reverse Osmosis System for Boiler Feed

sources of freshwater ecosystems, waterbodies can play a crucial role in addressing India's water needs.

Dr SK Jain (Ground Water & Mineral Investigation Consultancy): Storm water management is one area where waste water generated through rainfall runoff, on roads in cities and industry, can be used to recharge underground water.

Syamal Sarkar (The Energy and Resources Institute): Other than three R's, the alternate solution could be to increase the water use efficiency of the agricultural, domestic and the industrial sectors. The agricultural water use efficiency is about 38%. Thus, there is a great opportunity to reduce/mitigate the stress, on water resources, if the water use efficiency in agriculture sector is increased. The same principle is applicable for industrial and domestic sectors.

6. IS ENOUGH BEING DONE TO PROMOTE THE USE OF THE THREE R'S? WHAT MORE NEEDS TO BE DONE? PLEASE ELABORATE.

Abdul Rahman Mohammed (Sahara Industry): Globally, the wastewater management concept endorses utilization of waste as a by-product to the extent possible i.e., reuse, reduce and recycle. Fundamentally, wastewater reuse has to take into consideration rapidly depleting water sources, contamination of water, environmental degradation, rigorous policies, and health risks to workers and communities.

In India, this concept is not being properly used, as yet, in wastewater management, treatment and reuse. There are a few experimental projects, that are in their initial stages, in India, where the wastewater reuse facilities are being built and the concept is being implemented. For a country like India, which is facing an acute huge water crisis, the concept of wastewater management needs proper support from the government, in terms of policy decisions and making it mandatory to use treated water for non-potable purposes. We need to learn from examples, from across the globe, about recycling wastewater. This concept is very common in

According to a 2018 NITI Aayog report, India has become the world's largest extractor of groundwater, accounting for 25% of the total groundwater extracted globally. 70% of our water sources are contaminated and our major rivers are affected by pollution.

Chrys Fernandes (DuPont Water Solutions)

places like Australia, China, Singapore, Israel, and many more where its essential to ensure that agriculture and industries have access to adequate supplies of water to maintain sufficient productivity. Anand Iyer (Forbes Marshall): There is always room to do more. Digitization and data visibility to take corrective measures will further strengthen the 3R's.

Amit Vaidya (Xylem): There are efforts by the government and you know there is the launch of the unified 'Jal Shakti' ministry that aims to provide piped water supply to every household by 2024 as well as to fight India's water woes. Some of the government initiatives like AMRUT, Smart Cities, Har Ghar Jal are focused on improving the water scene in India. However, we can also see that there is also excessive groundwater pumping without it being sufficiently recharged, an inefficient & wasteful water management system and years of deficient rains. Though water conservation and also implementation of rainwater harvesting are priorities that is on everyone's agenda, there is not much being done to address the issue with the water management system in India. Realistic and effective solutions need to include smart water management, which cuts down water wastage besides providing real-time data and high-quality analytics to the water utilities and in turn to the government.

Dr Anil Kumar Mishra (Delhi Jal Board): Although, various Government and non-government organizations have been taking various initiatives by making necessary rules, regulations and guidelines for promotion of the three R's but the desired outcomes are still awaited. To achieve better/ desired results consumers need to be made aware about the benefits of adopting the three R's. Awareness about the three R's could be created by drafting and their proper implementation at various levels of governance (from central to panchayat level). Further, these policies need to be implemented in a proper manner at the ground level, maybe by providing incentives.

Dharmendra Pratap Singh
Senior Vice President
Voltas Ltd

Desalination has been touted as one of the solutions to fight the water crisis but it is not the best solution at hand.

Ashish Rajendra Mishra (Lars Enviro Pvt Ltd): I personally feel that a lot needs to be done and that too by the individuals and industries at large. I feel that the three R's can be implemented at home and in society along with the Industries. In the industry, implementation of the three R's needs to be made mandatory. Further, technologies like rainwater harvesting and alternate sources of energy like solar plants or biogas plants can be used for power generation to full fill their requirements. I say awareness instead of promotion. If peoples are aware about the benefit of Three R's, it will automatically implement and reflect at ground.

Chrys Fernandes (DuPont Water Solutions): A large portion of fresh water, almost 40%, is used for agriculture. Once used for irrigation, the water seeps into the ground and cannot be utilized further. We need to ask questions such as - what if irrigation is the last thing that water did? There is a dire need to look at how we have been functioning for centuries. It needs to start with smaller steps taken by individuals. These would include small things like fixing inefficient fixtures and leakages, classifying

600 KLD Reverse Osmosis System for Boiler Feed

water for reuse in chores, and treating wastewater. The technology to reclaim drinking water from sewage water exists - and except for the stigma of using sewage water, there is nothing wrong with using water that has been reclaimed. It might surprise you, but this treated water is safer than bottled water! It all starts with creating awareness that would lead to acceptance. This, I believe, will happen as the pressure on potable water grows.

Dharmendra Pratap Singh (Voltas): It is vital that we follow the concept of 3R's in water conservation, especially given the current issue of climate change and invest in the well-being of our planet for our future generations. However, it is necessary to increase the awareness of the 3R's among common public and corporates alike to ensure that everyone is contributing their bit towards water conservation and treatment.

Dr Indra N. Mitra (Cambi India): The efforts to promote the three R's is satisfactory but more needs to be done such as:

30 KLD Water Treatment Plant by Aquality Water Solutions

1. Sharing knowledge and holding conferences on the same, so that it creates awareness.
2. Regulations and policies promoting the three R's, need to be in place.
3. Compulsory filing of efforts in the three R's and water conservation in SEC.

Dr Indra Mitra
Director - Technical and Project Development
Cambi India

The awareness levels (about the 3 R's) are at an acceptable level. However, more knowledge, education and training need to be given for selection of right technology and saving more water.

Mohammed Naser Azeez (Aquality Water Solutions): In India, we are far behind European and Asian countries in promoting and adopting of three R concepts. It is worrying that we are not even providing basic treatment to generated wastewater, before disposing it into our already polluted rivers and water bodies, thus making them far more contaminated. The estimate suggests that we are treating only about 30% of all wastewater being produced, on a daily basis, leaving a big gap in its effective management. We need to learn from other countries like Israel, Singapore, Australia and even China where wastewater is not only treated but it is reused for augmenting water supplies, thereby reducing the consumption of fresh water. A water utility in Netherlands provides treated and processed water to industries in a customized method, as per their specific requirements and preferences, matching the needs. In India, a greater consideration is needed to construct better wastewater treatment infrastructure, for abetting water pollution and providing reliable solutions for water sustainability, by adopting three R concepts, in letter and spirit.

Dr SK Jain (Ground Water & Mineral Investigation Consultancy): I don't think enough is being done to promote the adoption and practice of the three R's. Irrigation sector requires major thrust for greater success of the three R's.

Subhash Sethi (SPML Infra): At a pan India basis, water reuse is still in its nascent stage. The reuse of treated sewage is an issue which hasn't assumed much importance, in policy planning, by successive governments. In order to meet the growing demand of water, wastewater reuse is the most sustainable option. Tremendous potential exists for wastewater recycling and reuse mainly for non-potable applications. SPML Infra Limited has been advocating for sustainable use of water practices with robust water and wastewater treatment solutions with modern technology and has been part of over 100 small and large projects in the wastewater treatment segment. We are providing wastewater treatment and reuse facilities to municipal and industrial segments that are cost effective, reliable and innovative solutions to meet their changing needs and market requirements.

When it comes to managing cities, in India, the local administration must plan at the local level to implement pilot projects to scale up for treated sewage, for reuse in horticulture, for washing activities (road, vehicles

and trains), fire-fighting, industrial cooling, toilet flushing and gardening. The treated water should also be made available on a large scale to farmers for use in agriculture. The reuse of treated sewage can decrease the water demand on surface water sources like rivers, ponds, lakes as well as groundwater sources.

Syamal Sarkar (The Energy and Resources Institute): Waste water reuse is the responsibility of the states, including municipalities. Most of the states which have policies regarding safe reuse of treated water, provide targets to improve collection of sewage, along with treatment and reuse. States like Gujarat and Haryana have prescribed higher targets, to use 100% reuse, by 2030 and 2033, respectively. While Karnataka prescribes 50% reuse by 2030. The implementation, of policies for water reuse after treatment, of sewage is slow.

7. IS DESALINATION A VIABLE WAY TO AUGMENT USEABLE WATER THAT WE HAVE AT OUR DISPOSAL? PLEASE ELABORATE. IS IT A FINANCIALLY VIABLE OPTION?

Abdul Rahman Mohammed (Sahara Industry): The desalination technologies for water treatment are still quite costly, hence the water produced becomes more expensive than fresh water. It is good for countries that have more saline water than fresh water sources and this face a challenge to provide quality water to their people and industries. In India, where price of water is at a bare minimum and its use is unregulated, desalination as an option is not much helpful in mitigating water crisis, except in some regions.

Anand Iyer (Forbes Marshall): Areas that have witnessed shortage, scarcity of water, less rain or have depleted levels of ground water do have desalination plants. For example, in India Chennai has one of the largest desalination plants (100 MLD) with a few more few plants being put up. It is obvious that the cost of water from a desalination plant is going to be expensive when compared to fresh water.

Cost of setting up a desalination plant is much higher than a standard water treatment plant. The cost of maintenance of desalination plant is also an expensive proposition. The desalination process also needs to take into account the factors like sea life.

If one has to look at cost of water alone, from a desalination plant, it will become viable only when desalination plant suppliers indigenize costly

components like the membranes. Even then the cost would be at least 2.5 times the fresh water/non saline water.

Dr Anil Kumar Mishra (Delhi Jal Board): Desalination is a viable way for treating saline water upto the optimum limit but it is not economical. The reason being reducing salinity requires reverse osmosis or similar type of technology, for which a lot of energy, financial involvement and other infrastructures are required.

Ashish Rajendra Mishra (Lars Enviro Pvt Ltd): Desalination of brackish water and seawater has proved to be a reliable option. It is a reliable option to extract fresh water from brackish water and is a good solution to mitigate issues of water shortage problem. Desalination processes is typically used to produce water that is drinkable, especially in areas where the only source of water is seawater or brackish water. Several technologies have been developed and many more methods are under research and development that will boost desalination. These technologies can be used at meet a wide range of requirement. For example, it can be employed to supply water to small communities (e.g. solar distillation) and even at a large scale, to supply water to cities. Though desalination costs seem to be progressively decreasing, but they are still costlier than conventional processes that produce potable water. Coming to environmental aspects, each desalination plant has to take proper measures for intake of water, pre-treatment of water as well as take care of proper disposal of water that is produced in the process.

Chrys Fernandes (DuPont Water Solutions): I am so glad you brought this up… Imagine having access to an infinite pool, and a few drops from that pool can end the drought problems, at a global level. DuPont's desalination technology has been proven in large desalination plants.

There are over 600 million people in the country currently facing severe water scarcity, and more than 50% of all households in the country do not have access to proper source of clean drinking water facilities.

Mohammed Naser Azeez (Aquality Water Solutions)

Mohammed Naser Azeez
MD
Aquality Water Solutions

The cost of treatment and high energy consumption of desalination plants and lack of funding makes it difficult to adopt it in a large scale.

DuPont FilmTec™ SWRO is highly durable with lower downtimes, manhours reduction, and up to 50% lower membrane cost. The membrane replacement accounts for about 5% of purifying water and 12% of operating expenses. For example, our desalination plant in San Pedro del Pinatar II - Murcia, Spain, with 6,000 membranes, has been functioning properly for 14 years without any membrane replacement. One of our other plants, Perth Seawater Desalination Plant with 18,000+ membranes, has not needed a replacement in 10 years. At DuPont, we are constantly innovating with a focus on efficiency and sustainability, making desalination a safer investment for securing water supply.

Dharmendra Pratap Singh (Voltas): Desalination has been touted as one of the solutions to fight the water crisis but it is not the best solution at hand. It is exorbitantly expensive and requires large amounts of energy. It is also not good for the environment and hence cannot be a viable option.

Dr Indra N. Mitra (Cambi India): Desalination is a still an expensive process. Viability depends on the level of the need for water for that place. Desalination may be kept as a last resort or for emergency needs only or for make-up water.

