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Editor's Note

RENU TOMAR
(Editor-in-Chief)

Dear Readers,

Given the effects of climate change, ensuring a stable water supply is becoming increasingly crucial in order to permit long-term spatial development. Water scarcity, which is already a problem in many parts of the world, is obstructing agricultural, urban, and industrial growth. Water scarcity now affects around half of the world's population, but only temporarily. Droughts are growing more prevalent as a result of climate change, exacerbating the problem.

Because ground and surface water supplies are frequently overexploited, new water sources must be developed to address the problem of water shortage. The reuse of treated wastewater is a significant alternative resource. Water reuse methods are seldom studied or executed nowadays. Unlike rainfall storage and usage, treated wastewater is a desirable resource since it is available on a daily basis and in predictable proportions. To create the new resource "reused water," certain wastewater treatment operations within wastewater treatment facilities are necessary. Because industrial and municipal wastewater flows, for example, have different concentrations, the treatment procedures are dependent on the quality of the wastewater intake to the treatment facility. In addition, water reuse solutions must be developed.

The reused water can then be utilized directly in areas such as irrigation, street cleaning, toilet flushing, or make-up water for cooling systems, following the "fit for purpose" approach.

This edition is focusing on Industrial and Municipal water treatment that can help tackle the issue of water scarcity.

Please have a look at the interesting and informative articles & case studies and provide us with your thoughts. Enjoy reading.... Write us at **editor@waterage.in.**

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Watergen from Israel Join Hands with SMV Jaipuria Group to Manufacture Air–to–Water Products in India

Watergen, an Israeli company that invented technology to manufacture drinking water from the air, has launched a strategic joint venture with SMV Jaipuria Group to deliver its globally patented technology to India.

The business stated that it will transfer 100 percent of technology from Israel to India in order to manufacture and export products from India.

"India will be the main marketing hub for global activities for Watergen. We will export from India to the global market. India is amongst our top three strategic markets and together with our partner, we are determined to provide safe mineralised drinking water available for every individual, across geographies and demographics," said Maayan Mulla, CEO of Watergen India.

According to Mulla, both companies would introduce their Atmospheric Water Generator (AWG) product categories in India, which creates high quality, mineralized, safe drinking water out of ambient air.

Watergen has become the global leader in atmospheric drinking water devices, machines that create drinking water from the air.
The globally patented 'GENius' system for water extraction by Watergen is the first heat exchanger ever to be composed of food–grade polymers in order to produce the best drinking water from the air.

When asked about the price of products in the Indian market, Mulla said Watergen will have special prices for the Indian market.
"For us, every place and every segment in India is a market. It's a cheaper price as compared to that of the global market. We want to make it affordable to many people in India," he added.

Welspun Enterprises Bags INR 4,636 Crore Order for Dharavi Wastewater Treatment Facility

Welspun Enterprises Ltd (WEL) has received its single–largest order of INR 4,636 crore from civic body Brihanmumbai Municipal Corporation (BMC) for the Dharavi Wastewater Treatment Facility.

Under this project, a joint venture led by the company will design, build, operate, and maintain the Dharavi Wastewater Treatment Facility including the Tertiary treatment facility under Mumbai Sewage Disposal Project, Stage II (Priority Works), a company statement said.

"This is the single highest value order so far for the company in the most essential sector of water infrastructure in India. This project for one of the largest wastewater treatment facilities in India is a significant step in the direction of achieving Swachh Mumbai, Maharashtra, and Bharat and we are extremely happy to be part of this journey," B K Goenka, Chairman, Welspun Group said.

Part of the Welspun Group, Welspun Enterprises is an infrastructure development company with a specialization in road and water projects under the Hybrid Annuity Model (HAM) and via large–value Engineering, Procurement, and Construction (EPC) contracts.
Daiki Axis Japan Setting Up a Second Facility in India, with an Investment of INR 200 Crore

Daiki Axis Japan, a producer of water treatment solutions, is establishing its second facility in India in Haryana, with an investment of INR 200 crore, according to a company spokesperson.

Kamal Tiwari, CEO of Daiki Axis India, said that a plant with a capacity of 1,000 sewage treatment units will be built in Palwal using Japanese "Johkasou" technology.

Daiki Axis India is a subsidiary of Daiki Axis Japan, which is situated in Japan.

According to him, the plant would be operational by September 2023, with a unit currently functioning in Vapi, Gujarat.
The Gujarat unit, which has a capacity to produce over 800 sewage treatment plants, was commissioned in 2019, Tiwari said.

The company is eyeing an increase in its customer base with the setting up of the new unit.

The product can be used in both industrial, commercial and residential segments. The company has a team to assist customers in the installation of the units, he said adding the technology is already in use in various states, including Gujarat, Maharashtra, Madhya Pradesh, and Delhi.

L&T's Construction Arm Bags Bandra Wastewater Treatment Contract from BMC

The water & effluent treatment business of L&T Construction has secured an order from the Brihanmumbai Municipal Corporation (BMC) to execute the Bandra Wastewater Treatment Facility under the Mumbai Sewage Disposal Project – Stage II.

As per L&T's classification, the value of the 'large' contract lies between INR 2,500 crore to INR 5,000 crore.

The project involves the construction of a wastewater treatment facility with best–in–class treatment standards. The scope includes the design, build, operation, and maintenance of the 360 MLD sewage treatment plant with a provision to generate in–house power.

The project will also host a panoramic viewing gallery, a knowledge centre, and a library with the larger goal of creating awareness amongst various stakeholders.

The project is to be executed under stringent timelines, L&T said.

36 Sewage Treatment Plants Sanctioned in Uttarakhand to make Ganga pollution–free

The central government has sanctioned 36 sewage treatment infrastructure projects in Uttarakhand so far to rejuvenate River Ganga.

According to National Mission for Clean Ganga (NMCG), through its flagship 'Namami Gange' project, the Centre is working on a mission mode in a multi–layered effort to ensure that every section of Ganga in the state receives clean water.

The key projects include intercepting major drains falling into the river and diverting them to sewage treatment plants (STP).

In Uttarakhand, as of the date, a total of 36 sewage infrastructure projects costing INR 1,373 crore were sanctioned to create 195 MLD (millions of liters per day) STP capacities and to lay/rehabilitate a 184–km sewer network. Out of which 34 projects have been completed and the remaining 2 projects will be completed soon.

To prevent waste from falling into Ganga, six STPs have also been installed in Rudraprayag.

These STPs are based on an electro–coagulation system where with the help of anodyne and cathodyne processes, the wastewater is separated and later treated as fresh water.

Further, under the Namami Gange programme, NMCG has installed a 26 MLD STP in Rishikesh.

Austria Development Bank Lends 13mn Euros for the Namami Gange Project in Bengal

Austrian Development Bank OeEB has lent 13 million euros for a sewerage treatment project in West Bengal, an official said on Thursday. Oesterreichische Entwicklungsbank AG (OeEB) has offered the entire amount as a loan making it the first European DFI lending for National Mission for Clean Ganga (NMCG's) Hybrid Annuity Model (HAM) projects.

Vishvaraj Environment Pvt. Ltd (VEPL), the water utility firm executing the project, said that it has received the amount for Namami Gange's sewage water treatment for Maheshtala in South 24 Parganas district, 18 km from here, in HAM /PPP model.

The project cost is to be funded by a mix of NMCG Grant, Equity, and Debt, with the entire project debt of over Euro 13 million to be funded by OeEB and Deloitte is the financial advisor for this transaction.

IIT Guwahati Develops a Device to Turn Wastewater into Energy

Researchers at the Indian Institute of Technology Guwahati have developed a microbial fuel cell (MFC), a bio–electrochemical device that can generate "green energy" by treating wastewater.

The researchers said the device offered a dual benefit – generation of bioelectricity and waste management – by converting chemical energy contained in organic substrates into electrical energy through microbes.

The Department of Science and Technology supported the research led by Mihir Kumar Purkait and his Ph.D. student Mukesh Sharma of IIT Guwahati's Department of Chemical Engineering.

The IIT Guwahati claimed the device could be used for obtaining clean energy from municipal wastewater economically.

The active biocatalyst in the anodic chamber anaerobically oxidizes organic matter present in wastewater to produce electrons and protons. Protons are transported to the cathodic chamber through the PEM. The external circuit conducts the electrons to the cathode, completing the electrical circuit.

At the cathode, electrons and protons reacted in the presence of oxygen (or another electron acceptor), which got reduced to water, the researchers said.

WABAG Signs Concession Agreement for 40 MLD Recycle & Reuse TTRO Plant in Ghaziabad

VA TECH WABAG ('WABAG'), has signed through its wholly–owned subsidiary – M/s. Ghaziabad Water Solutions Private Limited ('SPV'), a concession agreement with Ghaziabad Nagar Nigam (GNN) for the design, build, finance, and operation of a new 40 MLD recycle and re–use Tertiary Treatment Reverse Osmosis (TTRO) plant along with associated infrastructure under Hybrid Annuity Model (HAM). WABAG will be the technical partner of the project and will execute the Design–Build–Operate (DBO) contract with SPV worth INR 594 crores.

The project scope is scheduled for a two–year construction period followed by a long–term operation and maintenance period of 15 years. This project will receive a grant during the construction period from GNN, which has raised money through India's first municipal Green Bond.

The scope of works under this concession contract includes design, construction, supply, installation, testing, trial run, and commissioning followed by operation & maintenance for 15 years, of a new 40 MLD TTRO plant. The plant will use membrane technology with ultra–filtration followed by Reverse Osmosis to further purify the treated sewage water to industrial usage quality. In addition, WABAG will also perform renovation and refurbishment of the upstream 56 MLD STP plant, followed by its Operations & Maintenance thereafter.

Once commissioned, the 40 MLD TTRO plant will be the largest TTRO plant under HAM in India and is expected to provide a sustainable solution for the water needs of the industries located in Sahibabad Industrial Estate, Ghaziabad. In terms of environmental impact, this will be a pioneering project in the Ghaziabad area, since industries here will now be mandated to use TTRO–treated water, instead of groundwater, which is already depleting fast. WABAG has already built, commissioned, and is currently operating a state–of–the–art 45 MLD TTRO plant in Koyambedu, Chennai for CMWSSB on a DBO basis. It is supplying treated water from this plant to SIPCOT industrial estate in Chennai.

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WASTE TO WORTH – NOT JUST A CONCEPT OR MINDSET:

SHOWCASING DECADES OF EXPERIENCE FROM A SLUDGE MANAGEMENT PERSPECTIVE

Dr. Ashish K Sahu
Marketing Manager, Cambi

Dr. Ashish K Sahu is currently Marketing Manager at Cambi. He has over 22 years of work and academic experience in water and wastewater engineering. He has a Ph.D. in Environmental Engineering from the University of Massachusetts, USA with a specialization in the commercialization of technologies, and an MBA in Global & Energy from BI, Norwegian Business School. He has worked on a host of environmental technologies and has written several peer–review publications, patents, conference proceedings, white papers, and technical reports.

India, home to about 1.35 billion people, will soon be one of the few emerging economies with the largest number of Greenfield municipal sewage treatment plants (STPs) in the coming years. Just for the year, 2021 estimates were to build 1600 municipal STPs. This development is great news for both the environment and the health of its citizens. Many current STPs in major cities are due for an upgrade because of the increasing trend in urbanization and new stricter discharge regulations. Domestic wastewater, which originates from households and commercial facilities, is no longer considered "waste" as innovation has the means to convert the materials in the wastewater into resources. One would

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Business Unit Director
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Harald Kleiven is currently the Business Unit Director for Emerging Markets. He oversees and assisted in project development and sales of more than USD 200 million, including in the UK (Manchester, London, Cardiff, etc.), Washington DC, Santiago de Chile, China (Beijing), Greece (Athens), South Korea (Anyang City), Singapore (Jurong), to name a few, and supporting sales of other Cambi projects. Kleiven has a Master of Science degree from the London School of Economics and Political Science, LSE, UK, and Bachelor of Arts from the University of Oregon, USA.

think, how can humans flushing matter down the toilet be of worth? This article will shed some light on these facts with examples from technology with three decades of experience. It will also note some of the trends in wastewater reuse, decarbonization, and resource recovery, the need of the hour for India.

Wastewater and sludge treatment: A brief introduction

Barely any of us really think about or are bothered by what happens to what we flush down the toilet. In some cases, this matter, called sewage (wastewater), is pumped to a nearby STP for further treatment before being discharged to a local water body. About 30% of the sewage in India is connected to a

network for further treatment. In other cases, households have septic tanks, which collect the sewage over a period of time and later need emptying and cleaning depending on the capacity of the tank. Sewage is a mixture of complex substances like urine, faeces, grit, etc., which require a combination of physical, chemical, and biological processes for its treatment before it is discharged. If the resulting treated water is of a specific quality, it can be reused for purposes such as toilet flushing, gardening, agriculture, etc. This is, however, only half the story when wastewater is treated.

The other half is the creation of sludge, which is a by–product of wastewater treatment. Sludge comprises solids and complex materials that originate from wastewater treatment through primary and secondary treatment processes that are mainly biological in nature. Treatment of sludge typically accounts for roughly 50% of the operational expenditures (OPEX) for any STP. Sludge after treatment is termed "biosolids". Biosolids management is a subject on its own and many STPs fail to oversee this, and changes in regulations and drivers often result in problems for municipalities once STPs are in full operation.

The typical route to managing sludge has been either stabilization or thermal treatment followed by disposal. Stabilization comprises processes like composting, anaerobic digestion, and liming, while thermal processes include incineration, pyrolysis, and drying. Disposal methods can be landfilling, applying stabilized sludge on land for agriculture, reuse of materials in other industries like cement, etc. Each of these treatment processes and disposal methods has its pros and cons from an expenditure perspective. CAPEX, OPEX (energy costs, labor requirements, disposal costs), and even operational challenges (special labor needs, transport, and handling of biosolids) need to be taken into account.