Mohammed Naser Azeez (Aquality Water Solutions): Globally, water resources are not evenly distributed, among the countries. A growing portion of the world population lives in water-scarce areas that are naturally dry, or have more sea water than the fresh ones. Around 2.1 billion people of the world lack access to adequate drinking water supplies. In most cases there are technological interventions that can supply water to people through desalinating the saline water. The cost of treatment and high energy consumption of desalination plants and lack of funding makes it difficult to adopt it in a large scale. The capital-intensive options of desalination, to meet water demands may be evaluated depending upon the need, especially in regions where fresh water resources are not available and cost of water transportation is much higher than the desalination. So if a region is prone to drought or desertification and is close to the sea it can work, but for anywhere else a river or dam makes far more sense.

Dr SK Jain (Ground Water & Mineral Investigation Consultancy): Yes, desalination is a viable proposition to augment usable water particularly in costal areas. The financial viability of adopting desalination to augment usable has already been in places like California, in the US, and in Dubai.

Subhash Sethi (SPML Infra): The global innovation in water treatment technologies is helping countries handle water scarcity issues and support utilities with sustainable water management. The innovative technology that has been in use has made significant breakthroughs even in water desalination. There is a need to have more viable solutions to construct affordable desalination plants in Indian states that are facing acute water scarcity like Maharashtra, Tamil Nadu and Rajasthan. The cost of desalination, in the present day, is still quite high and requires more innovations to attract investments in such projects to extract drinking water.

Syamal Sarkar (The Energy and Resources Institute): Desalination is also a viable way to augment useable water, in India. It is known that 97.2% of water, in the universe, is in the oceans. India has proximately 7,500 kms of coast line and about 300 days of sunshine and high ambient temperature. A smaller solar thermal desalination unit could provide water especially, in coastal areas. In this regard the multi-effect plate evaporator, could be an option for use.

8. WHILE THE INDUSTRY IS LARGELY AWARE OF THE THREE R'S, WHAT IS YOUR VIEW ABOUT THE AWARENESS LEVELS AMONG PUBLIC AT LARGE? DO THEY NEED TO BE MADE AWARE ON THESE THREE ASPECTS?

Amit Vaidya (Xylem): We all know that the most effective factor of the water conservation is reducing water consumption. We must encourage the larger population to reduce their water consumption by a little bit by changing water usage patterns. Today, people are more aware of this than they were a decade ago. They are asking themselves the right questions when it comes to sustainability and waste. This is also the reason there is more adoption of smart water management. At Xylem, we are working towards creating a world that is more water-secure and sustainable and smart water management is the step one. However, more needs to be done and all stakeholders need to join forces to ensure more awareness. From an individual to a business, each drop will make a difference.

Anand Iyer (Forbes Marshall): Over the last few years, awareness about

There is enough water, both in India and globally, but it is not distributed evenly. While there are floods in some areas, there are also areas that suffer from drought.

Dr Indra N. Mitra (Cambi India)

4 Softeners of 6m3-Hr

the three R's, among common public has increased a lot. Today, in urban areas, especially in many large apartment complexes and malls, have water treatment plants and sewage treatments plants, through which water is recycled and reused. Rainwater harvesting has also been pressed into service at many places and have even made mandatory, in many places.

I feel that the general public must be made aware of the status of water, in their respective areas. The local municipal offices should display statistics related to water that would include costs, at multiple public places, in areas falling within their jurisdiction. All the projects on water distribution, water treatment, sewage treatment need to be automated. That way it becomes very simple and easy to keep data visible to all.

Dr Anil Kumar Mishra (Delhi Jal Board): I do agree that that both industries and consumers are aware about the three R's i.e. reduce, reuse and recycle of water and its resources but due lack of proper implementation at the ground level, desired outcomes are still awaited. For better achievement of goals, proper policies related to creating awareness and promotion of all the aspects of the three R's may be implemented at various level of government machinery. For the success of the three R's, the policies, need to be properly implemented at the ground level.

Ashish Rajendra Mishra (Lars Enviro Pvt Ltd): The public is not much aware of the three R's. At the ground level awareness programmes need to be organized and public, at large, needs to be informed about the future challenges and benefits of adopting the three R's. In the awareness program, public participation is very important, it involves school, college, social get-together, societies, public and private offices etc.

Chrys Fernandes (DuPont Water Solutions): Yes, as I said earlier, much more awareness is the need of the hour. It has to be an ongoing effort, for it to become a habit. To give an example, from the 150-200 liters, on an average, used by an adult, almost 25% is wasted in toilets and 20% on showers, which goes straight into drains and can be utilized for a few chores, in the domestic water cycle. There is a lot of work going on, in this

600 GPD Water Treatment & Storage Plant at Facebook India, Gurgaon

regard, at the global level. Several governments, social entrepreneurs, and the brightest minds are working towards this initiative and in finding easy-to-implement solutions for reusing and recycling water.

Dharmendra Pratap Singh (Voltas): Yes, the public at large needs to be made more aware of the importance of consumption of water and proper awareness can be fostered through campaigns, practices and systems for the public. All citizens have the opportunity to create and ensure sustainable use of water, through small changes like implementing efficient water management practices and systems within their properties that provides/promotes sustainable use of water throughout the project's lifetime. Acknowledging the responsibility towards the environment, it is high time for individuals and businesses alike to ramp up efforts towards water conservation and leave behind a greener future for the coming generations.

Dr Indra N. Mitra (Cambi India): The awareness levels are at an acceptable level. However, more knowledge, education and training need to be given for selection of right technology and saving more water.

Dr SK Jain (Ground Water & Mineral Investigation Consultancy): General public, particularly farmers, are still unaware about the benefits of three R's. They need to be made aware through local panchayats, village schools and forming special groups for this purpose.

Syamal Sarkar (The Energy and Resources Institute): Not every stakeholder is aware of the need for three R's. Some industries are aware of the three R's due to regulatory mandate. The agriculture sector is mostly unaware of the importance of for the three R's, so is the case with domestic sector. There is a need to increase awareness, at various levels, on the subject.

9. GOING FORWARD, WILL THE ADOPTION OF THE THREE R'S GAIN FURTHER STRENGTH BOTH BY THE INDUSTRY AND PUBLIC AT LARGE?

Amit Vaidya (Xylem): India's or even the world's water supplies are not endless and thus conservation is an essential, even in places where you might think water seems abundant. We, at Xylem, are committed to conserving water resources.

When conservation efforts like recharging local water bodies, rainwater harvesting, and more will address the supply side of the issue, smart water management solutions is what will address the demand side of it. With Smart City mission among the major government initiatives, we hope to enable wider and quicker adoption of smart water management solutions by urban and other local bodies across India as there is an urgent need for a transition from the 'supply-and-supply-more water' impulse and approach of today to a more realistic and effective initiative

Lack of access to clean water always has a greater impact on the poor. Not only is the water crisis increasing the vulnerability of the country's poor, it is also placing additional stress on an already overloaded health system.

Mohammed Naser Azeez (Aquality Water Solutions)

that address both the supply and demand sides and not just one.

Anand Iyer (Forbes Marshall): Right now the three R's are getting implemented in all industries. Some industries are focusing towards being water neutral. I am connected with many industries like metal, mines, textiles, food and beverages, power and so on and I have not come across a single sector that is not focussing on water as a subject. For the larger public, in urban areas/metros adoption of the three R's is becoming mandatory.

Dr Anil Kumar Mishra (Delhi Jal Board): Yes, the adoption of the three R's will gain strength going forward. This is so because after after proper implementation of three R's, there will be sufficient quantity of good quality water for industries and consumers. The visible benefits of the adopting the three R's will also encourage naysayers, to adopt them.
Ashish Rajendra Mishra (Lars Enviro Pvt Ltd): Yes, I feel that once the adoption of the three R's gathers strength, going forward, it will be beneficial both for the industry as well as for the public at large, and ultimately next -generation future will be secure.

Chrys Fernandes (DuPont Water Solutions): The policy interventions and strict implementation have vastly reduced industrial water wastage - the mandatory filtration before draining stops the release of toxins and effluents into the environment. However, communities have been slowly adopting the 'three R's.' I am hopeful that we will witness a transformation with the 'Smart Cities' initiative. Today, residential units adopt the circular approach of reusing water multiple times, to reduce their dependency on fresh water. We are working with several partners globally to offer commercially viable and sustainable solutions. Through their human waste management solutions, one of our customers - Banka BioLoo, in Hyderabad, provides water, sanitation, and hygiene infrastructure to the residential societies. Multiple interventions are simultaneously going on from both - industries and communities - which is a positive sign, and we hope the momentum continues. Urban migration is putting unprecedented demand on resources, especially water. With IoT, Big Data, and AI, wastewater infrastructure can be improved dramatically to ensure efficient, sustainable water management and water security.

Rangarajan Ramaswamy
Area Sales Director
Grundfos India

With the advent of sustainable technology, the water sector today is thriving with innovations for intelligent water management.

Dharmendra Pratap Singh (Voltas): Yes, it will strengthen, but it is also necessary to follow other practices apart from the 3Rs's for the conservation of water. Communities along with Government bodies need to address issues like, how to make their water utility systems more resilient, especially during times of natural disasters and the usual changes in weather patterns. Some of the solutions to meet the prevailing challenges include:

- An intelligent end-to-end water network that helps to improve productivity and efficiency of water along with enhancing customer service.
- Technology advancement in treatment of raw water as well as waste water is vital to improve operations and reduce costs. Use of advanced technology can help capture institutional knowledge and smoothen the transition to advanced technologies.

Energy recovery has become important for wastewater treatment. It enables utilities to produce more recoverable energy and helps solve disposal challenges such as keeping FOG (fat, oil and grease) out of sewer systems and waste organisms out of landfills.

Dr Indra N. Mitra (Cambi India): Yes.

Dr SK Jain (Ground Water & Mineral Investigation Consultancy): Definitely adoption of three R's both by the industry, general public and farmers will help in realizing their full potential.

Syamal Sarkar (The Energy and Resources Institute): Yes, the water resources will be saved through the use of three R's by various stakeholders.

10. DO YOU FORESEE FURTHER SCIENTIFIC DEVELOPMENTS THAT WILL MAKE ADOPTION OF THE THREE R'S EASIER AND SIMPLER BOTH BY THE INDUSTRY AND BY THE PUBLIC AT LARGE?

Amit Vaidya (Xylem): Everyday new developments are being made to enable water conservation. India's average NRW as per data is 38% but could be as high as 40-50% and this is way above the global average range of 30% to 35% according to the World Bank, and almost a third

of 100 cities qualify as high-risk zones by 2050. With deteriorating water infrastructure, increased operational costs, and reduced revenue, water utilities might soon find it challenging to balance the demand-supply in cities, in the years to come without newer means to combat it.

Dr SK Jain
Chairman cum MD
Ground Water & Mineral Investigation Consultancy (GWMICC) Pvt Ltd.

Improved technology would give better results in addition to the three R's already in use by industries.

The first step in addressing non-revenue water is ensuring accurate meter readings. To help address these issues, Xylem offers with its brand Sensus a range of metering, measurement, communications and analytics solutions. We help remotely identify sources of non-revenue water via Sensus software, provide revenue assurance with accurate billing and enable proactive customer service, alert utility via alarms to potential acts of unauthorized use, identify areas to reduce flow rate for water leaks and bursts with pressure management and enable and bolster regulatory compliance and water loss programmes.

Anand Iyer (Forbes Marshall): We need to make data visible which will give clarity to all. There are devices like flow restrictors, leak detectors, efficient faucets, household equipments that use less water. Visibility of data will made adoption of the three R's easier. From the industry stand point, newer technologies in cooling towers, chillers and so on will achieve the desired results with less water consumption. Proper measurements, continuous monitoring, analysing water consumption data, empowers us to take corrective measures to achieve optimum water usage.

Dr Anil Kumar Mishra (Delhi Jal Board): Yes, I definitely see such a scenario becoming a reality, in future. In present day, we have seen how developments in science have made our lives easy and fast compared to earlier days. I feel the same would be applicable for adoption of 3 R's. I feel it is going to easier and simpler, to adopt them, in future.

Ashish Rajendra Mishra (Lars Enviro Pvt Ltd): Technology is developing very fast, in every sector which is easy in installation and operation. The industry and public both are now techno-savvy. The technology is making life simpler and comfortable. Therefore, I feel, going forward, the adoption of the three R's will be easier and simpler for industries and the public.