Thermal processes have been deemed energy–intensive and very expensive to build and operate that so many STPs have opted for a more sustainable way of treatment which is stabilization. Some of the important factors to consider when opting for stabilization include how large or small the STP is, the characteristics of the sludge to be treated, and the processes used for wastewater treatment. This article discusses the most widely applied sludge management strategy using the sludge stabilization method i.e. Anaerobic Digestion (AD). AD process technology over the years has innovated itself by combining disruptive technologies like thermal hydrolysis process (THP) as pre–treatment followed by anaerobic digestion (AD) (Barber, 2020). Such treatment is often referred to as, Advanced Anaerobic Digestion (AAD).

Drivers for sewage sludge treatment

Disposal through landfills has its limitations as land availability is a scarce resource, especially in India. Many times, there are low to no tipping (gate) fees for disposal. So STPs can forego stabilization and send their biosolids cake for drying followed by landfilling or free distribution to farmers. In Europe and other countries, the gate fees have shot up as land is becoming less available and transporting biosolids an expensive affair. Rising gate fees and the establishment of carbon footprint requirements for transport are also important trends tied to the circular economy approach.

The same scenario is yet to hit India in a big way since many of these STPs are under construction and will take time to operate fully. The life of an STP typically goes over 30 years, and regulations and drivers will change with the changing population, the local climate change directive, energy availability, and other factors. Once in full operation, however, the production of sludge will take place instantaneously, and its management cannot be thought of as a last–minute action point. In addition, once high tipping fees come into place, the STPs will have to shift to innovative ways to implement a biosolids management strategy. Labor and transport fuel are bound to get expensive due to inflation over the years, so lowering the cost of transporting biosolids will be on every utility's/municipalities agenda. In a nutshell, the key to having a good biosolids management strategy is making sure the following drivers are planned for upfront:

- Asset optimization
- Circular economy
- Carbon footprint
- The following section discusses how the thermal hydrolysis process followed by anaerobic digestion (THP+AD) presents solutions for these drivers in sludge treatment.

THERMAL HYDROLYSIS AND ANAEROBIC DIGESTION

Asset Optimization

Several studies have indicated that the use of THP + AD has resulted in fewer anaerobic digesters by 1/3rd compared to any conventional AD setup. THP, with the help of steam, breaks down the complex sludge, especially waste–activated sludge (WAS). It also speeds up the hydrolysis step in the conventional AD process, which is the rate–limiting step. The use of THP results in higher loading of the digesters, enabling the treatment of more sludge, lower sludge retention times, and hence, less number of digesters to be built and operated. This results in space savings for greenfield digesters and an increase in capacity to treat higher loads in brownfield projects. A good example of this effect

of AAD is demonstrated by the utility DC Water. Details of the case study are available from Sahu et al., 2022 and Barber, 2020.

Several treatment plants in the US also used Zimpro technology (wet air oxidation process) for biosolids management. This infrastructure is now being replaced with THP+AD while utilizing some of the remaining equipment and systems (Childress et al., 2019; Barber et al., 2022), a good example of asset optimization.

Another example is based on combining food waste (organic household and commercial garbage) with sewage sludge using THP+AD. There are several advantages to this from an asset optimization perspective: it makes use of the spare capacity of current anaerobic digesters to produce more biogas, it has a good balance of carbon to nitrogen ratios in the existing anaerobic digesters, and it uses the current infrastructure to solve another waste problem besides sewage sludge. Several municipalities around the world have implemented this as shown in the table below:

Name of Plant	Location	Completed	Design capacity (tons Dry Solids/ day)	% Sewage sludge	% Organic Waste
Sundet	Vaxjo, Sweden	2014	26	70	30
Ivar	Stavanger, Norway	2014	36	35	65
Bakdal	Anyang, South Korea	2016	76	85	15
Mjøsanlegget	Lillehammer, Norway	2016	30	10	90
Luoqui	Chongqing, China	2019	297	15	85
Ecopro	Verdal, Norway	2008, upgraded 2022	24	60	40

Table 1. Summary of the different CambiTHP plant capacities and percentage of raw sludge and organic waste for anaerobic co–digestion

Circular Economy

THP+AD advances the circular economy model by ensuring that the biosolids produced at the end of the process are of exceptional quality. In the United States, treating sludge with THP+AD results in Class A biosolids (USEPA, 1994) that can be sent back to nature. Basically, the biosolids can be land applied directly or can be blended with soil to act as a soil conditioner. The biosolids produced are pathogen–free and have little to no odor, not attracting vectors like insects. There is a huge change in the texture and the nature of the biosolids, which can also be handled directly and easily by humans.

Several utilities/municipalities around the world are implementing THP+AD for their biosolids management strategy. The utility in Aberdeen–Nigg, UK, land applies its biosolids for agricultural purposes using tractors after sludge treatment (Cambi Factsheet, 2022). The quality of Class A biosolids restores carbon to the soil and the crop yield has been found to be better than commercial fertilizer over a period of time, as witnessed by Agrimann in South Africa. DC Water, in Washington DC, USA, decided to brand Class–A biosolids to produce a product called Bloom (bloomsoil.com), which is also available commercially for gardening and has been used for beautifying the surrounding parks, eliminating the problem of landfills.

Carbon footprint

Lowering carbon footprints has been an important global topic recently reinforced at the 26th Conference of the Parties (COP 26). Climate change creates pressure on municipalities to reduce their carbon production. Sludge production contributes significantly to a utility's carbon footprint

as large amounts need to be transported to a nearby field for either landfilling or land application. THP+AD usage results in lower volumes of high–quality biosolids compared to conventional digestion (Graja et al., 2005), as seen in an example of a utility in Athens, Greece. A lower quantity of biosolids means smaller amounts to transport and, therefore, lower carbon production. Independent studies over the years have shown that AAD has the smallest carbon footprint compared to other Class A treatment technologies.

The use of THP+AD has resulted in the following outcomes (Barber, 2009):

- Lower volume of high–quality biosolids
- Less energy is needed for thermal processing
- More renewable energy
- New disposal routes

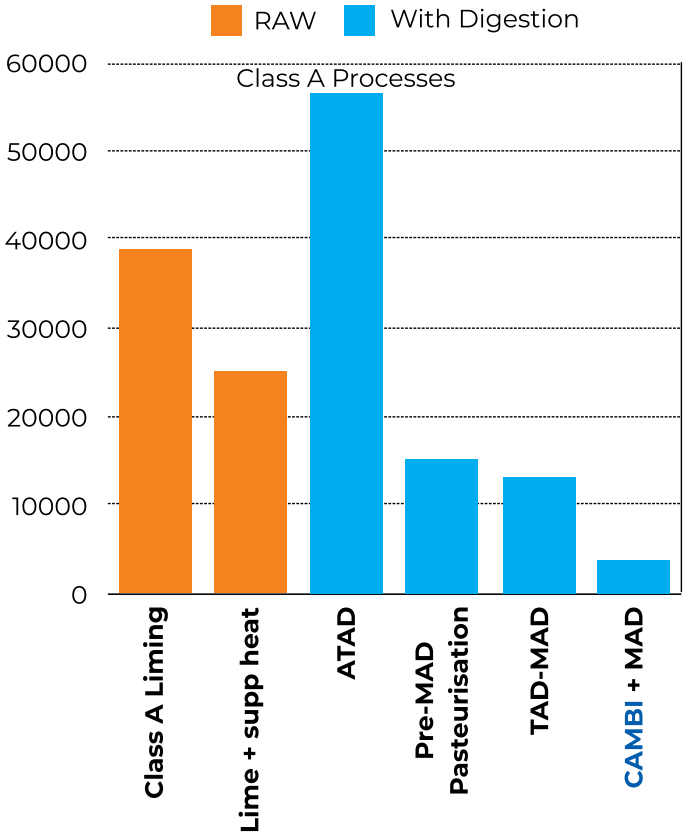

Figure 1. The carbon footprint of various Class A technologies

Another benefit of using THP+AD is the increased production of biogas. Biogas can be used as liquified biogas (LBG) fuel to run public transport, such as is implemented in cities like Oslo, Norway. Biogas can also be used for the production of electricity. The electricity can also be recycled back to the utility to run its other unit operations, which will result in lower electricity and energy costs. This is done by Thames Water Utility, UK, as an example. Many more utilities worldwide, ranging from medium to very large plants, do the same (Barber et al., 2022; Barber, 2020).

A desktop study for India showed that the sludge of 25 crore Indian citizens could produce electricity for about 15 lakh households using THP+AD. It can also fuel 9 lakh CNG vehicles, thus replacing 4.5 TWh of natural gas imports. Currently, that sludge either goes untreated or is being wasted. Such technology implementation can be a game–changer and address the needs for effective biosolids management.

Summary

"Waste to Worth" can be achieved today with effective biosolids management by implementing the right technologies and strategies. Thermal hydrolysis process + anaerobic digestion is a proven technology and has shown this pathway over three decades, used by utilities/municipalities worldwide. In addition to its several advantages, it also addresses the three main drivers of asset optimization, circular economy, and carbon footprint. Many utilities overlook these points while framing their strategies since the focus typically is only on costs. Though cost is an important factor, it's important to consider the lifecycle cost of STPs and examine the imminent drivers that will change regulations, and plant needs, and hence change the selection of technologies for biosolids management. Assets that are built with this technology last over 30 years and it's vital to make an educated judgment with reference to other utilities.

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IoT & AI based Real–Time Monitoring Solution

Bhagyashree Rath is working as Environmental Manager in Greenvironment Innovation and Marketing India for the last 3 years. She has a Bachelor's degree in Civil Engineering and a Master's in Environmental Science & Engineering. She has expertise in researching impacts associated with power plants and preparation of Technical consultant documents on environmental policies and regulations to maintain regulatory compliances. Her Unique strengths include Knowledge to troubleshoot environmental problems requiring investigation of questionable conditions in assigned projects. Strong attention to detail with excellent analytical and sound judgment capabilities, and the ability to readily become proficient in utility data management system processes and software.

WATER IN THE CLOUD?

IoT-Cloud-Based Water Monitoring Enables Build up ESG Compliances, Saving Water Footprint

As per NITI Aayog, India is reeling under a severe water crisis with around 50% population experiencing high–to–extreme water shortages. On the other side, it is estimated that up to 25% of water is currently lost in transit due to leakage caused by poor infrastructure maintenance. Seventy percent of our freshwater sources are contaminated and our major rivers are dying because of pollution. India has 18% of the world's population but has only 4 % of the global water resources.

In such a scenario, ensuring optimum use and reuse of water extracted from natural water sources comes imperative. New technologies such as IoT–cloud–based monitoring of water utilities and water resources offer a viable solution to optimize water use and address water pollution. By helping to reduce water footprint, IoT–cloud–based water monitoring systems exemplify the commitment to Environment Social Compliances (ESG) as well as to Sustainable Development Goals (SDGs) of businesses and governments, alike.

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By using this platform, a person or a company can take useful actions to ensure water quality and optimize water use or reuse.

IoT–cloud based water monitoring

The word 'cloud' stands for rejoicing in the Indian context, especially in villages where rain fed farming is the major, perhaps the lone source of livelihood. But, at times, in the digital era, the word 'cloud' has a similar, rather more elaborate connotation linked to water.

As the name specifies Internet–of–Things (IoT) is a network of interconnected devices such as smartphones, laptops, computers, sensors, and actuators that can communicate with each other to perform a wide range of actions. In the water sector, IoT is used in a number of scenarios to collect and analyze real–time data related to water such as flow, leakage, quality, consumption, and energy use. The performance of water treatment plants, public water distribution systems (WTPs), sewage treatment plants (STPs), effluent treatment plants (ETPs), and other water utilities can be analyzed with the help of IoT–cloud–based systems. Thus the system helps ensure better efficiency, improved operations, and higher revenue at each point of water consumption.

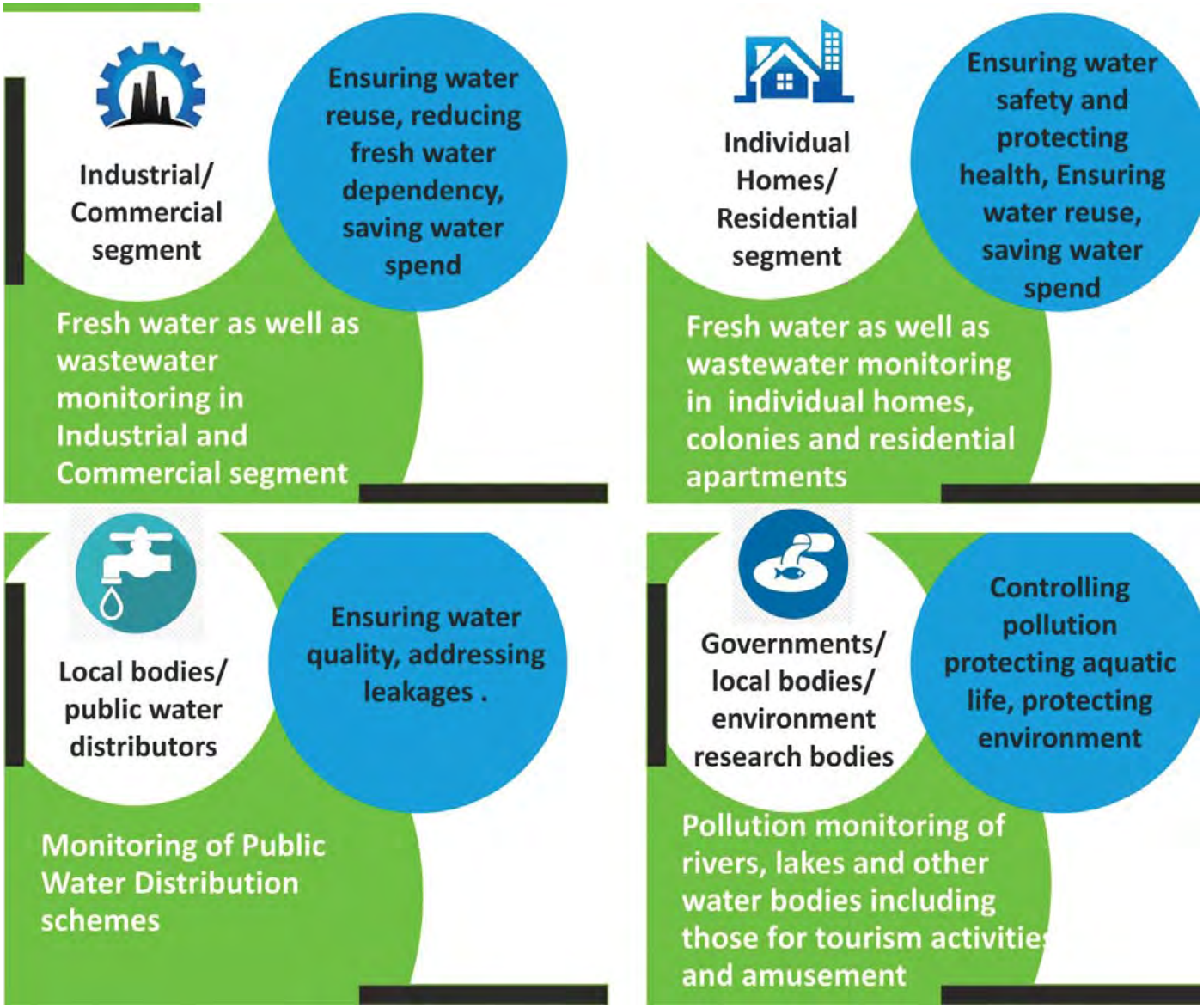
IoT–Cloud based monitoring of water: Fits into varied consumption scenarios

The IoT Internet of Things (IoT) and cloud–based systems for monitoring water can be installed and used across various sectors such as manufacturing industries, agriculture, commercial, hospitality, healthcare, and residential sector, and water and wastewater management projects of the government.

The purposes for which IoT based water monitoring could be used are as follows:

- Ensure quality of drinking water
- Checking water pollution
- Leakage detection of water infrastructure including pipelines and water tanks
- Monitoring performance of WTPs, STPs, and ETPs
- Monitoring recycled water quality to enhance reuse
- Monitoring of energy consumption of

The clients, from the sectors such as industries, hospitality, health care, commercial complexes, and residential sector testify to RTMs' effectiveness in addressing the water challenge at times.



WTPs, STPs, ETPs, and other water utilities

- Monitoring of aquaculture water quality
- Detecting the quality and level of water in freshwater sources such as ponds, lakes, rivers, and water reservoirs.

ESG, SDGs, and IoT –cloud–based water monitoring

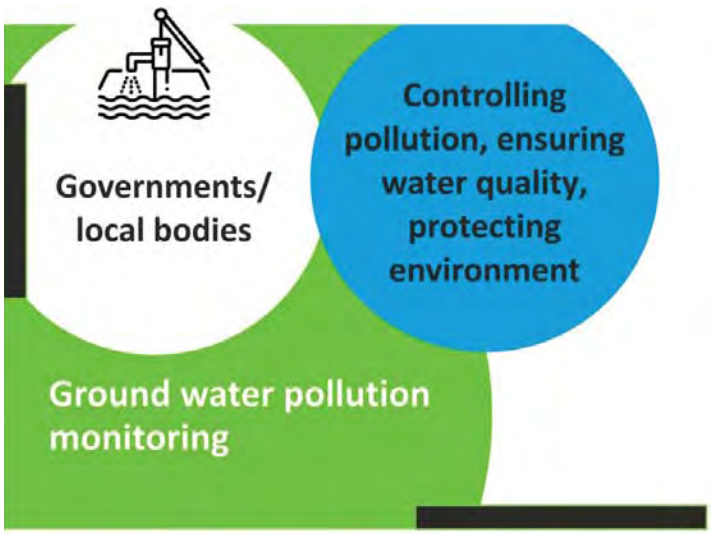
Helps to achieve the goal of water neutrality

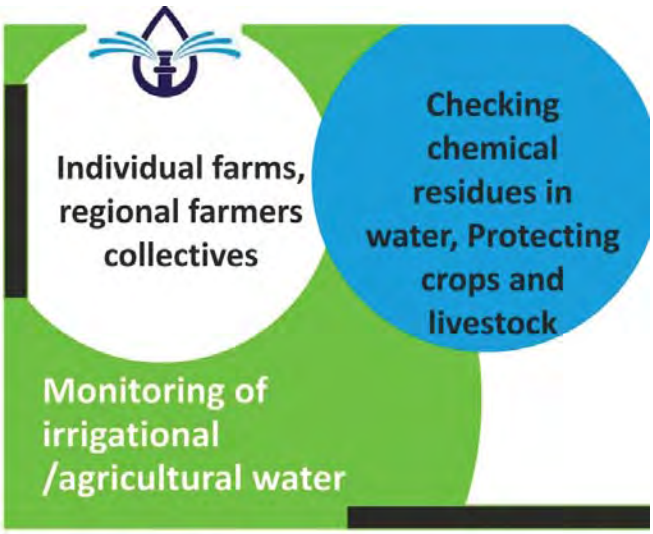
IoT –cloud–based water monitoring system was evolved as a response to the demand for a smarter measurable option for internalizing water use optimization. It is proved as an effective tool to report the performance of businesses in addressing water risks related to climate change and update the achievements in managing water. This is significant as proactive measures and quantifiable accomplishments in addressing water risks related to climate change are important requirements for the Environmental Social Governance (ESG) reporting of businesses.

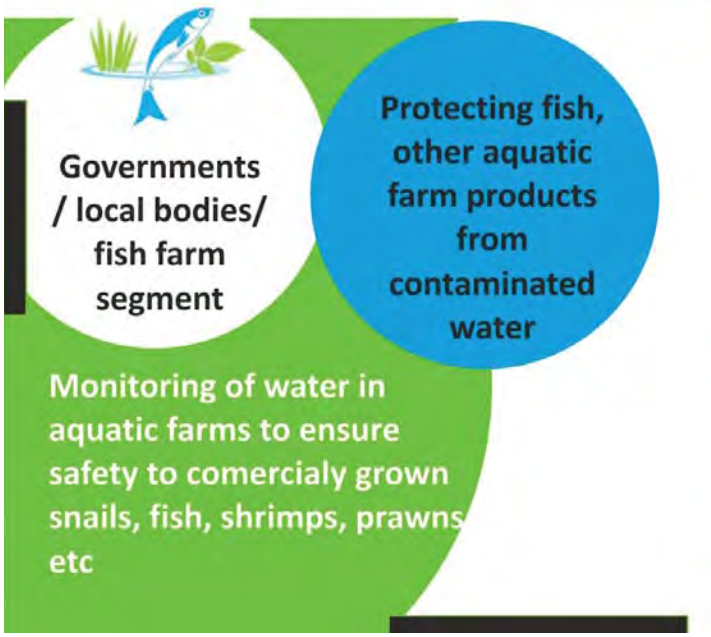
Treatment of sewage, effluents, and wastewater generated at various points of consumption such as residential, industrial, commercial, hospitality, and healthcare sectors under a well–monitored environment with the help of IoT has multifarious benefits. At the outset, it helps to halt the disposal of highly polluted water to natural water bodies. But it has opened a plethora of opportunities to consider wastewater as a resource, which can be tamed and consumed again. Reuse of water recycled in an environment where quality is monitored in real–time helps to reroute the recycled water for a host of non–potable purposes such as gardening, pavement cleaning cooling towers, toilet flushing, etc.

Water loss management

Water loss management is becoming increasingly important due to population growth and water scarcity. Currently, up to 25% of water is lost







in transit due to leakage caused by poor maintenance of infrastructure. However, now sensors to provide real–time insights into pressure, flow, and quality of water are widely used to control wastage of water during distribution. These measures are enabled by IoT–cloud–based real–time monitoring of water helps to reduce the withdrawal of fresh water and save the earth's natural water resources.

Help adhere to pollution control norms

IoT–cloud–based monitoring of wastewater comes necessary for industrial, commercial, hospitality, healthcare, and residential sectors in order to adhere to the pollution control norms set by the government. In India, installing an Online Continuous Emission Monitoring System (OCEMS) for Sewage Treatment Plants (STPs) and Effluent Treatment Plants (ETPs) would soon become compulsory for sharing the quality of the effluent on a real–time basis with the pollution control authorities. Central Pollution Control Board (CPCB) has already written to all Pollution Control Boards in states and Pollution Control Committees in Union Territories asking for time–bound implementation of OCEMS. The installation of OCEMS at the outlet of STPs for the measurement of water quality parameters would ensure that our freshwater sources (lakes, rivers, sea, ocean, aquifers, groundwater, etc.) are not contaminated due to the effluent disposal.

IOT–cloud v/s traditional water monitoring

In fact, the IoT–Cloud–based smart solution to water monitoring is cheap and reliable in ensuring water monitoring and water use optimization. The system uses the existing communication infrastructure for smart applications. Further continuous and real–time monitoring of water quality is possible in the system, which requires very minimal human interventions. It replaces all the major steps in the traditional way of

water and wastewater monitoring like sample collection, preservation, transportation, sample pre–treatment, calibration, reagent addition, and sample analysis with automated procedures and online analyzers.

What is monitored?

IoT uses devices like sensors and probes important parameters and real–time measurement is done based on data fed to the cloud. By using this platform, a person or a company can take useful actions to ensure water quality and optimize water use or reuse. The important parameters monitored under the system are as follows:

- pH
- Total Dissolved Solids – TDS
- Chlorine
- Biochemical Oxygen Demand – BOD
- Chemical Oxygen Demand – COD
- Total Suspended Solids – TSS
- Turbidity
- Oxidation & Reduction Potential – ORP
- Pressure
- Temperature

The government recognizes the potential of IoT–Cloud based water monitoring

The government of India had amply recognized the scope of IoT and cloud–based systems in monitoring water, by organizing the ICT Grand Challenge–Water 2020 under the aegis of the National Jal Jeevan Mission and Ministry of Electronics & Information Technology (MeitY) Government of India. ICT Grand Challenge–Water was aimed at creating innovative, modular, and cost–effective solutions for developing a 'Smart Water Supply Measurement and Monitoring System' to be deployed at the village level. Two hundred enterprises, which offer water monitoring solutions have taken part in the challenge.

A CASE STUDY: IoT–Cloud based RTM 2.0 by Greenvironmentindia

The experience of Greenvironmentindia, the runner–up in the ICT Grand Challenge–Water 2020, testifies to the scope of IoT–based water monitoring in India. RTM 2.0, Greenvironmentindia's Real Time Monitoring (RTM) system, which is IoT based has been deployed in 25 locations where water distribution schemes under Jal Jeevan Mission are getting implemented.

Greenvironmentindia has the privilege of close and long–standing engagement with most of its clientele in the company's nine years of operations. A real–time monitoring system based on IoT has been proven to be highly effective in addressing three challenging tasks such as fulfilling water needs, saving water cost, energy cost, and reducing water footprint. The company has been successful in ensuring the effective recycling of 70 billion liters of wastewater in the last three years through IoT–cloud–based RTM. The clients, from the sectors such as industries, hospitality, health care, commercial complexes, and residential sector testify to RTMs' effectiveness in addressing the water challenge at times.

In a competitive business scenario, even the noble idea of reducing water footprint would go long only when it adds value and helps to address costs. RTM's stress to contribute to the demands of operational efficiency, cost reduction, maintaining environment/pollution compliances, and energy–saving makes it inevitable for its clientele.

Greenvironmentindia's RTM 2.0 for water and wastewater works with the help of sensors fitted in water utilities, IoT, and cloud–based data management to check and analyze critical quality measuring parameters (e.g., physical, chemical, and microbial) of target water. It can be freshwater, wastewater, recycled water, water bodies, etc.

Based on the analytics, automated alerts about the quality of water or recycled water and the pointers to the impending issues of water management or recycling systems, are shared with the users enabling them for the right decision making.

In the case of freshwater, remedial measures include chlorine dosing and streamlining purification measures such as UV filtration and Reverse Osmosis can be taken based on the alerts generated with the help of data fed on water quality.

In the case of wastewater treatment plants including STPs and ETPs, based on the data on water quality, alerts are generated, which pinpoint the efficacy of plant functioning that would help in timely repairs and maintenance.

Vaishali J Patkar
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Vaishali J Patkar has dedicated the last 20 years to civic, mental health, social and environmental projects and activities. She works in Environment and Social action space, from living a sustainable lifestyle, educating students, and ensuring local environment protection, to taking up government projects and solving crucial water problems.

MUNICIPAL WATER AND

SEWAGE TREATMENT AND VARIOUS STAKEHOLDER'S RESPONSIBILITIES

India faces a major crisis of water. This crisis threatens the basic right to drinking water for its citizens and puts the livelihoods of millions at risk. The demands of a rapidly industrializing economy and urbanizing society come at a time when the potential for augmenting the water supply is limited. Water tables are falling and water quality issues have increased drastically. Both surface and groundwater are polluted by untreated effluents and sewage. Groundwater is accessed from deeper reserves which often contain hazardous levels of fluoride, arsenic, and uranium.