Chrys Fernandes (DuPont Water Solutions): There is always a scope for improvement. Customers had to choose between performance, durability, and economic viability in the past. Today, with technological advancement, it is easier for both the industry and direct consumers to find the perfect balance between high performance, sustainable water solutions, that is for the long-term and at the same time is cost-efficient. All these make adoption of the three R's easier.

A proof of this is in our next-generation FilmTec™ Prime RO industrial portfolio technologies. They reduce energy consumption by ~20% while improving the permeate quality by ~60% for brackish water. DuPont Water Solutions bring higher performance efficiency and take businesses closer to their sustainability goals. Since they are compatible with existing systems and improve membrane durability by several years, these solutions are financially attractive as well.

Dharmendra Pratap Singh (Voltas): Rapid urbanisation, rising consumer demand and emerging digital technologies urged the water industry to embrace the changes of the new decade. Some of the technologies that will prevail in the next era of water environment include satellite remote sensing-based irrigation monitoring and decision-making platform for governments.

This brings us to the next question i.e. **how can digitization and futuristic**

3672 FRP Pressure Vessel for Industrial RO Water Purification System installed in Le-Meridien

technologies, in the water sector, change the world for the better? The answer to this is that digitization will profoundly impact the water sector, including its infrastructure and the services it provides. It has been observed that better and efficient investments were made in the IT and asset management projects and that has made it easier to develop data-driven strategies for the water industry. Secondly, using futuristic technologies in the water sector can help in automation of various processes, improve maintenance response and therefore decrease water dispersion and wastage.

Dr Indra N. Mitra (Cambi India): Yes.

Rangarajan Ramaswamy (Grundfos India): With the advent of sustainable technology, the water sector today is thriving with innovations for intelligent water management. However, the inefficient infrastructure that exists might make it difficult to install such solutions. Development of advanced solutions that can be retrofitted to both existing as well as new infrastructure will make it easier to adopt such solutions. Grundfos is already offering products and solutions that can be customized and installed as per the customer's requirement, regardless of the state of existing infrastructure.

Dr SK Jain (Ground Water & Mineral Investigation Consultancy): Yes. Going forward, innovative techniques and further scientific developments will improve the efficacy and adaptability of the three R's by general public as well as the industry.

Syamal Sarkar (The Energy and Resources Institute): Yes, new technologies are being developed for sewage treatment. For example, in case of municipal sewage treatment and industrial sewage treatment, the Department of Science and Technology (DST) and TERI have developed TADOX Technology for waste water treatment. The TADOX technology involves use of nanotechnology and less use of chemicals in the overall treatment, needing to low levels and non-toxic sludge.

Such technology could also serve as decentralized waste water treatment technology. Adoption of such technology will help in advancing the progress of the three R's in a big way.

11. WHAT MESSAGE DO YOU WANT TO GIVE TO RELEVANT STAKEHOLDERS REGARDING JUDICIOUS USE OF WATER, IN ADDITION TO THE THREE R'S?

Abdul Rahman Mohammed (Sahara Industry): Water is at the core of all human activities, as it is comprehensively linked to survival of all living beings on earth. The proportion of people without access to safe drinking water and sanitation is growing, as we are adding about 3,85,000 human beings to the world population every day.

In February 2022, the government revealed that 30% of wells monitored by the Central Ground Water Board (CGWB) have seen groundwater depletion. This could further aggravate the water shortage issues in India.

Rangarajan Ramaswamy (Grundfos India)

The stress on water is for real to an extent that 100-300% of water that is recharges is withdrawn. This has resulted in decline of water levels to the tune of 1-3 metres per year. This has rendered close to 21 cities of India on the verge of Day Zero.

Dr SK Jain (Ground Water & Mineral Investigation Consultancy)

Water supplies are under tremendous pressure as population growth, climate change, pollution, and changes in land use affect water quantity and quality. To address the existing and anticipated water challenges, water utilities across the globe are working to increase water reuse and are seeking alternative sources of generating water. Water reuse is the use of treated wastewater or reclaimed water for purposes such as drinking, irrigation, or industrial use, is gaining momentum and is being touted as the best possible option that can help in addressing water scarcity concerns and augmenting water supplies. We have to seriously think about use of fresh water in agriculture and industrial sectors. We must try to build a consensus for use of treated water in these two core sectors that consume almost 90% of the total fresh water withdrawals. Further, water conservation needs to be done even at the municipal level and rainwater harvesting, so that aquifers get recharged, need to be made obligatory.

4000 LPD 6 stage Drinking water plant for Amazon Campus, Hyderabad

Amit Vaidya (Xylem): Water is treated as a social issue in India and most of the time, it is free or given with minimal charges and with relatively higher NRW figures, things get more complex. The biggest challenge for the water network is NRW (Non-revenue water). The sources of non-revenue water include Main leaks and storage tank overflows, Unauthorized use (theft and tampering), Unbilled consumption and meter inaccuracy, Unmetered consumption and Leak adjustments and bad debt. NRW can also have a serious impact on operational expenses for utilities. Smart metering technology can provide a solution to reduce it, thus helping in the first and foremost step in 3R's - REDUCE.

A smart water future needs collaborations and private sector partnerships. With India's water sector requiring investment worth US$ 13 billion, the major factors that will drive this demand will be increasing water consumption, aging infrastructure resulting into water losses, utilities focusing on reducing non-revenue water, supportive Government policies and the need for improvement in water utility usage and efficiency.

Anand Iyer (Forbes Marshall): Contextual awareness with data visibility is the key to the success of the three R's. Automation empowers us to analyse real time data and take corrective measures. I have seen that industries are taking advantage of automation. Industries should work towards upgrading their current processes with latest technologies. This will help industries to look at reducing their cost input of providing those utilities. There are many smart city projects that are addressing the 3the three R's. The larger public must look at protecting the environment around the areas they dwell.

Dr Anil Kumar Mishra (Delhi Jal Board): I would like to make a suggestion to all stakeholders that, in the first place, everyone needs to respect water. We need to understand that water is 100 per cent natural and there is no substitute for it. Use it judicially and in a sustainable manner, so that our future generations have sufficient quantities of potable and wholesome drinking water. If we do not use and maintain, the water that we use properly, significant section of the population may not get good quality of water in coming decades. One needs to remember that many organisations have been issuing warnings, from time to time, concerning water scarcity and deterioration, in its quality. So for proper conservation and management of water, adopt various technologies required for reduction of NRW (non revenue water), adoption of rainwater harvesting, reduce, recycle, respect, reserve and reuse of water.

Chrys Fernandes (DuPont Water Solutions): Water is life, and behavioral change is at an individual level and in the society. Countries must cooperate on water management because most problems arise

FRP Pressure Vessels of Different Capacities

from human activities. Water is a limited resource, and access to clean water and safe sanitation are connected to human existence. There still might be hope with sufficient political and financial assistance and strict implementation of the 'every drop counts' attitude.

Dr Indra N. Mitra (Cambi India): We need proper management of water, selection of right technology, training, education and knowledge sharing. Professionals should attend conferences and seminars globally to see how their plant performs with respect to other firms.

Mohammed Naser Azeez (Aquality Water Solutions): Water scarcity is a growing concern in many countries, including India, due to rapid population growth, growing urbanization trends, changing life styles and the associated increasing demand for water. The increasingly variable water supplies resulting from climate changes and global warming are other alarming challenges. Due to the economic costs of large-scale investments, in building infrastructure for water supply, together with the significant time required for planning and implementation, governments' are increasingly using policy measures to regulate urban water demands. Aquality Water Solutions has been promoting judicious use of water with modern and technologically advanced systems and processes, including water-saving devices and water conservation approaches, in residential and institutional water systems. We must understand that water is a finite resource and unlike energy and oil, it has no alternative. The demand for water is likely to surge in the next few decades and with unsustainable practices, it will be very difficult for us to make provision for drinking water and if we do not take a call now, we may be forced to import water like the oil and gas.

Dr SK Jain (Ground Water & Mineral Investigation Consultancy): I strongly advocate judicious use of crop yields with less water. Since, this sector is the main user of water, improved technology would give better results in addition to the three R's already in use by industries.

Subhash Sethi (SPML Infra): Risks related to water increasingly affect political and social stability and also dampen a country's economic growth thereby impacting its gross domestic product (GDP) and individual incomes and much more areas, thus demanding urgent and determined action. The United Nation's Sustainable Development Goal targets 6.1 calls for universal and equitable access to safe and affordable drinking water for all. The target is to provide safely managed drinking water services that are located on the premises and is free from any contamination.

Subhash Sethi
Chairman
SPML Infra Pvt Ltd

We need to consider an integrated approach to water supply and wastewater management, in the country, that is both reliable and financially sustainable.

The World Bank promotes a systematic approach to water resources management, incorporating water resources planning and management along with appropriate wastewater management into policy discussions as essential elements in an integrated scheme. The policy makers in India, need to think seriously about it as very large quantity of generated wastewater, both domestic and industrial, are being disposed into water bodies without any health and environmental considerations.

SPML Infra has been advocating for judicious use of fresh water sources for all stakeholders and that includes the agricultural and industrial sectors, with a conscious and integrated approach. In all large water supply systems, there need to be mechanisms for monitoring, review, and room for adjustments (over time) as per requirement to make it beneficial. Some of the steps that could be considered while moving forward with the approach could be:

- establish a lead organization and involve all stakeholders
- identify broad goals
- define specific, measurable objectives
- formulate and assess possible strategies
- select the preferred strategy, and then implement and monitor it.

Syamal Sarkar (The Energy and Resources Institute): Water resources are critical for life and these resources are finite. Increasing use of water resources by various stakeholders is putting a lot of pressure on the existing water resources. We need to save water and the three R's are a right step, in that direction.

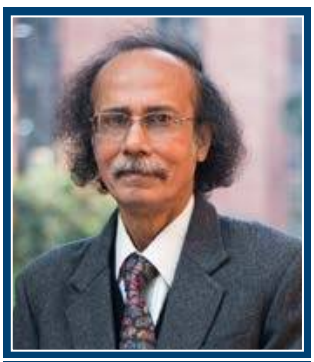
12. AS THE KEY PLAYER IN THE INDUSTRY, DO YOU SEEK ANY SUPPORT FROM GOVERNMENT, IN TERMS OF POLICY INITIATIVES? DO

YOU WANT THE POLICY MAKERS TO DWELL ON CERTAIN KEY ASPECTS, IN THE SECTOR?

Abdul Rahman Mohammed (Sahara Industry): Technological advancements now make it possible to treat wastewater for a variety of reuse operations. With fresh water sources declining fast, we have to move towards reuse of wastewater, source separation and treatment of separated effluents for resource recovery. All the more attention from stakeholders is needed and government should make arrangements with relevant policy reforms and allocation of adequate resources for this to become a reality.

Administration at the city level, needs to plan for implementing pilot projects, at the local level, for use of treated water, for all their non-potable purposes, and making fresh water available only for drinking purposes. In a conscious decision, Sahara Industry, has adopted modern systems and processes that are helpful in cleaning unsafe water to make it pure and safe, while at the same time not wasting much of it, in the entire process. With high quality products and excellent service standards, we have the crucial technical expertise and in-depth understanding of the water sector to offer our best integrated and strategic approaches to industrial and municipal water and wastewater treatment systems which are aligned with environmental consciousness.

Amit Vaidya (Xylem): India needs more cities to understand, adopt, and retrieve the benefit of digital water infrastructure. As the government continues to take efforts and encourage the use of digital technologies, artificial intelligence solutions in water management, such bodies and initiatives will need financial assistance to accomplish them. Water industry leaders have developed readily-available tools and technologies such as advanced metering infrastructure, real-time decision support systems, and digital asset management to help utilities with most accurate data and insights, empowering them to arrive at better decision making. However, to deploy them in Indian cities, equipping the old pipeline networks and distribution system will need to come under the government initiatives. The water crisis demands new legislation be drafted and implemented by state governments in India to conserve water. Without that, the burden to solve the problem will be on the consumer alone. We hope the initiatives of the central government will definitely help in improving the water distribution network and reduce the NRW.



Syamal Kumar Sarkar
Distinguished Fellow & Senior Director - Natural Resources and Climate Programme
TERI (The Energy and Resources Institute)

For implementing the processes related to the three R's, there is a regular need to build capacity of various stakeholders.