The total water available in the region considering 35 surface water sources is 142 TMC. Major and medium irrigation projects have a capacity of 98% of the total storage, while minor projects serve locally. Out of the 142 TMC water

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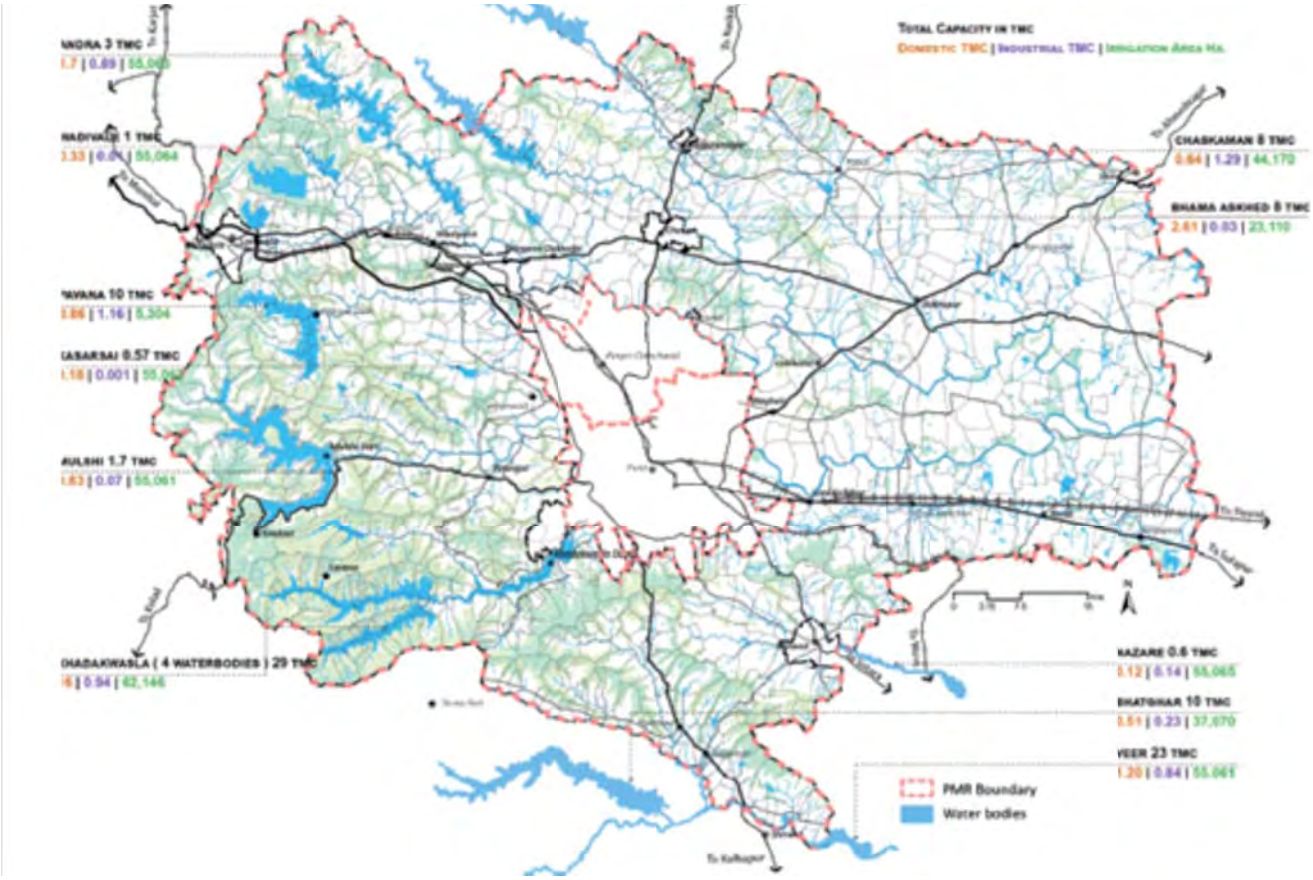
An Analytical Case Study of Domestic Water Consumption in Selected Wards of Pune Municipal Corporation JETIR, Dec (2018)

storage, 38 TMC (27%) is only sanctioned and reserved for use of water. It is observed that currently, the total water supplied to ULBs is much higher than the sanctioned demand and the non–revenue water (NRW) (water that is lost or unaccounted for) is also high in the range of 30–48%.

Currently, PMC recorded the treatment of around 555261.902 Million liters of water i.e 19.6 TMC (2021) every year. Although the 11.6 TMC sanctioned water quota of PMC has not been increased after the incorporation of 23 more villages in PMC. Thus, PMC itself may reach water–stressed conditions in near future. Whereas according to the Water Resource Department, PMR, which is 10 times more in the area but with a less dense population, will get only 13 TMC water in the future for villages. Given the rising water demand, shortages due to environmental factors, system losses, and population increase, Water conservation, and Water efficiency measures need to be accelerated immediately with science–based targets and interventions.

Surface water is used for domestic, industrial, and irrigation purposes through dams, reservoirs, weirs, and canals. Groundwater is monitored by the Ground Water Development Authority and is abstracted via bore wells and dug wells. For rural areas, groundwater plays a major role in providing domestic and irrigation water. Water supplied to the rural area is



River basins and Freshwater Reservoirs in PMR

significantly less compared to its estimated demand. At the village level, 428 villages are covered through regional and individual piped water supply schemes. Water deficit in rural areas can be covered with suitable reallocations of current water quantity supplied to urban and rural areas and reduced NRWs at ULBs.

It is observed that the water consumption in Pune city is higher than the norms laid down by the Bureau of Indian Standards. However, a study shows that only about 21% of the total households in these cities get 24 hours municipal water supply. The activity–wise maximum water utilization in households is in the cleaning (70–80 liters) followed by personal hygiene (40–50 liters), cooking, drinking (15–30 liters), and sanitation (10–25 liters). About 48 % of the population were getting a sufficient quantity of water and 52 % of the citizens getting an insufficient quantity of water at houses.

Groundwater is a major source of irrigation, accounting for about half of the net irrigated area as of 2011 in the Pune district. Irrigation Data 2010–11 indicated that the total area irrigated using groundwater sources in the Pune district is 1,45,500 ha. In contrast, area by irrigation accounts for 1,22,400 ha. The net irrigated area by all sources stands at 3,20,000 ha. Further, there were 91,699 dug wells/tube wells in the district for irrigation as of 2010–11. Additionally, groundwater is also an important source of rural water supply.

Water Treatment and current Losses

The percentage of households with access to tap water (from treated source) within premises is recorded to be 99.2% in Pune city (Census of India, 2011) covering all the housing typologies, partially slums as well. This is way higher than the average standard percentage for any urban center in India, which is 84.14%.

However, a study estimates that the average water consumption is 194 liters per capita per day which is more than the standard scale set by Central Public Health and Environmental Engineering Organization (CPHEEO). Each person can manage every household activity in 150 lpcd, whereas some parts of PMC are using 380 loads of water. This involves tremendous energy for treatment given the current systems. The consumption of water reduced up to 150 lpcd then 12.52 TMC water is enough for 50 lakhs population of the year 2047 whereas now water consumption is 194 lpcd which requires 28.24 TMC water for the same population. And is compounded by a lot of wasted energy caused due to water losses in distribution and use. Water loss was 45 percent in the year 2011 and 41 percent in the year 2017. Some causes of un–accounted water are leakages through very old and dilapidated water supply systems, illegal water connections, water theft, customers' illegal practices, no records of water supply by tankers, customers' illegal practices, and underground water leakages and unnecessary water usage at the domestic level.

The PMC has a network of 2360 km for daily water supply with pipelines that are 800mm and 100mm wide. The water treatment plant capacity is adequate at 1768 MLD for PMC. PMC population is currently 7,893,671, so assuming per capita 150 liters daily consumption, the city water demand is only around 1184 MLD. According to the irrigation department data, PMC borrows 1732 MLD of water per day and also an additional 310 MLD from groundwater, making it 2042 MLD per day. Approximately, 80% of this exits as sewage making the daily volume 1634 MLD. This water needs to be reduced, reused, and recycled.

Sewage Treatment

The water treatment for PMC is around 1500 MLD daily including Khadakwasla and Bhama Askhed projects. But total installed Sewage capacity is only one–third at 567 MLD. And these STPs are currently energy–intensive with the most efficient plant requiring 2 MWh energy for 1 MLD to more inefficient ones requiring up to 20 times more energy. If these are retrofitted to be more energy–efficient, they will leave room to add additional STPs to ensure healthy rivers and water bodies for citizens' well–being.

The GHG emissions from current wastewater treatment energy use are approximately 73993.02 TCO2eq yearly, given the current usage of 90235.4 MWh annual electricity consumption. The energy intensity of these STPs is also currently very high. Reducing demand and using efficient STPs will reduce wastage not just in terms of GHGs and energy but the cost of maintenance as well.

As per the 74th amendment about ULBs to the constitution, Maharashtra Municipal Corporations Act, and Maharashtra Municipal Councils Act, municipalities are mandated to collect, remove, treat, and dispose of sewage. The MJP was mandated for wastewater treatment in rural areas. However, no such function is currently carried out by MJP.

Villages within PMR currently have inadequate sanitation facilities. The untreated sewage is discharged into the natural sewer or low–lying areas or directly into rivers/water streams. Thus, the river pollution level has breached the threshold levels. Poor sanitation facilities in remote areas are posing serious environmental damages due to the discharge of untreated sewage and open defecation to a certain extent. Beyond STPs, rapidly introducing recycling water by reusing treated wastewater for beneficial purposes such as agricultural and landscape irrigation, industrial processes, toilet flushing, and replenishing a groundwater basin is needed to reduce water demand.

The two primary types of wastewater are known as greywater and blackwater. Blackwater is commonly known as sewage and is what

An overview of utilization and availability of drinking water in Pune Municipal Corporation, JETIR, Dec (2018)

people generally refer to as "wastewater." Greywater refers to wastewater that contains fewer concentrations of organic waste than water used for toilets or kitchen sinks but is nonetheless considered non–potable. Untreated greywater collected onsite can serve many of the same applications as treated wastewater. In addition to non–potable applications, wastewater and greywater can be treated up to potable standards and used to replace "virgin" water for any conceivable use, as is being done in Singapore and Orange County, California, if needed.

PMR must aim to be a water–plus region with integrated decentralized Renewable Energy and Circular Economic systems in Water management. According to protocol and the toolkit provided by the Union ministry of housing and urban affairs, a city can be declared as Water Plus only after all wastewater released from households, commercial establishments, and the like is treated to a satisfactory level before releasing the treated wastewater to the environment. A city can be declared as a Water Plus City on certain conditions:

- Wastewater released from households and commercial establishments is treated wastewater for the environment.
- Restrict Industrial pollution, give all industries a warning with deadlines, cooperate with these industries, and incentivize them but after the deadline doesn't leave a single industry. Penalize heavily and publish the fines, so others take it seriously 20%polluters causing 80%pollution. Satellite STP can be installed at various locations. Aerated taps to be fitted mandatory for existing and new sites to ensure minimum discharge from a domestic source.
- All public toilets in the city must be connected to the sewer lines and should be also clean.
- Lastly, 30% of the city's sewer water has to be recycled and reused
- Like almost all urban areas, Pune's sewage management has been dismal. In a recent Public Interest Litigation (PIL) filed against Pune Municipal Corporation (PMC) in National Green Tribunal (NGT) for failing to control water pollution in Mula–Mutha Rivers it was revealed that several crucial details regarding sewage generation and disposal in Pune city remain unknown even to PMC. PMC failed to furnish even the basic details like the present and future generation of domestic sewage (from 2022– 2025), present handling capacity, and performance of STPs for six months.[i] (PIL copy by Sarang Yadwadkar)
- Japan International Cooperation Agency (JICA) has recently agreed to extend a loan of 1000 Cr. to PMC under the project 'pollution abatement of River Mula–Mutha'.[ii] Utilizing this funding PMC has proposed to build 11 new sewage treatment plants (STPs) with a treatment capacity of 396 MLD (Million Litres per Day). It is hard to imagine that PMC which celebrated the signing of the loan agreement in January 2016 was not in a position to furnish even the basic details about sewage generation and treatment in May 2016.
- Currently, in Pune, there is a total of ten STPs with an installed capacity of 567 MLD. Five of them have been funded by PMC while the other five have been funded by JNNURM (Jawaharlal Nehru National Urban Renewal Mission) Phase I. Operation & Maintenance (O&M) of these plants has been outsourced by PMC to various contractors. Treated effluent is being discharged into the rivers Mula, and Mutha Rivers. PMC recently admitted in the print media that though the installed capacity of its existing STPs was to treat 567 MLD, only 290 MLD was being treated at present. [iii] The balance – almost 50% of the sewage – is going into the river untreated. Pune's Rivers are some of the most polluted in the country.

Sr. No.	Name of the STP	Installed Capacity (MLD)	Treatment Process
1	Bhairoba	130	Activated Sludge Process
2	Erandwane	50	Modified Activated Sludge Process
3	Tanajiwadi	17	Biotech with Extended Aeration
4	Bopodi	18	Extended Aeration Process
5	Naidu (old)	90	Activated Sludge Process
6	Naidu (new)	115	Activated Sludge Process
7	Mundhwa	45	Sequential Batch Reactor Process
8	Vitthalwadi	32	Activated Sludge Process
9	Baner	30	Sequential Batch Reactor Process
10	Kharadi	40	Activated Sludge Process

Sewage Treatment Plants in Pune (Source: PMC)

It is clear from this review of Pune STPs that local Residents and citizens of Pune have no role to play, are in fact pushed away from even visiting Sewage Treatment Plants, which is the first and the only line of action to tackle water pollution. At the same time, the governance of almost all existing STPs is dismal, to say the least. Maharashtra Pollution Control Board on its part is not bothered to be involved in monitoring and is only interested in "packets". Unless the governance surrounding centralized sewage treatment does not improve, unless it became transparent, accountable, and democratic, assuming that INR 1000 crores worth of additional STPs will make Pune's Rivers, or India's Rivers clean is like living in a fool's paradise.

Prior to spending more public funds on setting up newer and bigger STPs, the existing infrastructure needs to be put to use, participatory audit of the existing STPs need to be conducted, citizens need to be encouraged to visit STPs, and they need to be a part of the monitoring board, the downstream population needs to have a say in STP management in Pune, PMC and Pollution Control Boards has been held accountable for the increasing pollution of rivers, aquifers, and other water bodies. Until governance is made transparent, participatory, and accountable, more infrastructure, funds, or technology is not going to help, it will all go down the polluted drains and rivers. All sewer lines, drainage chambers & all STPs are in the riverbed. Throughout the monsoon either they are partially or fully submerged. Then how such Infrastructure is allowed? This can never stop sewage from entering the river! So Sewers and Rivers have to be away. There is pmc STP policy of 2005 and as per rule

societies above 150 flats have compulsory STP. MPCB has to monitor this.