Ashish Rajendra Mishra (Lars Enviro Pvt Ltd): Integrated Water Resources Management (IWRM) is a process that "promotes coordinated development and management of water, land and related resources, to maximize the resultant economic and social welfare, in an equitable manner without compromising on the sustainability of vital ecosystems." Managers, whether in the government or private sector, have to make difficult decisions with regard to water allocation. It has been seen that over the years, due to increasing pressures on water, managers have been reducing as against ever-increasing demand. Changes in climate create an additional stress on water. The traditional fragmented approach is no longer viable and a more holistic approach towards water management, is essential.

This is the rationale for the IWRM approach that has now been accepted across the globe, as the way forward for efficient, equitable, sustainable development and management of the world's limited water resources and for coping with its many conflicting demands.

Dr Indra N. Mitra (Cambi India): Water Industry is largely driven by government policies and regulations. So a large number of policies can be initiated to help the industry. This will be industry specific. A knowledge platform and certification process will help. Have worked on developing US EPA water programmes and can share various ideas. India needs to focus more on quality, frequent monitoring and penalizing those who violate those norms.

Mohammed Naser Azeez (Aquality Water Solutions): With water scarcity

Around 65% of India's total water demand is met from groundwater sources, which play an important role in shaping the nation's economic and social development. However, one needs to remember that the groundwater, in the present day, is at a critical stress level, especially with increasing number of aquifers reaching unsustainable levels due to their over exploitation.

Subhash Sethi (SPML Infra)

threatening lives and livelihoods, governments should consider adopting the three R concept for recl amation of all generated wastewater through proper treatment and reuse it. There should be a mandate to use only recycled water for irrigation and industrial purposes. Another important consideration is required in terms of water pricing, as it is mostly free or charged minimum in urban India that results is wastage and unsustainable usage. Appropriate water pricing is one of the economic instruments in optimal water allocation and increasing efficiency. When it is free, it fails to find its true value and requirement to recover costs of production and supply. Consumption based tariffs should form the basis of charging while flat rates should be discouraged.

There needs to be a thoughtful and planned initiative to address the high level of unaccountability for water (UFW). The UFW in many Indian cities is as high as 50% or even more, while the acceptable level is about 15%. Aging infrastructure tends to loose water in the distribution network with leaks, pilferage and theft and poor cost recovery has rendered most of the water utilities, in the country, financially unsustainable. Water pollution is a major issue concerning health and it is an increasingly dangerous problem affecting people and production. There should be a focused approach to minimise the pollution level, in surface and ground water sources, by building up wastewater treatment plants, in all towns and cities, with reuse facilities.

Rangarajan Ramaswamy (Grundfos India): While there are active conversations on the three R principles, India has a long way to go in terms of executing it, at every level. Wastewater treatment and reuse initiatives can be accelerated across India. While policies are rolled out for mindful discharge of wastewater, we also need to implement them aggressively. For instance, a penalty system for harmful and irresponsible wastewater disposal can encourage industries and individuals to adopt water recycle and reuse.

In order to ensure holistic operations of wastewater networks, we need a stronger emphasis on adopting sustainable technologies, that offer optimal water and energy efficiency. For a system's long-term efficiency, it is essential to consider the overall productivity of solutions rather than the initial cost of investment. Products selected based on the efficiency of their lifecycle costs will benefit the entire system with longevity in operations and effective return on investments. Therefore, tenders for water and wastewater treatment solutions need to prioritize system efficiency and lifecycle cost over the least cost method.

Dr SK Jain (Ground Water & Mineral Investigation Consultancy): I

2587 MLD Pumping House for SAUNI Yojana Phase-1, Gujarat

Bisalpur Jaipur Water Supply Pipeline

had the opportunity to work in the water sector for the past 45 years, both in the public and private sector and would like to work towards bringing awareness, about water, both in the scientific as well as general community through national and international seminars, conferences and so on. I would also like to be involved in implementing concepts of water conservation and management, within and beyond the fences.

Subhash Sethi (SPML Infra): We need to consider an integrated approach to water supply and wastewater management, in the country, that is both reliable and financially sustainable. Improved cost recovery by adopting a systematic approach towards wastewater treatment and resource recovery with complete reuse facility should be made mandatory. I would suggest that the following steps may be considered to improve water sources and proper management in the country:

- encourage private participation and provide adequate financial resources for building better water and wastewater infrastructure
- modify the National Water Policy (2012) so that it emphasizes on re-use of treated wastewater and reduction in groundwater extraction. Industries shall be required to adopt innovative water efficient technologies to reduce dependence on ground water sources
- water audit could be made mandatory for industries extracting large quantities of groundwater and that they should adopt appropriate technologies and practices so that it leads to reduced extraction of ground water.
- expand funding for water source development, sewerage networks and sewage & effluent treatment plants under dedicated schemes and resources.
- increase technical and financial assistance to water utilities and municipal corporations to manage public private partnership (PPP) for both water supply and wastewater treatment and reuse projects.
- water industry should be supported for taking up projects for reduced water loss, improvement in non-revenue-water (it is the water that has been produced and is "lost" before it reaches the customer) and helps in recharging groundwater. A watershed approach, integrating research, monitoring, data base implementation and management will also be helpful.
- create a national regulatory framework and institution to oversee management of water resources. Such framework will take care of disputes related to water and pricing of water on pan India basis.
- upgrade planning capacity by engaging town planners, water experts and environmental engineers to develop plans for sustainable water supply, management and expanding sewage collection and treatment networks.

There is a declining trend, in the availability of water, due to pressures from high population growth and rapid urbanisation. According to NITI Aayog 2019 India's water demand by 2030 will be twice the available supply. In the agricultural sector, which uses significant water resources, there is low efficiency in the use of water.

Syamal Sarkar (The Energy and Resources Institute)

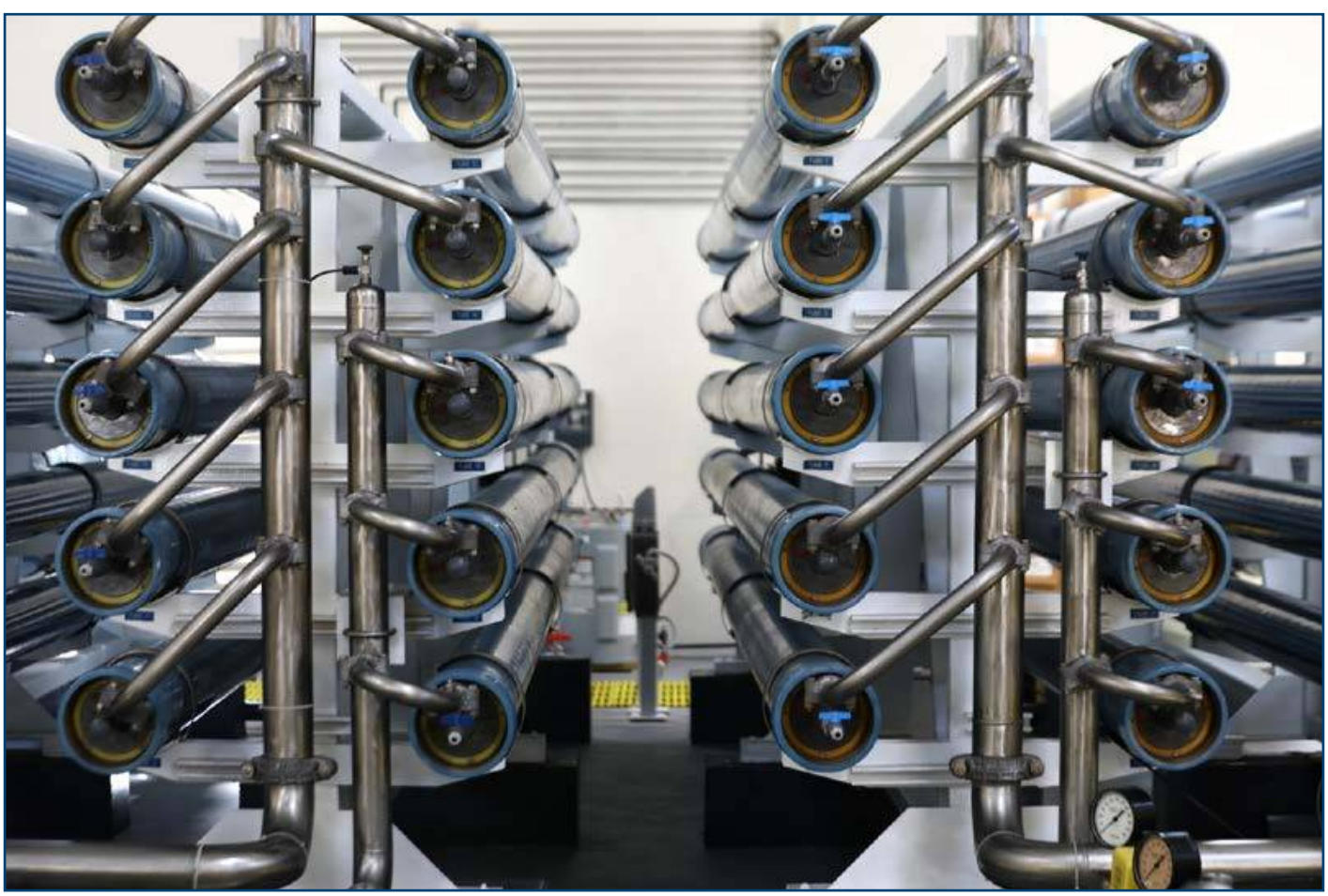
- efficient irrigation practices to be adopted by farmers with water-use efficiency and provide them incentives for adopting innovative technologies to save water.
- improve water governance system that is based on participation of relevant stakeholders.
- capacity building programmes at all levels with clear objectives and monitoring systems with the use of technology
- there should be a mission mode approach intended to improve water availability in water stressed regions, in the country
- conservation of river, dams, and other water bodies should be undertaken in a scientific manner and their survival should be restored to the extent that is feasible and that it can be maintained properly.
- enact suitable legislation that deals with ground water, that regulates its extraction and aids its developed. Such legislation needs to be implemented homogenously across the region.

Meanwhile, other challenges that the government can look into and improve upon are things like inordinate delays in land acquisition, regulatory bottlenecks, statutory clearances, shortage of skilled manpower, timely availability of materials, control rising cost of raw materials, financing issues (difficulty in getting long-term loans and working capital), absence of cost-effective technology, lack of technical expertise, operation & maintenance (O&M) of water supply systems and so on.

13. AS A KEY PLAYER IN THE WATER INDUSTRY HOW HAS YOUR JOURNEY BEEN IN THE FIELD OF WATER CONSERVATION, ESPECIALLY IN YOUR FIELD OF WORK?

Anand Iyer (Forbes Marshall): The government already has its hands full. There are many projects in the pipeline that would provide water in remote areas. The water industry has an open mindset towards adapting to latest technologies and it is evident when we look at the ongoing projects.

Policy makers must analyse the data pertaining to water and come out



Island Water Sanibel FilmTec horizontal 477A1917

BENEFITS OF THE RAINWATER HARVESTING SYSTEM

- it improves the quality and quantity of groundwater.
- it reduces soil erosion, stormwater runoff, flooding, and pollution of surface water with fertilizers, pesticides, metals and other sediments.
- promotes sustainable processes that help in preserving water for future needs.

Here I would like to speak about rooftop rainwater harvesting, where the rooftop becomes the catchment, where the rainwater from the building and house is collected. The components of rooftop rainwater harvesting are:

- first, flush.
- transportation.
- catchment.
- filter.

For example, if your house or office rooftop area is 1,000 sq. m and the average rainfall, in the area, is a minimum of 300 millimeters in a year then

The total quantity of water to be collected (m3) = Roof Top Area (Sq. m.) x Average Monsoon Rainfall (m) X 0.8

The total quantity of water to be collected (m3) = 1000*0.3*0.8
= 240 m3 (240,000 Litres)

Ashish Rajendra Mishra, Senior Manager - Process, Lars Enviro Pvt Ltd

The concept of three R's has been more relevant for municipal solid waste management, for many years. However, the stress condition of fresh water sources has forced us to implement the three R strategy for liquid waste management as well.

Abdul Rahman Mohammed (Sahara Industry)

with benchmarks like X litres of water per person per day, Y m3 of water per industry for their production.