Nitin Deshpande had petitioned the petition demanding that the sewage should be used in agriculture and should be used for agricultural and industrial purposes, even after processing it. This request has been approved by the National Green Authority. (80% of water source is used for irrigation purposes, which is a huge quantity in TMC) The order has been issued by the central government to issue instructions to implement this outcome in one month.

353 rivers of the country are polluted out of these 323 rivers are highly polluted. The reason is that water was released into the river due to the old wastewater treatment process. The rivers are still being polluted. The authority has given this historic result after formulating all these issues in the National Green Authority.

The wastewater is not completely processed in the rivers, the main reason for these rivers being polluted is that the Green Authority has given the scourge to the central government's policy of relaxing the rules for processing centers. The authority had appointed the expert committee to decide on the decision. The representatives of the IIT and the Central Pollution Control Board were involved in this. After this report, the authority gave the decision to all pollution control boards in the state have been asked to apply this order to the local bodies.

The State and ULBs need to adopt intensive water pollution and encroachment monitoring and policies to keep further degradation of the water bodies in check. And simultaneously work on restoring the disturbed ecosystems.

Figure 1: Solar panels over water bodies help in conserving water (Downloaded from Scientific American.com)

'HAR GHAR JAL'

A LIFETIME OPPORTUNITY FOR WATER INDUSTRY

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Introduction

Water is perhaps the most precious gift which Mother Nature has given to all living beings including humans. In fact, a certain form of life is possible without oxygen but not without water. Rapid urbanization, industrialization, unsustainable developmental activities, and population growth all have their share of responsibility for taking freshwater resources away from common human beings.

Earlier civilizations developed and evolved around major perennial water sources. But gradually economic development forced humans to shift away from water sources. Arranging water for families became a major activity in urban as well as rural areas. The quantity and quality of water have now become a vital issue for survival. In remote villages, women had to walk long distances to fetch a few buckets of drinking water. Sometimes they had to risk their health and often their lives.

'Ayurveda', the first authentic record of medical science written several thousand years back, has mentioned various types of sources of water and methods to treat water before drinking. This fact indicates that sufficient and safe drinking water was an issue of concern even during the Vedic period. Since then, many technological advances have taken place and enormous efforts have been put by mankind, rulers, and governments to quench the thirst of everyone in all seasons, but the gap between supply and demand could never be matched particularly during summers in rural areas. Even during floods when water is all around, safe potable water becomes a scarce commodity.

Now, the Government of India has launched the mission 'Har Ghar Jal' in 2019 to ensure

the availability of piped supply of drinking water in each and every house of our country. This mission aims for providing water of desired quality and in sufficient quantity in 19,31,99,823 (about 193 million) houses. At the beginning of this mission, only 16.5% of rural houses had piped connections and this figure has reached 49% now.

Nearly 100 million houses will have to be connected to piped water supply by 2024. No doubt, this is the largest and most ambitious mission of its kind ever undertaken in human history!!

Apart from various faces and issues this mission has, it is putting up challenges for all stakeholders concerned with water viz.; water engineers, water scientists, water activists, water administrators, and the water industry. Those who are dealing in the field of wastewater management also need to mend their concepts and designs of STPs to emphasize reuse rather than safe disposal to reduce the burden on freshwater bodies.

In this paper, the possible focus areas and business opportunities available to the water industry have been discussed. For successful implementation of this mission availability of water alone is not essential but material and manpower management is equally vital. Further, the role of players in this field does not end with the execution of the last tap connection to a remote house but the real challenge will start thereafter – to make it sustainable. Water supply in sufficient quantity and of acceptable quality will have to be supplied at appropriate pressure in all corners of the country round the clock, 365 days!

Apart from the requirement for freshwater, the materials like pipelines, valves, taps, pumps, motors, reservoirs, storage tanks, treatment units, chemicals (alum and chlorine, etc.), level sensors, floats, drainage/sewer pipes, a wastewater treatment, and disposal/reuse, etc. will be required in large quantities. Operations, monitoring, and quality assurance will increase the demand for equipment, laboratories, field test kits, and skilled manpower at various levels. The overall water industry is going to get a boost and a new dimension to its sphere of activities is being added i.e. rural India.

Quantity of Water

The freshwater requirement per liter per capita is recommended by NBC for various cities. The same is listed in table 1 below. Hitherto, for villages, only 45 lpcd was considered but in this mission, 55 lpcd has been considered. The gap between water requirements in urban and rural sectors is due to different lifestyles and the non–availability of waterborne sanitation in rural areas. Over a period of time, with development in rural sectors, this gap will reduce.

1	Towns with piped water supply but without sewerage system	75 lpcd
2	Cities with piped water supply and with sewerage system	135 lpcd
3	Metros with piped water supply and sewerage system	150 lpcd
4	Villages with piped water supply in each house (https://jaljeevanmission.gov.in/media/harghar–jal–jal–jeevan–mission)	55 lpcd

Table 1: Per Capita Water Supply (NBC 2016–part 9)

The projected rural population is about 900 million for the year 2024. Thus about 50,000 million liters of water are required to be pumped, treated (normal treatment is coagulation, filtration, and disinfection), transported, and distributed to about 20 crore houses per day.

There will be a requirement for the storage of raw water. It can be in form of large reservoirs, small check dams, wells, groundwater holding, direct catching of rainwater, etc. India has diverse climatic conditions, from the extreme cold of Leh in the North; to the extreme hot desert of Rajasthan; to the saline coastal belt of south India; too high rainfall areas in the North East, and the flood plains of UP and Bihar. All have unique solutions for the storage of water for use throughout the year. However, one common point in all regions is that water needs to be conserved during rains, stored in a manner to have minimum losses and quality deterioration, and to be used during the remaining part of the year. If possible, store some for unforeseen requirements in the future as good monsoons do not take place every year.

Apart from mega water schemes like interlinking of rivers, other projects for enhancement of the capacity of existing reservoirs by desludging, increasing upstream storage, tapping surface runoffs from small catchments through check dams, etc.

All options will be required. New concepts for the minimization of water losses will have to be used. Provision of solar panels above water bodies (Figure 1 shows a typical solar panel above a water body), use of heat reflective sheets as cover and use of tree lines to break wind speed are some of the techniques that can be used for reducing evaporation losses. Similarly, for checking seepages various methods viz., use of fine particles like silt or coagulated clay, etc. can be used for blocking pores in the unlined beds of reservoirs. Subsurface earthen dams can also be tried for enhancing groundwater storage. Such projects will open vistas for many new projects at various scales for the water and construction industry to grow. Overall water management from macro to micro–level will be required to provide a sufficient quantity of piped potable water to all.

Transport of Water

A network of pipes for the transport of water from the source to the treatment point and for distribution thereafter will be required. Although it is very difficult to assess the requirement of pipes, however, a rough estimate of about 20 km of the pipeline for each village can be made. India has more than 7.5 lakh villages. For 50% of villages, about 75 lakh km of pipe length will be required! This is roughly double the distance to the moon.

Since the age of water pipes is 50 – 100 years, this will be a one–time peak demand for 50mm–150mm diameter pipes. However, the high demand for ½ '' pipe will continue for many more years as this size is primarily for internal plumbing.

Demand for other accessories like pumps, motors, switch systems, and plumbing items (tap, bends, valves, etc.) will also get a boost and will last for a longer period.

Quality of Water

The physical, chemical, biological, and radiological characteristics of drinking water should be as per BIS 10500–2012. The standard has recommended two limits – 'acceptable limit' and 'permissible limit in absence of alternate source'. For all piped water supply schemes, new or old, design requirements of water treatment plants/community water treatment plants should take care of supplying drinking water with quality parameters within the prescribed limits. A total of 64 parameters have been specified by the BIS including pesticides. However, 16 basic parameters are listed below in table 1. Certain chemicals like iron, fluoride, nitrate, and arsenic, heavy metals are area/region–specific but require adequate treatment.

SN	Parameter	Unit	Limits as per IS 10500	
			Acceptable	Permissible in absence of alternate source
1	Colour	Hazen	5	15
2	Odour		Agreeable	
3	pH		6.5 to 8.5	No relaxation
4	Turbidity	NTU	1	5
5	Hardness	mg/l	200	600
6	TDS	mg/l	500	2000
7	Alkalinity $_{CaCO3}$	mg/l	200	600
8	ChlorideCl	mg//	250	1000
9	FluorideF	mg/l	1	1.5
10	IronFe	mg/l	1	No relaxation
11	NitrateNO3	mg/l	45	No relaxation
12	SulphateSO4	mg/l	200	400
13	ArsenicAs	mg/l	0.01	No relaxation
14	E Coli/ Thermo tolerant bacteria		Shall not be detected in 100 ml sample	
15	Coliform bacteria			
16	Free chlorine Residual	mg/l	0.2	1

Table 1 : Quality parameters for drinking water

Depending upon the quality and source of raw water various treatments are done. Normally, groundwater is free of turbidity and floating material and requires nominal treatment and disinfection. However specific treatment, when TDS or any of chemicals contaminations (Arsenic, Flouride, Nitrate, Iron, and Chloride) are high, is to be provided to groundwater The chemical contamination due to these chemicals and heavy metals does not have pan India presence but are local to certain states only as tabulated below at table 2. Treatment units/processes at a large scale but of smaller capacities will be required. This will give ample opportunities for research and development. Manufacturing of membranes for ultra–filtration and at molecular levels will find larger markets thus bringing down costs. Since these processes and units require continuous use and maintenance, their demand will remain even after the completion of this mission.

SN	Chemical	No of States affected	Most common in states (top two)
1	Arsenic	10	West Bengal, Jharkhand
2	Fluoride	20	Rajasthan, Gujarat
3	Iron	28	Assam, Arunachal Pradesh
4	Nitrate	17	Andhra Pradesh, Maharashtra
5	Salinity	17	Rajasthan, Gujarat

Table 2: Chemical Contaminations in raw water

Surface runoff water normally has high organic impurities and also high turbidity. Therefore, apart from aeration, it requires coagulation and filtration. Hard waters require the removal of hardness. In case saline water is to be used then demineralization processes are required. All waters require disinfection and also free chlorine to take care of possible contamination en route to the end–user. These processes are summarized in Fig 2 below.

For this mission, it must be understood that in all villages small water treatment plants will be required. The population of villages varies from 500 to 10,000 and for small towns it will remain less than 1 lakh. Even if future growths are accounted these figures will remain more or less in this range only due to the migration of rural folks towards urban areas. The second important issue is the availability of electricity. Although, most of the villages are having electricity regular supply round the clock is still a distant reality.

	1	2	3	4	5	6	7	8	9	10	11
	STORAGE	CHLORINATION (PRE)	AERATION	RAPID MIXING	FLOCUULATION	SEDIMENTATION	SOFTENING FILTERATION	SLOW SAND FILTERATION	RAPID SAND FILTERATION	CHLORINATION (POST)	DEMINERALISAT ION
GROUND WATER (A1)										→	
GROUND WATER (A2)			→	→	→	→			→	→	
SURFACE WATER (B1)	→									→	
SURFACE WATER (B2)						→		→		→	
SURFACE WATER (B3)		→	→	→	→	→			→	→	
SURFACE WATER (B4)				→	→				→	→	
HARD WATER							→		→	→	
SALINE WATER						→	→		→	→	→

Figure 2: Various Treatment Processes for Drinking Water

There are certainly positive aspects that will help in the cost reduction of treatment plants. First of all, the cost of land is low thus the costly technologies for land saving need not be adopted. For example – a slow sand filter, which gives excellent quality of treated water and does not require highly skilled manpower for operations, can be used for rural areas instead of a rapid sand filter or pressure filter. The slow sand filter of 50 m2 to 500 m2 area and with 10– 16 hours of operations will suffice for small (500 persons) to large villages (10,000) respectively. These can function effectively for 2–3 years without a change of sand bed. It can be seen that rapid sand filters, although about 20 – 40 times faster than slow sand filters do not have many advantages in terms of savings in space and cost due to inherent higher requirements for M&O. Another favorable factor related to low–cost land is the ease of harvesting of solar power. SPV plants can be erected on waste/barren lands, water bodies, or rooftops as an alternate source of electricity.

Membrane filters can also be effective for rural areas because the total mass loading of particles to be removed will remain low in the case of small capacity plants. The demand for membranes will increase substantially and also will remain steady. New start–ups may find it profitable to venture into the business of manufacturing membranes indigenously.

It can be seen that the development of standardized designs of WTP can be evolved at the State level. The cost of WTP can be brought down using standardized designs with the economics of scale keeping in view that several lakh WTPs will be made pan India. Large industry players can invest amounts for the purchase of equipment and heavy machinery to further reduce costs by saving labor and time. The use of trenchless technologies for laying pipes, and the use of prefab structures are a few examples where new technologies can be adopted.

Quality Assurance and Testing Facilities

Quality assurance is achieved through regular testing in labs and in the fields. This will lead to an increase in the demand for setting up laboratories at the district level. Facilities at these labs help in source selection and therefore will have facilities for testing most of the parameters barring pesticides and radiological contaminants. The requirement of field test kits for testing TDS, turbidity, free chlorine, etc. will always be there. New avenues for the training of personnel to skilled or semi–skilled manpower in each village will be there. Lab technicians, ground engineers, operators, and plumbers will also be recruited or hired. In a nutshell capacity building of HR at various technical and managerial levels will be required.

Financial Sustainability

Every mission or project needs to be supported financially. Further, for its sustenance, it needs to be financially viable and independent. Water is essential for life but since it is supposed to be available for free by Mother Nature, expectations from the public at large are that water tariffs should be very nominal. However, a change of mindset is required and a sustainable financial model must be evolved by administrators.