Dr Anil Kumar Mishra (Delhi Jal Board): DJB is a key player in the field of water and waste water treatment. We are also into proper management of water and we keep adopting advanced and sophisticated technologies related to conservation of water, rainwater harvesting, rejuvenation of water bodies, recycling of used water. Being a member of the DJB family since August 2007, I regularly promote mandates of DJB at various platforms.

Ashish Rajendra Mishra (Lars Enviro Pvt Ltd): We have started our journey from industrial wastewater treatment. Initially, we focused on highly polluted wastewater and provided an anaerobic treatment process, which generated biogas (that was utilized as fuel for boiler or power generation) and treated water. As per the future need, we implemented four R's. the four R's being reduce, reuse, recycle and recover. To explain it further. We need to reduce the waste at the source, reuse it after segregation, of the waste as per the demand, recycle the treated waste for it to be utilized it as a resource and finally recover salts or ions from the waste. We have to increase our basket as per the market demand and provide solutions like from waste to energy, wastewater treatment, water treatment, solid waste management, compressed biogas (CBG), operation and maintenance, expert technical solutions, built own operate transfer (BOOT) basis and so on.

Chrys Fernandes (DuPont Water Solutions): The government has taken up many sustainability initiatives, though we feel that dedicated water conservation and reuse policies can be introduced. Besides, stricter implementation could also give this the required necessary thrust.

Syamal Sarkar (The Energy and Resources Institute): For water conservation there is a need to involve various stakeholders. TERI in association with Editorji and UNDP-India launched a six month digital media campaign on water titled, 'PAANI: CONNECTING THE DROPS', for saving water, which ended on 22nd March 2022 (The World Water Day). TERI has also awarded "Water Sustainability Awards" under individual category and under institutional category, to water champions and those who are adopting the three R's. These awards were given to organisations and people working, in states, in the industrial sector, for many years.

14. DO YOU USE RAIN WATER HARVESTING AS A MEANS TO AUGMENT YOUR SUPPLY? IF YES, PLEASE ELABORATE YOUR JOURNEY IN THIS REGARD?

Dr Anil Kumar Mishra (Delhi Jal Board): Yes, we are using rainwater harvesting techniques, as a means to improve the quality and quantity of surface and ground water. By adopting these techniques, we augment more water in our supply system, which means consumers will get sufficient quantity of potable and wholesome drinking water required for their day-to-day activities.

Ashish Rajendra Mishra (Lars Enviro Pvt Ltd): Rainwater harvesting system is one of the best practiced methods and is followed to support conservation of water. Today, scarcity of good quality water has become a cause of concern. However, pure rainwater of good quality can be used for irrigation, washing, cleaning, bathing, cooking, and also for other livestock requirements.

The benefits of the rainwater harvesting system are

- it improves the quality and quantity of groundwater.
- it reduces soil erosion, stormwater runoff, flooding, and pollution of surface water with fertilizers, pesticides, metals and other sediments.
- promotes sustainable processes that help in preserving water for future needs.
- Here I would like to speak about rooftop rainwater harvesting, where the rooftop becomes the catchment, where the rainwater from the building and house is collected. The components of rooftop rainwater harvesting are:
- first, flush.
- transportation.
- catchment.
- filter.

While a United Nations, 2016 World Water Development report, estimates that about 30% of water is being lost through leakage globally, in India, this could be as high as 40-50%.

Amit Vaidya (Xylem)

For example, if the rooftop in your place of work or at your house is 1,000 sq. m and the average rainfall, in the area, is a minimum of 300 millimeters in a year then
The total quantity of water to be collected (m3) = Roof Top Area (Sq. m.) x Average Monsoon Rainfall (m) X 0.8

The total quantity of water to be collected (m3)= 1000*0.3*0.8
=240 m3 (240,000 Litres)

Dr SK Jain (Ground Water & Mineral Investigation Consultancy): Yes, certainly rainwater harvesting is a very simple and effective means to increase underground water availability and improve the quality of ground water.

Syamal Sarkar (The Energy and Resources Institute): Yes, the source of water is monsoon rain and melting of glaciers. In India, monsoons last for just about four months. If the rain water is not harvested, it is wasted. Although ground water is also recharged. Even Narendra Modi, Prime Minister of India, has given a call for rainwater harvesting, to various stakeholders, including the states.

15. HOW IMPORTANT IS IT TO REGULARLY UPSKILL YOUR MANPOWER? HOW PROACTIVE ARE YOU IN PROVIDING TRAINING TO YOUR EMPLOYEES? WHAT MEASURES HAVE YOU TAKEN TO TRAIN THEM, ON A REGULAR BASIS?

Dr Anil Kumar Mishra (Delhi Jal Board): Training is an important tool for development of competency among staff members, working in various departments like quality control, process control of WTP/STPs, quality surveillance monitoring systems, disinfection systems in various installations and so on. At DJB, we regularly conduct training programmes, of different departments, either at our training centre by internal/external faculties or at other national laboratories and organizations.

Ashish Rajendra Mishra (Lars Enviro Pvt Ltd): The professional world around has changing rapidly and will do so even more, in the future. As a professional, one needs not only to keep up with these changes but also be ahead of them. Even if you think the experience you are gaining, in your job, is gratifying and useful, it is certainly not adequate to shield yourself from the rapid pace of change that can make you redundant. Upskilling to future-proof your career is vitally important. At the most basic level, upskilling involves keeping abreast of the latest changes at work (technology, processes, domains, businesses avenues and so on), and participating in internal trainings to keep pace with change. As a proactive measure, it would mean researching a little more, on the subject, to get an idea of how the broader market and industry are being impacted, and what are the additional skills required to counter this change. We enroll our manpower for extra studies (online or in-person) or register them for certification.

We have made it mandatory for all employees to attend at least two training programmes, in a year. One programme is for skill development and the other is for personality development. We also encourage our employees to join a professional forum so they can be in touch with relevant subjects. We organized an annual get together programme and organize team building games, which helps to build up a strong bond among the employees. We also made it mandatory for employees to join professional networking, sites and forums and cajoled them to be on social media, which can help in a big way, in brushing shoulders with the right people in the right communities, in the right domain apart from providing them inputs with regards upskilling.

It is very important to upskill scientific and general masses for adoption of new methods and means for augmenting water resources and their judicious use.

Syamal Sarkar (The Energy and Resources Institute): For implementing the processes related to the three R's, there is a regular need to build

Sripad Sagar Lift Irrigation Scheme, Telangana

capacity of various stakeholders. They should also know the latest technological advancements, in the field of the three R's.

16. INITIATIVES THAT YOU ARE TAKING TO DRIVE AWARENESS AMONGST YOUR EMPLOYEES OR THE SOCIETY AT LARGE?

Dr Anil Kumar Mishra (Delhi Jal Board): We regularly organize awareness programmes for our staff to sensitize and to make them aware about aspects that we feel, they should know. We are also taking steps to create awareness among customers. For this we take the help of various social media tools, in some cases we even do it telephonically or even through direct meetings. We also spread awareness and educate students of schools, colleges (engineering, MBBS, nursing, ITI, IIT and so on) either by conducting internship trainings or organizing visits to WTP/STPs.

Ashish Rajendra Mishra (Lars Enviro Pvt Ltd): First, we have to show, through our actions, than just our words. It is only after that people start believing in us. We need to understand the basic points of what we should do and how to do it. We have a focus on the three P model that makes drastic changes among employees and in the society. The three P model is focused on creating public awareness, ensuring public participation, and public movement, which can be done at the personal and professional levels with the help of documentation, awareness, and training.

17. HAVE YOU TAKEN ANY MEASURES TO IMPLEMENT THE THREE R'S AS A PART OF YOUR CSR (CORPORATE SOCIAL RESPONSIBILITY) INITIATIVES?

Amit Vaidya (Xylem): Although India's digital journey of water is gaining momentum, there still lies a blatant need for more constructive efforts and extensive collaboration within water industry stakeholders to accelerate this transformation, mitigate NRW concerns on the ground and create

a more sustainable environment for present and future generations. To address the biggest challenges of our time, we need to tap into the bold thinking of our youth. We at Xylem are for example offering programs like Xylem Ignite to engage with our customers, governments and young creative and innovative thinking people.

With our corporate social responsibility program *Watermark*, we, help strengthen communities facing the most severe water challenges, and we raise awareness of water challenges around the world through partnerships with non-profit organizations on sustainable development programs. We provide water-related disaster relief expertise, technology and equipment to communities in need. We seek to inspire the next generation of water innovators and stewards, and we mobilize our employees and stakeholders by creating volunteer opportunities to solve water and support social change. This increases social value in the communities we serve around the world. Our approach allows us to advance sustainability and have greater impact for all those we serve.

Dr Anil Kumar Mishra (Delhi Jal Board): Being a Government organization, DJB regularly conducts various programmes to create awareness programmes among staff members and consumers for successful implementation of the 3 R's and other mandates / social responsibilities assigned to DJB by the Govt. of India / Govt. of NCT Delhi. Detailed social responsibilities / activities have been already discussed earlier.

Ashish Rajendra Mishra (Lars Enviro Pvt Ltd): Yes, every year, we target a specific area and try to implement the three R's. We identify a village and focus on the poor farmers. We provided Gobar Gas Plant, Toilets

(Swatchta Grih), Water ATMs, Bicycles to girls, and delivered free lectures in colleges and institutions to create awareness among students. CSR is not mandatory in our case as we are a small organization. However, we consider our responsibility towards the society and try to serve the nation.

Chrys Fernandes (DuPont Water Solutions): DuPont Water Solutions is committed to uplifting the quality of life with customer-centric innovations. Our innovations promote healthy lifestyles, for our customers around the world. The pillars of our Sustainability strategy are Innovate, Protect, and Empower. We have implemented CSR initiatives with our "The Flow of Life" project to promote water science literacy and educate students of

all levels.

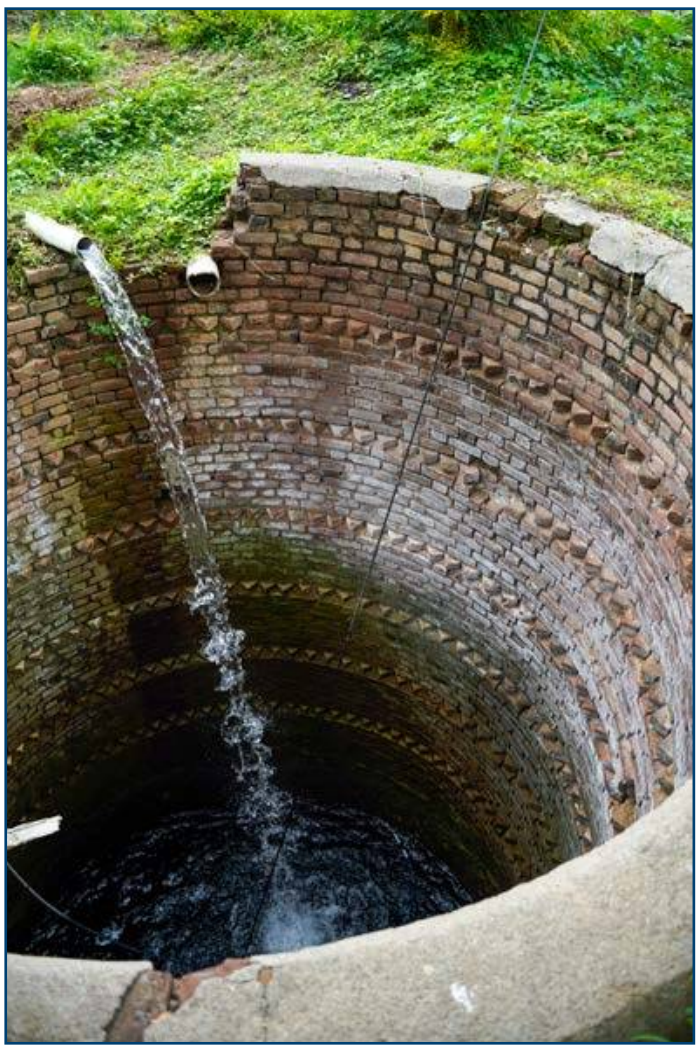
Dharmendra Pratap Singh (Voltas): At Voltas, we continuously prepare for the next. Our operations across verticals are conscious of the planet, either in the form of reducing carbon footprints, ensuring water security or taking steps towards a cleaner and greener India. Under the phase 2 of our Participatory Ground Water Management Project, six needy villages, in the perennially drought affected Beed District, of Maharashtra are covered through interventions for water resource management and sustainable agriculture activities. We are taking the initiative by actively contributing, and consistently moving forward to integrate sustainability in everything we do. We are consciously reducing, reusing, recycling and increasingly trying to reduce our carbon footprint. We have recycled more than 7,800 KL of water. As water is a precious resource, we are committed to utilising it judiciously while ensuring efficient water management.