Development of water treatment plants such as picnic spots having nominal entry fees, one–time connection fees, telescopic tariffs with smart metering, and using high water tanks for advertisements are a few ways to increase revenue. Educating the public about gains in terms of good health, good hygiene, and improved quality of life with a piped water supply can change their perception and they can be motivated to bear the actual cost.

Conclusion

'Har Ghar Jal' is a mission that if implemented properly, will not only provide water to every house of this great country but will also open very large business opportunities for all those, who are in or willing to join, the water industry directly or indirectly. Political will is already clear. Now it is up to water engineers and all other stakeholders to gear up their resources and talent and convert this dream mission into a reality. Lastly, the participation of a common man will make it sustainable.

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THE NEW WATER SOURCE

Smita Singhal
Director & Founder, Absolute Water Pvt Ltd

Smita Singhal *is the Founder and Director of Absolute Water Pvt. Ltd. Innovator for India's first-ever 100% green and organic water recovery system from sewage, converting it into potable drinking water without the use of chemicals and RO systems. Smita's biggest achievement has been that of being able to persuade esteemed government agencies such as the Delhi Development Authority, Delhi Jal Board, Punjab water and Sewerage board, and Karnataka Municipal Department, to reuse and recycle sewage into potable water and to secure work orders for the same.*

Water is the essence of life, but the reckless exploitation of this valuable natural resource has inclined the civilization towards a future where the availability of potable water will appear like an unrealistic dream. Although, a renewable resource to date, in the near future it will become the scarcest of the resources, leaving half of the population to dwell on unfit water.

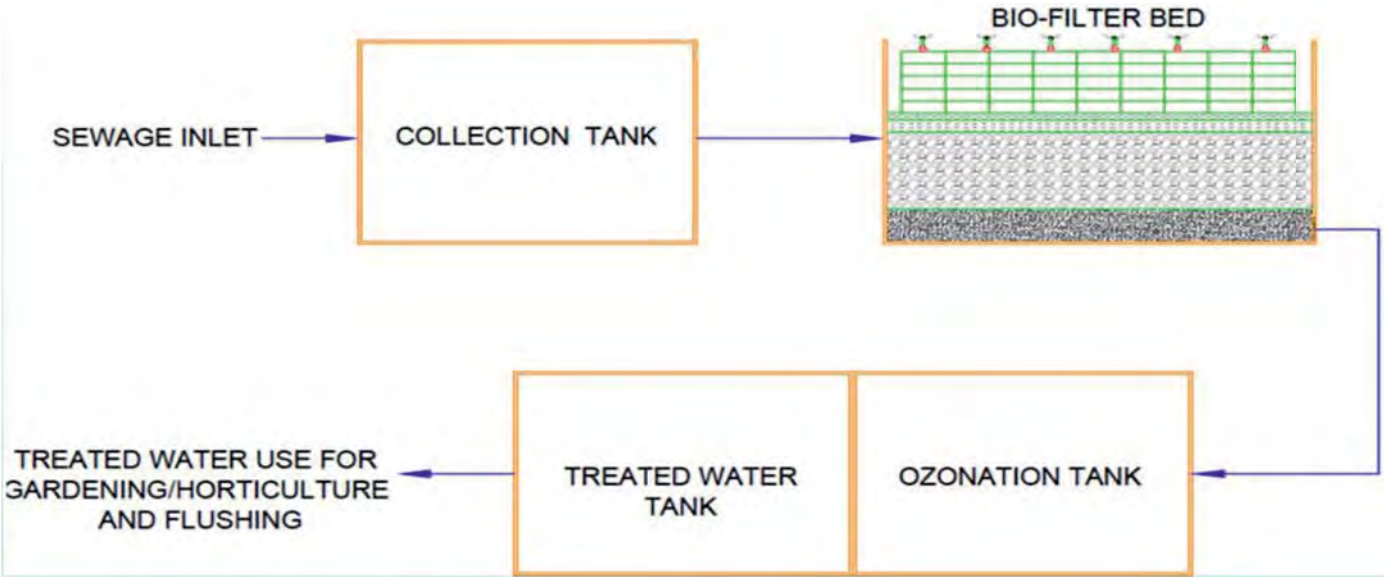
Partially or un–treated sewage is the single major source of deterioration of surface or groundwater quality. It contributes to 70% of the population load to streams or water bodies of India.

The untreated wastewater is a massive pollutant that contaminates the groundwater, rivers, and the natural drainage system causing pollution in downstream areas. The consumption of polluted water has an adverse effect on human health as well as on aquatic life.

The Need of the Hour

Treatment of sewage is absolutely necessary for making our river and water bodies clean. In spite of all efforts, only 20235 MLD of treatment capacity have been developed against the

www.absolutewater.in



total sewage generation of 78368 MLD. It is mandated for SPCB's/ PCC's under section (l) (i) of The Water Prevention and Control of Pollution Act, 1974 to make, vary, and revoke any order for prevention, control, or abatement of discharge of waste into streams and under section 24 to prohibit the use of stream or well for disposal of polluting matter. Therefore, it is necessary to make it mandatory for setting up STPs by the municipal authorities for bridging the treatment gap.

So why is only 30% of Sewage Being Treated?

In a conventional methodology, which India has adopted too, sewage is being transported to a centralized treatment plant for the treatment. It demands a highly stabilized infrastructure for the continuous working of the system.

The principal disadvantages of centralized conventional process technologies are:

- Laying a sewage network is highly expensive
- High power requirement
- Long Retention time; hence storage/collection tanks/ Clarifiers etc.
- Sludge formation and its disposal
- Long time for stabilization
- Highly skilled manpower needed for operation
- High Operation & Maintenance cost

Way Forward: Reusing the Treated Water – Need of the Time

In such a scenario, alternatives are needed urgently for treating domestic wastewaters which are eco–friendly and effective in a decentralized arrangement. We can recover WATER from sewage in an effective manner where the quality is safe for human consumption, be it fit for drinking, bathing, flushing, gardening, groundwater recharging, etc.

Reusing treated municipal sewage is not a new idea. It has been treated and used for indirect possible use in a number of ways. In Adelaide, Australia, the treated sewage is discharged into the Murray– Darling rivers, which are then used as drinking water sources for the cities downstream (https://en.wikipedia.org/wiki/Water_supply_and_sanitation_in_Australia). Orange County Water, California treats the raw sewage and uses the same for water recharging. (https://en.wikipedia. org/wiki/Orange_County_Sanitation_District). NEWater, Singapore is another example – where the treated wastewater (sewage) goes into the water supply. (https://en.wikipedia.org/ wiki/NEWater)

The Absolute Water Vermi–filter ™ Technology

The global scientific community today is searching for a technology that should be "economically viable", "environmentally sustainable" and "socially acceptable", in addition to creating maximum impact.

Vermi–filtration has opened new grounds for treating wastewater in the world and especially so in developing countries due to it being low in cost and more importantly being a nature–based solution. Absolute Water has come up with such unique green technology that can be used in a decentralized way, which face multi–dimensional issues when it comes to managing wastewater as well as exiting water resources i.e. to treat the sewage in a cluster and recover potable quality water which meets the WHO/BIS standards of drinking water.

The Process

The process described here is unique as it is the first such proven project in India, directly converting raw sewage into drinking water.

3 levels of filtration:

Level 1: Sewage Treatment through AWPL Vermi–Filtration

- Vermi–Filter System is high in efficiency using a multi–filter medium which includes worms, specially developed microbes, and organic & in–organic media.
- Sewage pumped from the Effluent collection tank is allowed to pass through a screen to remove/ separate the macroparticles present in the effluent.
- Sewage is distributed evenly over the surface of the filter medium,

Civil Unit – CAPACITY: 100 KLD – 2 MLD, The footprint of our Vermi–filter STP is smaller in comparison to competitive green technology.

by sprinklers. As the wastewater slowly percolates down, naturally occurring microbes degrade the solids and organic matter, reduce coli form bacteria, and nitrify ammonium, producing clear and odorless water.

- Filtration through In–organic media followed by sand filtration to remove the traces of suspended solids present in the treated water.

Step 2: Ozonation:

Proven disinfection naturally

- Treats the Covid Virus, as it has been established by various sewage control in many countries during the pandemic
- An effective way to treat water contaminants such as industrial contaminants, pesticides, organics, BOD, and COD.

Step 3: Membrane System

This is a non–R.O. System with very high recovery (> 80%).

- The specially designed Membrane not only filters out various contaminants but also harmful bacteria, viruses, and other pathogens.
- The feed is taken from the ozonation tank
- The filtered treated sewage is fed into the membrane system and permeates from the membrane is of potable/contact water/bathing water quality.

Distinct advantages over other conventional treatment methods are as follows:

- Totally natural, green process, based on beneficial microbes and earthworms to break down the organic waste present in the sewage
- It harnesses the energy, carbon, and other elements present in the waste and converts them to energy–rich humus, biofertilizer & nutrient enhanced treated water
- Reduces costs of collection, transfer, and treatment of raw sewage
- The toxicity of Ammonia gets reduced through Nitrification, converting to useful Nitrates that will act as a nutrient when the treated water is used in gardening (an eco–friendly substitute to urea)
- No odour and no sludge formation
- Very low power requirement, only one small pump of 1.0 KW/ 100KLD System
- Does not require a skilled person for operation & monitoring
- Acceding the Pollution Board norms for use of treated water in gardening
- The system can be tailor–made to suit site conditions and geometrically

Capacity: 20 – 50 KLD – Can be used via solar energy.
Suitable to cater small villages, housing colonies, localized treatment plants, etc.

sized accordingly.

- Automatic operations
- Noise–free system
- Plug & play assembly for easy installation. Frequent start/ stop will not disturb biological balance or plant output water characteristics
- Very cost–effective

The reclaimed water from this plant is already being catered to the nearby communities, which is used for:

- Potable/non–potable
- Bathing/washing/flushing
- Irrigation
- Horticulture/construction
- Groundwater recharging
- River rejuvenation

Modular Arrangement for Lower Capacities with Utmost Result

Another aspect of Vermi–filter which makes it superior to other technologies is its arrangement, as it can be easily installed in a modular system for those industries/institutions/hotels/housing colonies where the wastewater generation is in low quantity and facing space constraints as well. It needs very less workspace for its installation as compared to conventional techniques acquiring a smart footprint for its installation with the shortest stabilization time overall the conventional technologies,

Inlet & Outlet Water Characteristics

Inlet: Raw Sewage

Sl. No	PARAMETERS	UNITS	VALUES
1.	pH	s.u.	6.8–8.0
2.	TSS	mg/l	Up to 400
3.	BOD	mg/l	Up to 300
4.	COD	mg/l	Up to 450
5.	Oil & Grease	mg/l	Up to 40
6.	Faecal Coliforms	MPN/per 100ml	106

Sewage Post Vermi Filter Ozonation

Outlet: AWPL Vermi–Filter Treated Water

Sl. No	PARAMETERS	UNITS	VALUES
1.	pH	s.u.	6.5–8.5
2.	TSS	mg/l	Up to 10
3.	BOD	mg/l	Up to 10
4.	COD	mg/l	Up to 50
5.	Oil & Grease	mg/l	Up to 10
6.	Faecal Coliforms	MPN/per 100ml	230

Tested by the Central Pollution Control Board, State Pollution Control Board, Shriram Labs

The reject stream having its BOD < 10 ppm, can be sold as a liquid fertilizer (highly nutritive and rich in NPK), very much beneficial for horticulture purposes in parks & golf courses, or in converting a wasteland (contaminated land) into fertile land. The evaluation of the project has already been carried out with the present system. The Vermi–filter media is generally re–filled once a year, depending upon the system operation; the rejected media is a highly enriched humus, used as rich bio–fertilizer manure for irrigational land/horticulture or can be even marketed to nurseries as well.

Our Scalability and Growth Areas

- **Industry:** ZLD concept can be introduced for 100% usage of treated water and zero discharge of industrial effluent into Sahibabad drain, especially for food processing, steel, dairy, and the textile industry
- **Residential:** Modular Bio–STPs can be introduced in a cluster of societies such as RWA, for decentralized treatment, where treated water can be reused for horticulture, and toilet flushing/car washing.
- **Green Area:** Our modular units can treat water on–site and dispense treated water for hydration. Being mobile in nature, one unit can easily hydrate 4 to 5 zones in one day
- **Construction Use:** 100% reuse of treated water from Sahibabad drain for all construction uses, thereby eradicating the use of groundwater or buying of water for the same

Conclusion

Water is one of the world's most valuable resources, yet it is under constant threat due to climate change and resulting in drought, explosive population growth, and water pollution.

One of the most promising efforts to stem the global water crisis is industrial and municipal water reclamation and reuse.

Water reuse allows communities to become less dependent on groundwater and surface water sources and can decrease the diversion of water from sensitive ecosystems.

The mission of ABSOLUTE WATER is to always be at the forefront to fight the global water crisis by managing our most valuable water resources. We believe that this "new water" source may also be used to replenish overdrawn water sources and rejuvenate or re–establish those previously destroyed. We are the green alternative to all kinds of polluted water.

VIRTUAL WATER

IN TRADE AND ITS GEO–STRATEGIC IMPLICATIONS

Col. Bhaskar Tatwawadi
Director, Double Shotz Pte. Ltd.