Rangarajan Ramaswamy (Grundfos India): Recognizing the importance of waterbody restorations, Grundfos has been executing several such initiatives over the years. Grundfos has partnered with Cognizant, The Nature Conservancy, Care Earth Trust, and the Indian Institute of Technology (IIT), Madras to restore the 100-acre Sembakkam lake, in Chennai, Tamil Nadu. The project when complete, this year, will increase the lake's storage capacity by 50% and benefit over 10,000 households residing around the lake. In collaboration with the Environmentalist Foundation of India (EFI), Grundfos also rehabilitated the Annaikeni pond in Sholinganallur, Chennai. The activity improved the pond's water holding capacity by about 20%, catering to the needs of about 10,000 individuals directly and indirectly, within a radius of kilometer. Partnering with Hand in Hand India, Grundfos also helped in restoring a 2.5-acre temple pond, Gangai Amman Koil Kulam, off the East Coast road, in Injambakkam.

Dr SK Jain (Ground Water & Mineral Investigation Consultancy): Yes, we have seen companies like GSK (Now HUL), Nayara Energy, Reliance Industries, TATA Group, L&T and many more do lot of work in the field

This process (recycle and reuse of used water) will provide enhanced water security, health benefits, environmental benefits, social benefits, economic benefits and so on.

Syamal Sarkar (The Energy and Resources Institute)



of water conservation and recharge, including waste water management thereby adopting to the three R's as a part of their CSR initiatives.

18. HOW CAN DIGITIZATION AND FUTURISTIC TECHNOLOGIES IN THE WATER SECTOR CHANGE THE WORLD FOR THE BETTER?

Abdul Rahman Mohammed (Sahara Industry): Water utilities across the globe are under tremendous pressure to innovate and address the growing challenges posed by population growth, increasing demand, water scarcity and deteriorating asset health. Adoption of modern technology can accurately help analyse the demand-supply, predict flow volumes, availability at source and determine the next steps on a real time basis. The solutions will add intelligence to pumps, allowing automated processes to reduce manual work, remove latency, reduce breakdowns, and eliminate delays in enabling real-time decisions.

AI and ML have revolutionized our lives, but the water sector has been slower to adopt smart solutions than many others. Despite AI systems underpinning everything from power grid regulation to Google's search tools, water and wastewater services have only recently embraced data-driven technologies, mainly after safety protocols have been tightened after the pandemic. After years of lagging behind other industries, in adopting smart technologies, the waste water sector is making up for lost time, and is gradually adopting smart systems. however, the adoption has been slow, in India, compared to other countries.

Amit Vaidya (Xylem): Technology is promising real productivity gains in water and one key example is smart water itself. At the foundation of a smart water cycle is reliable and robust data delivered through a smart utility network. Connectedness is the norm of today. Advanced metrology and sensors, smarter end points, more bandwidth, stronger security and an exceptionally reliable network is what is available. Our Advanced Metering Infrastructure (AMI) solution provides this. We must have the right data at right time to make the right decisions to optimize smart water systems as needed.

Anand Iyer (Forbes Marshall): Digitization and newer technologies provide information to take corrective actions that help in controlling the usage of water without human intervention. They also help to keep all assets in their optimum working condition. To give an example, in detecting a pipe line leakage, detecting a malfunctioning valve or providing consumption data with alerts.

Chrys Fernandes (DuPont Water Solutions): New and upcoming technological developments are already playing a significant role in bridging the gap between availability of water and its efficient use. Innovative water systems use IoT-enabled sensors to collect real-time data that help monitor water distribution, detect leaks, and optimize water facilities. Farmers using AI for irrigation can increase efficiency in agriculture, freeing water for urban dwellers. Digitization is being used to measure moisture in tanks, check the speed in pipes, calculate waste within the system, and help with many other solutions in the demand and supply cycle.

These are only a few examples that I am citing. Water management goals

Increasing demand for water is putting tremendous pressure on water resources and to address this situation initiatives like innovative wastewater treatment, reclaim and reuse has become a necessity.

Subhash Sethi (SPML Infra)

can be reached when governments, industry, businesses, and ordinary citizens come together to deploy digitization, intelligent tools and systems.

Dr Indra N. Mitra (Cambi India): It will change the water sector drastically and will improve the process. For example, remote monitoring of treatment plants, even at the remotest of places will be a reality. This will ensure proper monitoring, improve process efficiency, save costs and will protect the environment.

Mohammed Naser Azeez (Aquality Water Solutions): Water utilities across the globe, are facing challenges with their aging infrastructure assets and retiring trained work forces. Though the past 10 years have seen significant change and new challenges, they have also brought the technology that water utilities needed to overcome, the rising obstacles. Digital new age technologies are finding its way into the water system with broader artificial intelligence (AI) that offers abundant rewards, from providing a holistic view of the water system to enhancing efforts to track consumption, drive efficiencies, save energy and prioritize investment thus increasing resilience and sustainability.

All this comes against the backdrop of intensifying efforts to embrace digitalization, data analytics, and AI, advanced simulation technologies such as digital twins - a real time digital counterpart of a physical object or process, using historical and current data to help predict asset performance, provide better insights and help with overall performance. While these new technologies have their own complexities, data-driven efforts boost efficiency and automate processes, ultimately providing the benefits of helping operations run more smoothly with fewer workers and create opportunities for more capacity enhancement, from the available resources.

Rangarajan Ramaswamy (Grundfos India): Digitizing the wastewater sector can propel advancement of how wastewater is treated and reused, in India. Technologies such as big data and data analytics can help in automating and improving the overall reliability and resilience of a wastewater treatment plant. With data analytics, wastewater treatment facilities can study data such as flow, pressure statistics, maintenance systems, safety checks, airflow, and many more, to understand the pattern of operations. Predictive maintenance is the major benefit of

big data, as it uses current and well as historical data and trends to predict potential problems or failures before they manifest. Predictive maintenance allows planning and maintenance without major operational impact or production losses. It also urges technicians and operators to improve processes, quality, and efficiency.

One such advanced solution is Grundfos' Demand Driven Distribution (DDD), which is an automated technology that runs real time diagnostics and provides water as per the need of the user. With the ability to supply water as per demand, this solution helps in reducing energy consumption and water wastage. DDD has a history of proven efficiency in the world. For example, a Cambodian water plant that supplied treated water, that was operated manually to 44,000 people. This led to pipe damage, non-revenue water (NRW) losses and wasted energy. When Grundfos' DDD was provided, the system began studying water consumption patterns of the village, thereby only supplying water as per the demand. This reduced any excessive and unwanted water supply, which automatically resulted in energy and water savings.

With intelligent and digitally connected pumps, every part of the wastewater treatment process, from intake to the final stage of distribution can be automated, thereby ensuring energy and water conservation. For instance, when a wastewater agency in the United Arab Emirates (UAE), emirate of Ras Al Khaimah was looking at upgrading their systems, Grundfos offered them iSOLUTIONS. With the Grundfos Remote Management solution, the operators were not required to manually control the system, allowing the system to perform real-time monitoring. This enabled a 20% reduction in energy consumption and a 12% savings in overall operational cost.

Grundfos' iSOLUTIONS and IE5 efficient motors can significantly reduce energy consumption, while also managing water efficiency in any given sector.

Subhash Sethi (SPML Infra): Water industry is in a transitionary phase as it has to embrace technological innovations like the other industries to so that it is capable to take on present and challenges that may come in the future. If one look at other industries, one can clearly see that they have adopted latest technologies, that have come their way, and are reaping their benefits. In comparison, there are a host issues, concerning the water sector that can be dealt with through innovation and employment of proper technologies. It needs to be noted that countries, across the globe are experimenting with technology, so that it helps them to address challenges faced by the water sector.

I feel that the combination of smart infrastructure and digital technologies will be helpful in addressing the challenges, faced by the sector. The Internet of Things (IoT) and the increasing use of devices that are connected to the Internet is central to this, as well as for advanced data analysis, machine learning (ML), and cloud computing.

Solutions powered by artificial intelligence (AI) and ML help in smart asset management, by analysing the probability of failure in aging infrastructure, thereby identifying areas that need improvement and repair which would help in improving the life and efficiency of the asset through timely intervention. It has been seen that such timely interventions typically lead to cost savings. AI also offers the potential to enhance service delivery, optimize investments, and reduce costs. It can improve the efficiency of water supply systems by maximizing information and data that would aid in making better operational and planning decisions. Big data and analytics techniques help in harnessing the data coming

With use of advanced technology and sustainable governance, wastewater can be treated to cater to meet many of the country's needs of water.

Rangarajan Ramaswamy (Grundfos India)

from different sources and provide early indications in areas like quality, abnormal consumption, reliable fault detection and optimized customer interactions. Drones on the other hand can be used for efficient execution and monitoring.

19. HOW CAN THE USE OF SUSTAINABLE AND INTELLIGENT TECHNOLOGIES BRING THE MUCH-REQUIRED CHANGE?

Abdul Rahman Mohammed (Sahara Industry): Smart water technologies are in focus globally, especially as new challenges are being faced by the water industry. The sector has faced with the twin challenge of countering water losses and severe to extreme water scarcity. Against this background, implementing smart water solutions, to improving reliable physical infrastructure that increases efficiency and aids in effective decision making, is essential. Use of tools like IoT devices and data analytics not only help in monitoring water activities and generate real-time data but they also help in better management of infrastructure while reducing non-revenue water as well.

Incorporation of digital technology along with inter-connected devices and systems are intended to achieve greater efficiency in day-to-day operations, decrease human intervention, have better control of water losses, reduce management expenses and improve other indicators like water footprint. Implementation of smart water networks combined with AMI leak detection techniques can majorly reduce the amount of revenue lost due to leakages and wastage, as well as water wastage at a macro level. With the new instrumentation option for water production, transmission, distribution, wastewater collection and consumer end-point, implementing these technologies can improve efficiency and reliability of water networks, that too with myriad options. Utilities need guidance on which technologies are most suitable to their needs and how they should be implemented.

Amit Vaidya (Xylem): Smart water is more than measuring the flow from storage to consumption. It's more than remote meter reads. It spans every part of the water cycle from sourcing to treatment to delivery to consumption to reclamation. With continuous innovation in advanced measurement and monitoring technologies, at Xylem, we enable measurement of pressure, temperature, level, flow, status and more across the water cycle networks. Our approach to sustainability centers on our belief that by providing innovative and reliable technology, solutions, services and expertise, we can help our customers achieve their sustainability goals and advance sustainability in communities

Fundamentally, wastewater reuse has to take into consideration the rapidly shrinking fresh water sources, increasing water pollution, adverse impact on environment, and health risks associated with it.

Subhash Sethi (SPML Infra)

across the globe. By deploying our innovative technologies and solutions, our customers mitigate water scarcity, reduce water losses and optimize water system assets to improve water affordability.

Anand Iyer (Forbes Marshall): In the real word we face dynamic situations, smart technologies model the ever changing dynamics and allows us to work at the best operating points of the assets. Such interventions will help us to manage the demand while conserving water. For example, data provides us information on pumping costs and taking cues from the same, we can reduce costs or undertake preventive and predictive maintenance works.

Chrys Fernandes (DuPont Water Solutions): Water management is a circular process, and stakeholders need to focus on water reuse and reclamation. RO forces industrial wastewater through membrane systems that clean and purify water safely for reuse and recycle, in the plant itself, or for release into the environment. Using our CCRO technology, more than 90% of wastewater can be reclaimed.

CCRO is a future-ready technology. It adjusts to water and operating conditions autonomously. The need for manual intervention is eliminated due to system intelligence. The inherent fouling and scaling resilience cuts maintenance costs by hal f, and lower energy consumption ensures rapid payback.

Dr Indra N. Mitra (Cambi India): It will bring a huge change in the industry by producing cost efficient and quality products and optimizing processes.