Col. Bhaskar Tatwawadi (Retd), *an army veteran and a Civil Engineer from VNIT Nagpur with a Master's degree in Environmental Engineering (Gold Medallist with Honours, 1984.) from IIT Roorkee have over 47 years of professional experience. His 23 years stint in the Army, Corps of Engineers, included the construction of water treatment plants and the design of several sewerage and sewage treatment projects for military, naval, and air stations. Later, he has worked on many projects in water and wastewater management including the design and execution of rural and urban water supply and sanitation schemes, the Visakhapatnam Industrial Water Supply Project (1998), construction of the BWSSB Water Treatment Plant of 300 MLD (2000 -01) and the first Chennai Metro-water Seawater Reverse Osmosis Plant of 100 MLD (2005).*

Introduction

Virtual water trade refers to the import and export of hidden water in the form of products such as crops, textiles, machinery, and livestock. The Chinese claimed that Virtual Water as an integrated component of their Belt & Road Initiative would help all the involved nations. Post–2019, in the SARS–COV–2 Pandemic era, virtual water has emerged as a potent geopolitical weapon. Trade balance based on the virtual water component of the exports and imports will now shape the commerce and future of global trade. A new framework of Hydro–Hegemony will call the shots. An ADBI paper on The Trade and Water Nexus explored the linkage between the virtual water trade and SDG–6. This article presents the various facets of virtual water trade from water–rich and water–deficient countries. The formulation of trade strategies to weaponize surplus water stocks and secure favorable trade agreements shall become the order of the day as more and more areas and communities face water scarcity and aridification.

Virtual Water – The Invisible Component of Water Use: Part II

The Chinese Belt and Road Initiative

Virtual water trade refers to the import and export of hidden water in the form of products such as crops, textiles, machinery, and livestock – all of which require water for their production. Chinese authors YuZhang, Jin–HeZhang, QingTian, Ze–Hua Liu, and Hong–Lei Zhang in their

article titled "Virtual Water Trade of Agricultural Products: A New Perspective to Explore the Belt and Road" (published in Science of The Total Environment; Volumes 622–623, May 2018, Pages 988–996) have stated that Virtual Water is a new perspective to explore the Belt and Road.

As stated in their article, on the virtual water component, China was in a virtual water trade surplus with the countries along the Belt and Road. More than 40 countries had a virtual water trade surplus with China. Moreover, the proportion of the grey water footprint that China exported to the spanning countries was much higher than that imported. The authors also claimed that the Virtual water trade with China benefited both the countries along the Belt and Road and China.

The authors go on to explain: The Belt and Road is an initiative of cooperation and development that was proposed by China. Moreover, most of the spanning countries faced water shortages and agriculture consumed a lot of water. Virtual water links to water, food, and trade and is an effective tool to ease water shortages.

To understand the Belt and Road from the new perspective of virtual water trade of agricultural products they considered agricultural products trade from 2001 to 2015. They found that China was in a virtual water trade surplus with the countries along the Belt and Road. More than 40 spanning countries were in virtual water trade surplus with China and eased water shortages. Russia had the largest net imported virtual water from China. Furthermore, the proportion of the grey water footprint that China exported to the spanning countries was much higher than that imported.

The authors claim that more than half of the countries' virtual water trade with China conformed to the virtual water strategy, which helped to ease water crises. Furthermore, the products that they exported to China were mainly advantageous products that each spanning countries have. Virtual water trade is a new perspective to exploring the Belt and Road. While theorizing that the agricultural products trade with China definitely benefits both the countries along the Belt and Road and China from the perspective of virtual water, their findings claim to be beneficial for the water management of the countries along the Belt and Road and for China to alleviate water shortages, encourage the rational allocation of water resources in the various departments and to provide references for optimizing trade structures as well.

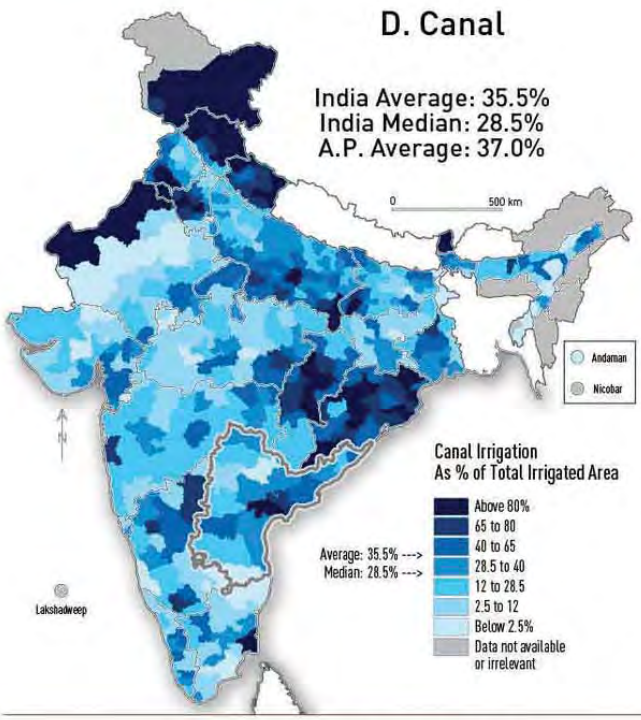
Cut back to 2021 and the post–SARS–COV2 pandemic era and the trust deficit against China and its hegemonic designs. There can be no doubt that Virtual Water has now become a weapon in the hands of water surplus countries. An image from the above–referred article shows the extent of imported virtual water annually.

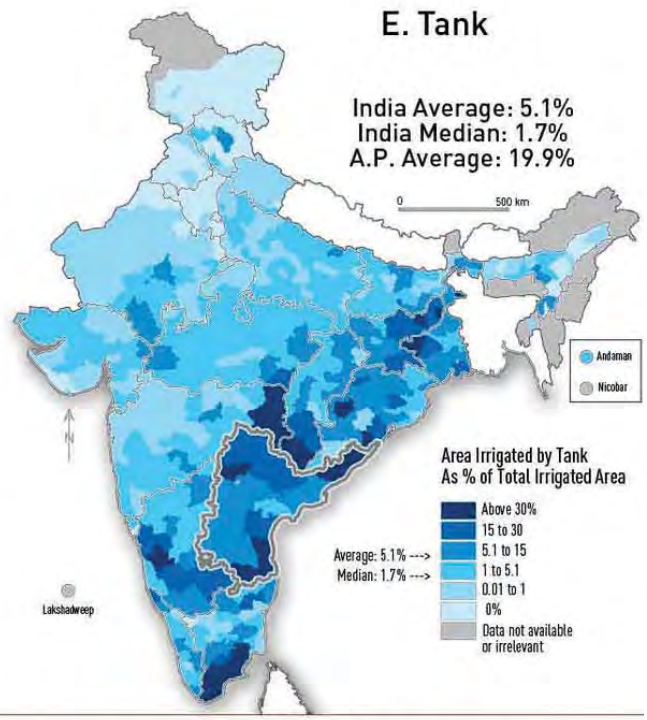
Another article titled "The Economic Significance of the Virtual Water Trade" by A Gunatilaka and Buddhadasa Hewavitharana published in the Felicitation Volume II, 2010 – ips.lk further emphasizes the human need for a staggering amount of water to feed, clothe and provide health and sanitation in a lifetime. As populations increase and economic growth and standards of living improve, this is immediately reflected in the per capita use of water. Exports and imports of food, grain, cotton, sugar, textiles, paper, timber, etc. are actually an indirect trade in large amounts of water designated embedded or virtual water (VW) as these items are water–intensive products (Allan, 1993). This concept quantifies trade flows between countries and gives a VW trade balance in the context of water needs and availability and with a characteristic water footprint for each country.

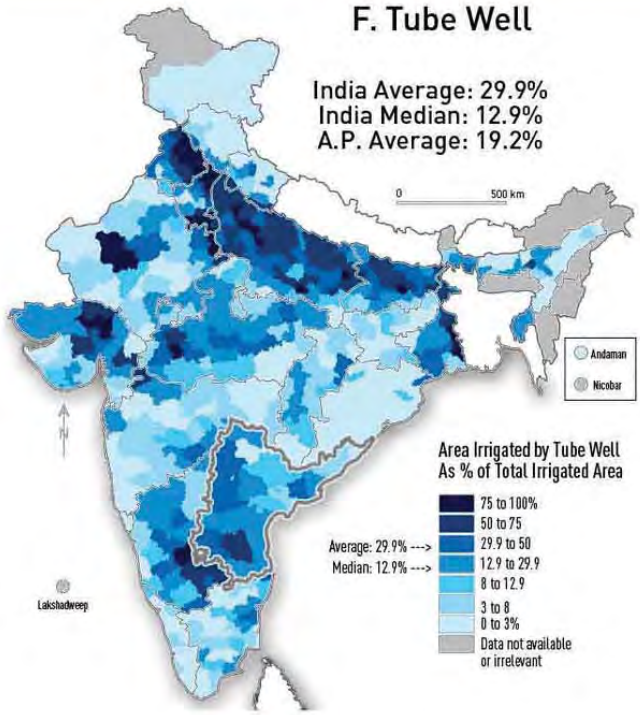
Virtual Water Trade In India

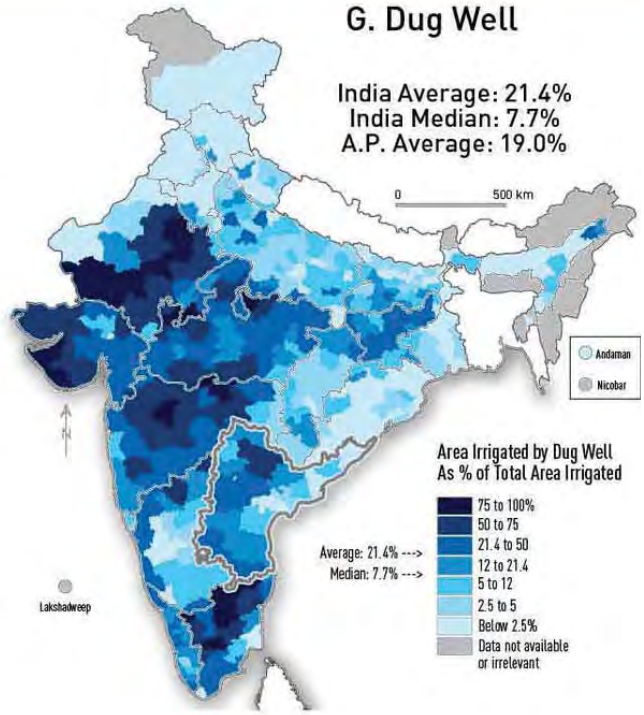
M. Dinesh Kumar in his article "Physical Transfer of Water Versus Virtual Water Trade: Economic and Policy Considerations"– provides comparative economics of physical water transfer and virtual water trade in India to deal with the problem of growing scarcity of water. This is based on a

DISTRICT WISE









nuanced understanding of the difficulties in operationalizing the concept of virtual water trade from a regional perspective; a better appreciation of the differential economic value of water use of land–rich, water–scarce regions and land–scarce, water–rich regions; and a recognition of the various direct and indirect benefits of large water transfer projects as evident from recent empirical studies.

His study of comparative economics of physical water transfer (between water–rich regions of eastern India to water–scarce regions of peninsular India) and the "virtual water transfer" alternative, considering the anecdotal evidence of various direct and indirect costs and benefits throws up interesting results. Whereas the direct costs included the economic cost of infrastructure, and various damage costs and transaction costs; the indirect costs covered economic, social, and environmental costs. The several cost components were more pronounced for physical water transfer. The benefits considered in the analysis included direct economic benefits and various indirect benefits that are social, economic, and environmental in nature. The analysis showed that the net benefits of physical water transfer outweigh virtual water transfer.

Hydro – Hegemony

Becca Farnum in the Paper titled "Virtual Allocations: Expanding the Framework of Hydro–Hegemony to Inform Virtual Water Trade" presented at the 2014 Norwich Conference on Earth System Governance, investigated the relationship between access to water resources, global trade patterns, and power through the lens of virtual water and hydro–hegemony. Virtual water trade refers to the ability of countries to trade 'water' by importing and exporting goods requiring water for production, rather than actual water.

According to the author, the proponents of virtual water trade argue that food trades from water–rich, arable land to arid land can help to enhance the arid area's food and water security, freeing up local water resources for other uses. Critics of the virtual water discourse are concerned that highlighting markets and trade as the saviors of water–poor countries may be yet another component of the neoliberal economic prescription. The paper examines the power relations at play in how virtual water is accessed and allocated by expanding the Framework of Hydro–Hegemony.

In 2006, Zeitoun and Warner introduced the Framework of Hydro–Hegemony, as an analytical tool for analyzing transboundary water conflicts. Expanding that Framework to be relevant for the analysis of virtual water trade patterns and applying this to three case studies (Peruvian asparagus exported to the United Kingdom, American cereals imported by Egypt, and Israeli agricultural produce consumed in the European Union) the author concluded that virtual water flows are highly subject to hydro–hegemony, shaped by material, bargaining, and ideational powers.

Jenny Kehl in her article "How virtual water is lost" published in Straits Times on 18th March 2013 gave some interesting numbers. While explaining why virtual water matters, she provided the Estimates by UNESCO–IHE, the International Institute for Water Education, showing some 1,040 billion cubic m of virtual water are traded each year globally. This trade could be reorganized for water–scarce regions to become virtual importers, a reversal of their current net loss, and for water–rich regions to become virtual exporters.

Since the reality is that overall water consumption to produce water–intensive crops in water–scarce regions constitutes an inefficient use of water, such products may be discontinued. For example, producing 1kg of

grain in favorable climatic conditions requires up to 2,000kg of water; the same amount in an arid country requires up to 5,000kg. The difference is due largely to high temperature, high evaporation, soil conditions, and other climate factors. It also means that global coordination is needed as water scarcity increases. Water scarcity and food security are inextricably linked due to the fact that agriculture is the largest water user, requiring about 70 percent of all water used for human production and consumption. For example, it takes around 500 liters of water to produce one cup of rice and 4,500 liters to produce a 300g serving of beef.

Similar data on excessive water use for the production of unit a mass of food items and other goods and services for consumption by humans and other bio–sphere consumers are doing rounds in print media. Imbalances between water availability and production of water–intensive crops like sugar cane and rice in dry and drying areas are only adding to water woes. The lack of national policies and enforcement of water discipline mechanisms are leading to excessive food grain production in water–stressed regions; for export to water surplus regions!