Mohammed Naser Azeez (Aquality Water Solutions): With a wealth of digital technologies available, water utilities can gather telling information

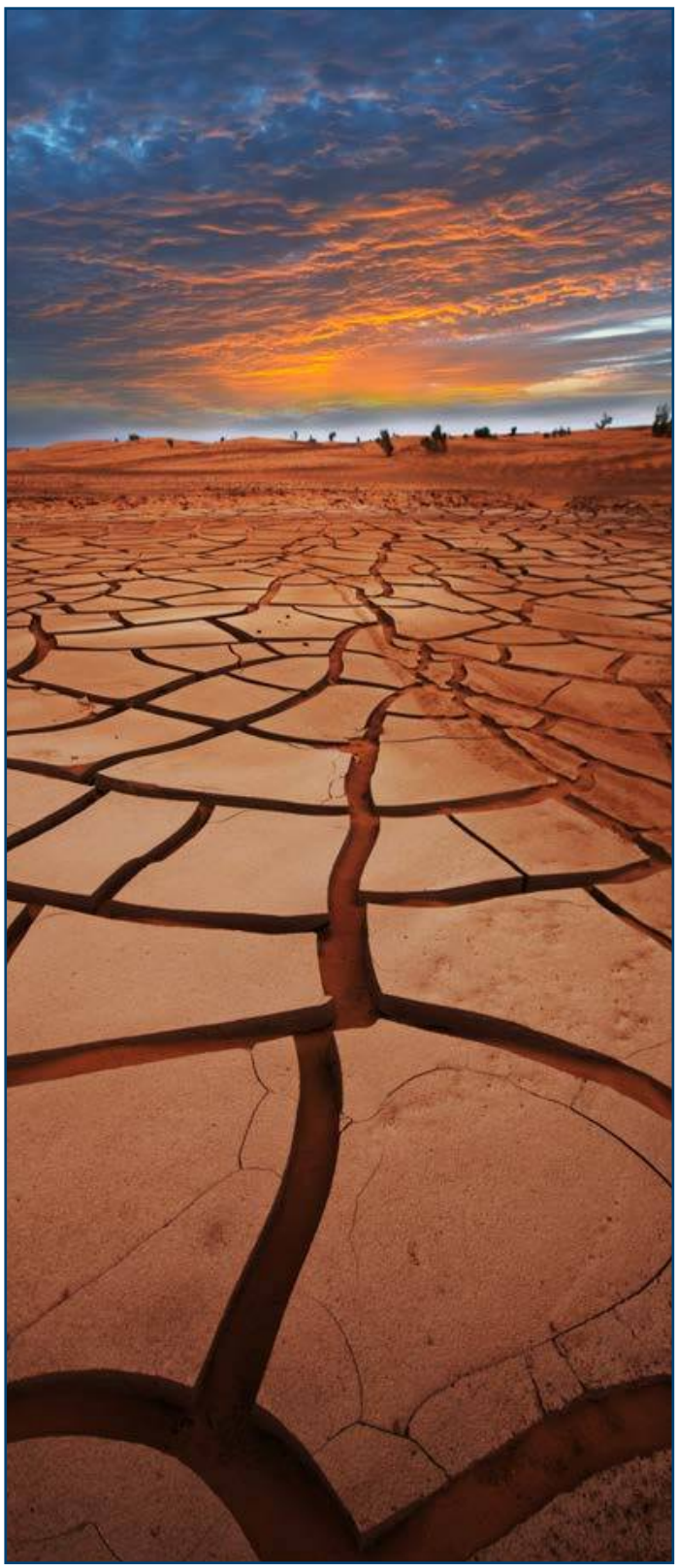
on just about any metric imaginable. Putting that data to the best use to optimize their assets and operations should be the goal. But the effectiveness of digital solutions depends upon the willingness of the water utilities and its workers to embrace them. A recent report suggests that water utilities have felt technological resistance from their staff, likely stemming from concerns that automation displaces people from their jobs and that machines simply can't measure up to human decision-making, or from previous failed attempts at synchronizing new technologies with legacy assets.

While data facilitates decision making and empowers better asset and operations management, it has little ability to do so, if it is not accessible or easy to locate. This presents another challenge for water utilities, which often collect data but fail to store it properly to make it available or interpretable on time. As utilities work out how to turn raw numbers into valuable insights, they must also work to harmonize the need for widely accessible data management systems with more robust cyber security measures demanded by the digital age.

In this rapidly evolving digitalization landscape, the needs and possibilities for data management are in a flux. To keep up, utilities must develop plans and tools for data analysis and usage. As they do this, they must prioritize knowledge sharing and cyber security education, within their organizations, to promote success through a culture of productive yet safe use of digital solutions.

Subhash Sethi (SPML Infra): Automation and robotics help to fine tune work processes for greater efficiency. Robotic lab analysers can test two to three times more samples than human operators, in the same amount of time, and allow analyses to be carried out round the clock. This helps to keep a strict check on various parameters concerning quality of water. Adopting smart water infrastructure like smart metering, smart leak detection techniques would help in reducing non-revenue water with real-time monitoring that would ensure a sizeable reduction in transmission and distribution losses that will support the overall broad water conservation plans. Electronic instruments such as pressure and acoustic sensors, telemetry units and control systems connected wirelessly with cloud-based monitoring systems generate real time information on leaks with accurate location details so that they can be detected in the distribution network quickly and precisely.

Smart irrigation systems are especially needed for India, where irrigation consumes almost 80% of fresh water. A sensor-based solution for smart and on-demand irrigation helps in measuring water requirements, in



plants to make sure they get enough water for the best produce in an effective manner which would ultimately lead to lowering water usage. Technological innovations in wastewater treatment with reverse osmosis and other emerging process is required to be implemented to reclaim water. Use of this reclaimed water will help in reducing dependence on fresh water for irrigation and industrial purposes.

Use of advanced and innovative technologies like AI, ML, Automation and Robotics, IoT and Big Data Analytics not only provide modern solutions to manage the water infrastructure, in an efficient manner, and help in reducing non-revenue water, but also support important changes to the manner in which water industry operates. Smart end-to-end water networks offer businesses the opportunity to improve productivity and efficiency while enhancing customer service.

20. AS A LEADING WATER COMPANY, WHAT HAS BEEN YOUR CONTRIBUTION TOWARDS IMPLEMENTING THE THREE RS AT LARGE?

Abdul Rahman Mohammed (Sahara Industry): With a legacy of about two decades, Sahara Industry has helped in shaping up the water and wastewater treatment market, in the country. With technologically advanced systems and processes along with world class quality compliance, we provide specialised water treatment and management systems, sewage and effluent treatment systems, ultra-pure and reverse osmosis purification plant along with drinking water softener and treatment facilities.

The treatment systems being designed and developed, on the parameters of raw water quality, that has a wide range, from conventional to membrane filtration, along with treatment for specific chemical contaminants and various disinfection technologies to meet all drinking water standards. With leading edge technologies, including membrane filtration and desalination plants, we are a leading name in the water industry. With the ISO 9001:2015 certification, the company has proven domain knowledge and experience of implementing sustainable solutions for the water sector, across India, with footprints in several countries across the globe. With social and environmental consciousness, the company always strives to maintain a healthy environment with high performance and sustainable water treatment solutions.

Amit Vaidya (Xylem): Let me get back to the 'REDUCE' bit that we are more tuned in with. I will provide a hypothetical example of Chennai as the city deals with major water crises. Chennai currently requires 1200 MLD of water supply daily, roughly half of which comes from the government-owned water utility for the city. Through smart water management, the utility can save 25% of it and this works out to over 150 MLD of water daily. This brings Chennai's daily requirement down to 1050 MLD from the current 1200 MLD. The projected savings over a year is about 37 days

of daily water requirement of the entire city. On an annual basis, Chennai can manage its water needs even if it has only storage for a little over 10 and a half months. Or there can be more hours of water supply than currently reducing the longish queues before taps and pumps or water tankers that is almost a common sight and daily ritual for most Chennai citizens.

Anand Iyer (Forbes Marshall): With our smart instruments we enable users to establish, benchmark and further partner with users to reduce the water consumption in a systemic manner. By deploying the newest technologies, we help users of different departments like legal, operations, and maintenance teams get aligned to work together and achieve the common sustainability KPI's.

We have been associated with many water projects at the municipal level, irrigation projects, water distribution projects across India, over last two decades. The flowmeter that we manufacture helps our customers, in accurate flow measurement.

We manufacture water quality measuring instruments like Ph/ Chlorine/ TSS/Multi-parameter analysers and have helped several WTPs and STPs to measure/control their quality parameters.

We are associated with all the industries providing them metering solutions, water measuring quality parameters. Through our digital solutions we help to analyse the data and accordingly provide corrective measures.

Chrys Fernandes (DuPont Water Solutions): Access to clean, affordable water is a fundamental human right, yet estimates say that over 1.8 billion people will be living in water scarcity in the next 5 years. Much commendable work is happening around the globe to bring water security, to communities. Existing and evolving technologies are being employed to improve water management. Water-Optimized World campaign launched by DuPont Water Solutions in 2021, is playing a pivotal role, in this field.

We collaborate with all stakeholders, of the water ecosystem, by sharing data, technology, and policy to offer a portfolio of sustainable water purification and separation technologies for reuse, recycling, desalination, and unlocking groundwater access.

Dharmendra Pratap Singh (Voltas): Voltas forayed into wastewater treatment way back in 1977. Since then, the company has completed many landmark projects, and has improvised, innovated and offered top-notch solutions to tackle the issue of wastewater pollution competently. Today, services offered, by the company, encompass the entire treatment range from MBBR (Moving Bed Biofilm Reactor), SBR (Sequencing Batch Reactor) and ZLD (Zero Liquid Discharge) to other technologies in industrial waste water treatment as well, such as MBR (Membrane Bioreactor), UF (Ultra filtration), and RO (Reverse Osmosis).

Dr Indra N. Mitra (Cambi India): We are the world leader in sludge treatment using Thermal Hydrolysis Process (THP). We promote circular economy by converting wastewater sludge and food waste to fertilizer/ soil conditioner/amendment and enhance converting sludge to energy (biogas) in anaerobic digesters. We have 77 installations around the world including Washigton DC, London, Beijing, Singapore, South Korea and several cities in USA, Europe and Australia.

Mohammed Naser Azeez (Aquality Water Solutions): Aquality Water Solutions being a strong mission driven organization was established with the sole intention of providing clean drinking water facility to the people of India. It has contributed immensely to the water treatment segment that has helped in improving quality of life with commitment, technological innovations and quality par excellence. With over a decade of development with a conviction to deliver purest water solutions, to industries and people of the country, it has helped industries with their water treatment needs and reuse facilities of wastewater. It firmly believes that innovation holds the key to growth and it is the basis of sustainability of any organization.

Growth remains the key parameter to success but community development and environment replenishment is equally important while doing business. At Aquality Water Solutions, we firmly believe that caring for the environment is fundamental and everyone needs to do his or her bit to reduce the environmental footprint. With unsustainable usage pattern, our drinking water resources are becoming scarce day by day and the situation may mandate us to import our water at high cost for the survival.

Rangarajan Ramaswamy (Grundfos India): Grundfos offers wastewater treatment solutions for every step of the process, right from collection of wastewater, transporting, treating, storing, and supplying recycled water for reuse. Grundfos India's headquarters in Chennai is the first commercial building in the country to receive LEED Gold certification. The headquarters is an energy efficient, zero liquid discharge (ZLD) facility, equipped to execute rainwater harvesting and rooftop solar power systems. The facility has underground water tanks with a capacity to hold 3,50,000 litres that collect 53% of precipitation through rainwater harvesting. This way, we can perform wastewater treatment and reuse water, without creating excessive demand for the resource. In 2020, the factory was certified the LEED Platinum rated.

As the world leader in pumps and water solutions, Grundfos develops advanced solutions that provide maximum water conservation. Last year, the pump solutions, sold by Grundfos, have enabled our customers to reuse over 1.8 m^3 water per year, which is a 20% increase in water conservation done with Grundfos compared to 2020. With consistent efforts to provide the most efficient water and water reuse solutions, we aim to save 50 billion m^3 of water by 2030.

We are also working towards making our manufacturing footprint more circular, implementing the three R principles across every step of the process. Our take-back programme allows us to reuse, refurbish and recycle materials and components such as copper, aluminium, neodymium, and plastics, to ensure utmost circularity. In 2021 alone, we managed to collect 37,000 kg through the take-back programme. This also reduces waste production, as we mindfully identify ways to recover material for production.

Subhash Sethi (SPML Infra): Through our focused efforts in SPML Infra Limited, we have designed and constructed a large number of wastewater treatment plants for both sewage and effluents and have contributed immensely towards environmental sustainability by effectively managing municipal and industrial wastewater and not allowing it to harm our ecosystem. Recycling wastewater further enhances reuse and social responsibility conforming to pollution control norms. SPML Infra Limited has built plants that are fully equipped with automation systems and reliable treatment technologies for efficient operation and maintenance.

The digital technology, satellite surveillance, supervisory control, data acquisition systems, remote sensors and geographic information systems etc. is being deployed across the country for monitoring of collection and treatment with minimum human intervention. The projects executed by the company have witnessed noticeable improvements on operational parameters and quality of treatment.

Some of the significant wastewater treatment plants constructed by SPML Infra Limited include:

- 240 MLD Sewage Treatment Plant in 4 modules of 60 MLD each, with each module having its own primary and secondary treatment section plus sludge thickening and digestion facilities in Ahmedabad, Gujarat. Common facilities for disinfection of biologically treated water, biogas collection and flaring, supernatant/filtrate collection and re-circulation system, collection of digested sludge and digested sludge dewatering system along with common chemical preparation and dosing facilities were created in this project.
- 72 MLD Sewage Treatment Plant in Okhla, Delhi based on activated sludge process with gas mixing technology complete with gasholder and compressor to generate energy.
- 70 MLD Sewage Treatment Plant in Nasik/Nashik, Maharashtra along with two gas holders of 11m x 5m with gas flow meter for 4800 m3/day of gas production.
- Executed one of India's largest and first Comprehensive Underground Sewerage Systems in Mira Bhayandar, Maharashtra having 113 km of sewer lines; 10 pumping stations and 10 decentralized sewage treatment plants with total 115 MLD capacity having latest Moving bed biofilm reactor (MBBR) technology. (It is a biological technology used for wastewater treatment suitable for municipal and industrial application).
- Executed a sewerage network and sewage treatment plant project for Kanpur city having 130 km sewerage network of 150 to 1800 mm dia pipelines, three pumping stations of 14, 40 and 42 MLD and 42 MLD sewage treatment plant based on activated sludge process including power generation from biogas.
- SPML Infra Limited also contributed to the prestigious XIX Commonwealth Games held in Delhi, in 2010, by constructing 25 MGD (million gallons per day) effluent pumping station (EPS) including twin transmission mains for carrying 33.34 MGD treated effluent to the power plant to generate power which eventually illuminated the Games.

A wide variety of wastewater management approaches are practiced in the country depending upon the budget municipalities. We need to have a uniform national standard with integrated water management system that have the advantage of uniformity of application and meets our water quality goals. The uniform system used in the United States has achieved significant improvements in levels of wastewater treatment to not only reduce water contamination issues but also to augment fresh water reserves significantly.

21. HAVE YOU SEEN COMPANIES TAKE MEASURES TO IMPLEMENT THREE R'S AS PART OF THEIR CSR (CORPORATE SOCIAL RESPONSIBILITY) INITIATIVES?

Syamal Sarkar (The Energy and Resources Institute): Yes, there are initiatives undertaken by some companies for implementing three R's using their CSR fund. However, such industries should act as models for others to follow.

22. WHAT ARE THE RECENT DEVELOPMENTS IN YOUR COMPANY IN TERMS OF WATER AND WASTEWATER PROJECTS?

Mohammed Naser Azeez (Aquality Water Solutions): With exceptional experience in designing and implementing suitable water and wastewater treatment solutions for industries across different sectors and many institutional clients on pan India basis, Aquality Water Solutions has come a long way for becoming a trusted name in the industry. The company has recently executed a drinking water supply project for Facebook India, for its offices based in Gurgaon and Hyderabad. It has also executed an important water treatment project for C P Aquaculture (India), a subsidiary of Charoen Pokphand Foods (CPF), a Thailand based multi-national conglomerate with $35 billion businesses in agro-industry and food, retail and telecommunications. The production units and live stock farms of CPF has been provided with commercial water treatment plants of different capacities for broiler feed suitable for the expansion plans in future. A centralized drinking water plant was also installed for providing safe drinking water facilities to for hundreds of workers and others.

Subhash Sethi (SPML Infra): SPML Infra Limited is a well-known name in the water sector, in India. In a legacy spanning four decades, the company has executed more than 650 water supply, wastewater and energy transmission and distribution projects. With several executed urban and rural water supply projects, SPML Infra Limited is providing clean drinking water facilities to over 50 million people, in the country.

The company has recently received an order to build a large water network under the Jal Jeevan Mission, in Rajasthan. The project, in Dausa and Sawai Madhopur districts, will provide clean drinking water facilities to

While a United Nations, 2016 World Water Development report, estimates that about 30% of water is being lost through leakage globally, in India, this could be as high as 40-50%.

Amit Vaidya (Xylem)

approximately 2.5 million rural and urban population spread across 1,256 villages and six towns. The company is already executing four different projects, in Rajasthan,; to provide tap water connections to over 1 million population in villages, across districts of Bhilwara, Nagaur, Jhalawar, Bisalpur and Tonk.

Another large water supply project under the Jal Jeevan Mission is being executed in Uttar Pradesh to develop water infrastructure that would provide tap water connections to over 1.6 million people of 915 villages in districts of Moradabad, Amroha, Rampur, and Sambhal.

In the area of sustainable water management, SPML Infra Limited is currently engaged in Phase III of the Saurashtra-Narmada Avtaran Irrigation Project (SAUNI Yojana). The ambitious water supply and irrigation project envisage providing drinking water facilities to around 39 million people across 132 towns and 11,456 villages. At the same time, the project will also provide irrigation facilities in approximately 1.8 million hectares of land in Kutch, Saurashtra and north Gujarat region, thereby benefiting millions of farmers. In the wastewater segment, SPML Infra Pvt Limited has executed a sewage treatment plant and sewerage network project in Kanpur city, Uttar Pradesh, that has helped in the Clean Ganga Mission.

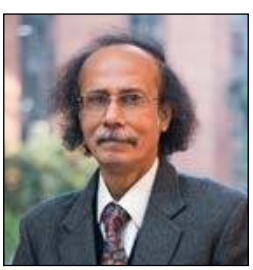
The company has also executed several sewage treatment and industrial effluent treatment projects in several states including a decentralized sewage treatment plant and sewerage network in Mira Bhayandar, the satellite city of Mumbai where it has built 115 MLD sewage treatment plants, in different modules of varied sizes, along with underground sewerage network with proper pumping facilities.

There is no denying the fact that water plays a very important role in our lives and is central to our very existence. It is also apparent that water is one of the most abused natural resources and its high time we (all stakeholders) need to take corrective action before it gets too late. While the importance of adopting the three R's is central to rejuvenation of water, equally important are the steps that need to be taken to promote recycling of wastewater and promoting the use of recycled water, in our daily lives. At the same time tools like rainwater harvesting need to be employed, so that the groundwater gets replenished. Being a knowledge and marketing solutions provider, in the water and wastewater sector, EverythingAboutWater will launch a strategy paper, on the need and importance of adopting the three R's at the 17th EverythingAboutWater Expo, between 4-6 August 2022. Hope to see you at the event and at the launch of the strategy paper ■

PS. Views provided by experts, on the topics, have been showcased in the story, in alphabetical order, as per their first name (minus their salutations like Mr and Dr).

ABOUT THE PARTICIPANTS

Subhash Sethi is **Chairman** of **SPML Infra Pvt Ltd**, a leading infrastructure development company, in India, with over 650 completed projects. Under his leadership, SPML Infra went on to establish itself as the leader in the water domain and developed sustainable infrastructure to help water utilities deliver safe drinking water to over 50 million people. Mr Sethi has been bestowed with several prestigious awards including *Economic Times* Global Asian Business Leader for his valuable contributions.



Syamal Sarkar (Ph.D.), is former Secretary, Ministry of Water Resources & Department of Personnel and Training, Government of India. In his present capacity, Mr Sarkar is the **Distinguished Fellow** & **Senior Director**, Natural Resources and Climate Programme, **TERI (The Energy and Resources Institute).**

Rangarajan Ramaswamy is the **Area Sales Director** of **Water Utility segment** at **Grundfos India**. In his present capacity, he is responsible for the Business Development of the Water Utility segment and sales of Grundfos in India, Bangladesh, Bhutan, Maldives and Nepal. With more than 20 years of association with Grundfos India, Rangarajan has held various roles in the company. His 29 years of industry experience includes his work across the industrial, commercial building equipment, water treatment, water services and wastewater.

Abdul Rahman Mohammed is the **Founder & CEO** of **Sahara Industry** and established with the sole purpose of providing technologically advanced, most economical and best quality water and wastewater treatment solutions. With his guided approach and dynamic leadership, the company has achieved enormous success with group turnover surpassing INR 1000 million.

Dr SK Jain is the **chairman cum MD** at **Ground Water & Mineral Investigation Consultancy (GWMICC) Pvt Ltd.** Dr Jain has served in the Central Ground water Board, Ministry of Water Resources, Government of India as class I officer and a Groundwater expert for eight years. Dr. Jain is a Groundwater resources expert, who run his own organization with a team of experts since 1985 and is continuously serving in the field of ground water. Dr Jain was instrumental in publishing a 200 page book on "Water Vision" which was released by the then President of India Smt. Pratibha Patil.

Dr Indra Mitra is an international water and wastewater expert and technologist with 25 years of global water and wastewater experience in Leadership, Business Development and Technology. He was recognized as a "Who's Who" in Water & Wastewater by American Academy of Environmental Engineers and Scientists, USA. He is a registered Professional Engineer (PE) of the State of Virginia, USA. In his present capacity, Dr Mitra is the **Director - Technical and Project Development, Cambi India**.

Amit Vaidya is **Director, India - Metrology Business, Xylem.** Mr Vaidya has over 20 years of experience in the energy and utility sector, with significant proficiency in implementing smart metering, AMI and utilities IT related solutions. In these areas, he has provided leadership and contributed to several successful multi-million dollar programmes and has worked extensively with the senior management of several utility majors.

Dharmendra Pratap Singh took over as the **Head of Infrastructure Solutions** and **Senior Vice President** at **Voltas Ltd**, in January 2019. Under his leadership, the company has strategically increased its focus on Government funded projects, empahsizing inclusive growth. Prior to Voltas, he has been associated with Repono Warehousing Pvt Ltd.

Anand Iyer is **Country Manager at Forbes Marshall**, India's leading process and energy efficiency company. In a career spanning 25 years, Mr Iyer has spearheaded industrial water monitoring and optimisation initiatives. He has helped a leading Indian software giant achieve its sustainability benchmark and reduce its cost of ownership. He also had the privilege to work with the largest irrigation project in India, advising the EPC with right selection of flowmeters. He is also actively involved with multiple 24*7 and public water projects.

Chrys Fernandes is a chemical engineer, with 28 years of experience, in the industry, ranging from manufacturing, consulting and sales & marketing. In his present capacity he is the **India Business Head** at **DuPont Water Solutions** and is responsible to help, build and implement a strong business growth strategy for India. He joined DuPont Water Solutions (formerly part of Dow) in 2006, as part of the New Business Development group evaluating new technologies, business models and M&A for business growth.

Dr Anil Kumar Mishra has been working with the **Delhi Jal Board**, Govt. of NCT Delhi, since August 2007, in the capacity of a "Bacteriologist." Dr Mishra received the "Best Employee Award" for the year 2019-2020, at Delhi Jal Board by the Chief Minister of Delhi.

Ashish Mishra is a water and wastewater operation expert with more than 15 years of field experience of overseeing more than 250 projects for commissioning, in India and abroad. He is working with **Lars Enviro Pvt Ltd** as **Sr. Manager-Process**. Lars Enviro is a leading expert in Environmental Engineering in India with its footprint across the World.

Mohammed Naser Azeez is a first-generation entrepreneur. He established Aquality Water Solutions to provide technologically advanced water treatment solutions to domestic, institutional and industrial clients. In his present capacity, Mohammed Naser Azeez is the **MD, Aquality Water Solutions**