Virtual water is deemed a consumptive use, simply because it's not returned to its original remote hydrological system. This causes a net water loss from the region when its products are exported. Virtual water exports exacerbate scarcity, food insecurity, and income loss. The imbalance could subsequently decrease political stability and stunt economic prosperity and hence are strategically significant.

Approximately 25% of all water used in production is traded through water–intensive commodities in the international market. In short, this means that one–fourth of water use is exported as virtual water. The amount is even higher in countries that are large food and grain exporters. For example, the United States exports approximately one–third of its total water withdrawal in the country. The scale of the virtual water trade is expected to increase as global demand for food increases with population growth and economic development. On the other hand, the water–scarce regions can mitigate food shortages and improve water–use efficiency by importing agricultural products with high virtual water content and exporting products with low virtual water content.

The stark facts are that the water–scarce regions are overwhelmingly producing and exporting water–intensive products. Arid parts of Egypt, Turkey, and Eastern Europe produce large quantities of water–intensive cotton for export to Asia and Europe. Based on scarce land and water resources, Singapore and Malaysia have used the international food market to import water–intensive grains and meats; they export mostly non–agricultural value–added manufactured goods. This lets them maintain food security while harnessing scarce water resources for competing uses.

International water trade and food output can be improved if the idea of comparative advantage is applied to decisions about importing versus exporting water–intensive crops. Water–scarce countries should import water–intensive grains and export products with less virtual water content.

Ria Tan, who is the endowed chair of the School of Freshwater Sciences and director of the Centre for Water Policy, University of Wisconsin–Milwaukee writes: "CORRECTING inefficiency in global water–use requires substantial international coordination. A high level of cooperation is possible in this area, as the food crop trade is globalized and food security highly interdependent. It is the dearth of information about the hidden water trade and the current lack of coordination that perpetuates global water–use inefficiencies. The Food and Agriculture Organization of the United Nations and the Organization for Economic Cooperation and Development have the experience and are best suited, to provide information about global water–use efficiency and coordinate the world's large food producers and consumers. We must look for the water hiding in plain sight."

Karthikeyan Brindha in an article titled "Virtual Water Flows, Water Footprint and Water Savings From the Trade of Crop and Livestock Products of Germany" (29 May 2020) assessed the virtual water trade of Germany and the national water footprint for a twenty–five years period from 1991 – 2016. This was based on 328 crop and livestock products. His study revealed that Germany was a net water importer with about 100 billion cubic meters of virtual water imported and about 60 billion cubic meters of virtual water exported annually.

A Le Vernoy, in a Working Paper of the Asian Development Bank Institute (ADBI), published in February 2017 and titled "The Trade and Water Nexus" (ADBI Working Paper 669. Tokyo: https://www.adb.org/publications/trade–and–water–nexus) has investigated and theorized the direct and indirect links between international trade and water resources. The author states that with the right domestic policies and international trade system, trade–in water–related services, as well as the transfer of innovation and technologies, can efficiently contribute to the goal of achieving access to water, sanitation, and hygiene (Sustainable Development Goal 6).

Indirectly, international trade in goods also affects water usage. Countries are relying on international trade to source products from abroad for domestic production that would otherwise put further strain on their water resources and with the right policies, data collection, and accounting methods in place, trade in goods may be a powerful tool to help alleviate the water crisis across countries and regions.

The ADBI Paper Goes on to Explain

"At a global level, it is expected that under a business–as–usual scenario, by 2030, the demand for water will outpace current supplies by 40% on average and by more than 50% in countries that are developing most rapidly (WRG 2009). Contributing to 70% of the world's water withdrawals, agriculture and farmers will suffer the most from the water crisis. At current growth rates, the coming decade is likely to witness a cereal production shortfall of 30% (WRG 2009). A recent World Bank report suggests that the effect of the crisis will have an impact beyond agriculture to affect industrial capacities. In India, for instance, over the course of 2015, power plants suffered from long shutdowns due to decreasing levels of water in dams and reservoirs and due to erratic monsoon seasons. Overall, lack of water in all its forms could reduce the world's gross domestic product by 2.6% (World Bank 2016)".

Trade and Investment Nexus

The trade and investment nexus has a role to play in stepping up the development of infrastructure in water as well as in other areas and strengthening a county's competitiveness while achieving poverty reduction. Demand for investment in the water sector is expected to increase rapidly, creating a predictable gap between the current funding capacities and the obvious capital and operational requirements for new infrastructure.

Globally, $11.7 trillion of investments have been made in water facilities and other forms of water–related infrastructure to support the projected growth toward 2030 (McKinsey 2013). During the negotiations to conclude the North American Free Trade Agreement (NAFTA), Canada forced the inclusion of a clause in the regional trade agreement to "protect" its freshwater from exports.

The Paper listed out the top ten virtual water importers and exporters of 2005. The figures indicated are in cubic kilometers (1000m*1000m*1000m = 1 cubic km). The exporters include Australia (64), Canada (60), the USA (53), Argentina (45), Brazil (45), Ivory Coast (33), Thailand (28), India (25), and Ghana (18) and Ukraine (17).

The virtual water importers include Japan (92), Italy (51), the UK (47), Germany (35), S. Korea (32), Mexico (29), Iran (15), Spain (14), Saudi Arabia (13) and Algeria (12). However, these numbers and indeed the countries would have undergone significant changes in the last sixteen years.

Karthikeyan Brindha in his paper says "The world population will reach 9.3 billion in 2050 and the world will need 70 to 100% more food to be produced to meet the demand (World Bank, 2007). So far, the area equipped for irrigation has increased from 184 million ha in 1970 to 324 million ha in 2012 (FAO, 2016). Global water withdrawals have also increased from about 600 billion m3/y (Bm3/y) in 1900 to about 4000 Bm3/y in 2010, of which 69% was for agricultural use (FAO, 2016). Freshwater accounts for 96% of the total global water withdrawals. As the finite freshwater resources are unevenly distributed around the world, several countries with scarce resources are not able to meet their domestic food demand locally and import from other countries. Owing to the vast use of fresh water for agriculture and the trade of these agricultural products to other countries, the exporting countries are trading the water virtually embedded in the traded products.

Virtual Water, Water Pricing and Geo–Political Strategy

A Le Vernoy argues – "The overall amount of water available globally, as well as the theoretical dynamics underpinning the water cycle, have been established. Far less is known about local hydrological dynamics, particularly the state of groundwater resources. Catchment–based surveys often rely on outdated data. Furthermore, little is known about the dynamics of demand and the extraction rate of water resources. The trend is advancing towards more monitoring rather than less, but local and national regulations are more often than not based on incomplete information…

….water is too often mispriced and accounts for an insignificant share of production cost, rarely reflecting the value of scarcity and the cost recovery of the investments made to secure its availability. Moreover, if scarcity or decreasing quality issues are not correctly reflected in prices, it may leave the terms of trade generally unaffected by a relative difference in water endowments, hence distorting the positive impact trade can have on a "sustainable" and "efficient" relative allocation of water uses. Natural resource pricing is typically a domestic policy prerogative, which reinforces the notion that the benefits of more open trade can only be achieved with a relevant set of domestic policies".

At the basic level, it would be appropriate to account for the net virtual water component in the National Water Resources. For, any accounting sans virtual water will never clearly define the consumption pattern of water across regions and countries. Leveraging the imports and exports of goods and services (bundled in virtual water) as a weapon to bargain and indeed secure hugely favorable trading terms of reference will become routine as the water stress (which has kicked in during the last few decades) grows more and more acute.

The Indo–Pacific Region, home to over 25% of the world population and just 10% of the water resources would become most vulnerable to the water–rich states of the EU and the North. While working for the fulfillment of the SDG–6, the countries endowed with abundant water resources need to lead a global alliance for leveling the virtual water trade.

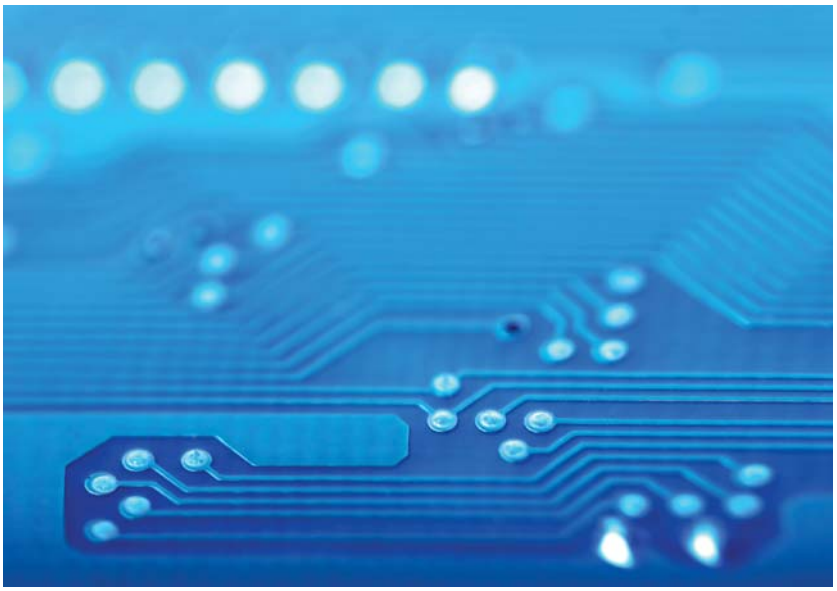
The writing is on the wall….

VIRTUAL WATER WILL RULE THE WORLD!

THE **SMART** IN SMART WATER

Priyanka Sinha
Global Lead - Digital Programs,
DuPont Water Solutions

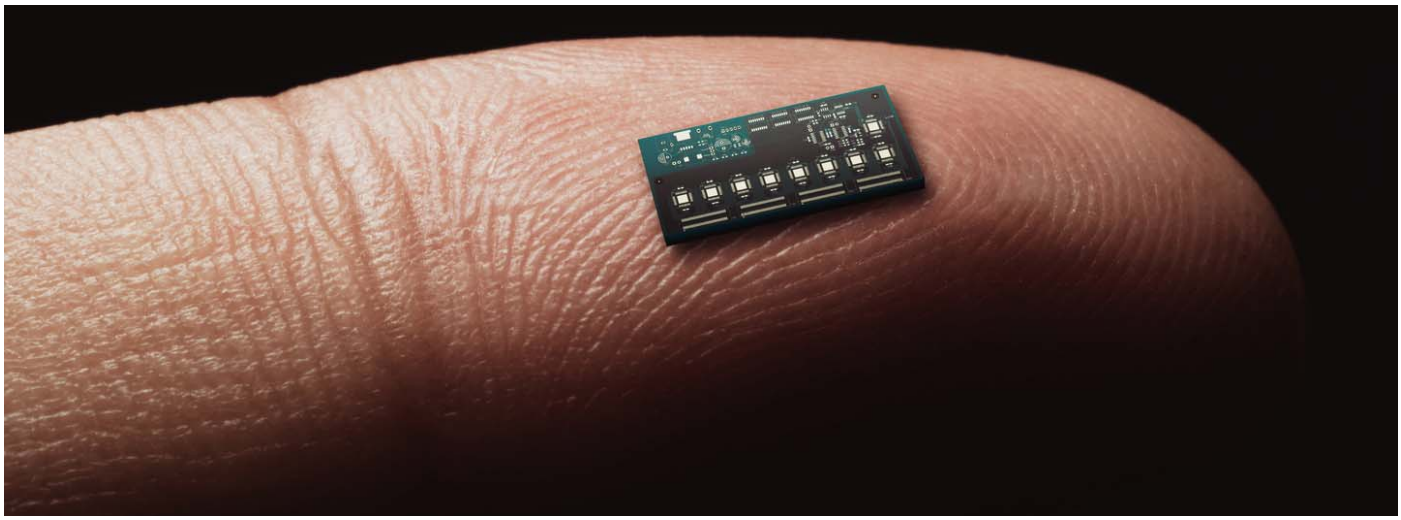
Priyanka Sinha *in her role as Global Digital Lead for DuPont Water Solutions, is responsible for developing and executing digital solutions for complex business challenges mainly to drive revenues or to achieve operational efficiencies, along with working on the long-term strategy for digital transformation and digitalization of water business globally. She is currently managing multiple projects related to digital infringement solutions, blockchain, IoT and AI based commercial offerings, digital sales enablement, e commerce, social media marketing and customer engagement platforms. She has over 15 years of rich multi-functional experience in enterprise & retail sales, marketing, Supply chain, global business development and digital strategy. She is also a trained six sigma black belt. She started her career with Dow Chemicals and later worked in The Climate Corporation, a Silicon Valley agriculture tech startup, prior to joining Dupont water solutions.*



It is hard to imagine that the water industry just a few years back was looked upon as an old traditional industry with set products and technology driving the business. After all need for pure and safe drinking water is an old age problem. However, the gap between demand and supply and the advent of technology coupled with a digital push during pandemic has catapulted the water industry into the one which is thriving on innovation and digital technology.

While the old guard is updating themselves, the industry is also giving way to the new–age startups with an intent to change the way this industry has operated. This is a great point in itself as the net beneficiary is the customers. The usage of digital technology is also pushing us towards sustainable environmental benefits making it even more lucrative.

SMART water is not a new term anymore, as an article published in WWD, March 2021 by CRISTINA TUSER describes it aptly which is, Smart water refers to a movement in the water industry involving emerging technology that includes hardware, software, and analytics to help water and wastewater utility target solve problems through automation, data gathering and data analysis. While this gives a comprehensive view of what we mean by SMART water, there is some perspective on each of these elements and how it brings in the Smartness.



Sensors

The S of the Smart has to be sensors, while water industry has been using some kind of sensors in past as well, it is really now that is its finding many mainstream applications, these sensors once combined with wi–fi, data analytics platforms and its own mobile APPs can deliver multidimensional results, from lead detection to managing day to day plant operations to measuring the quality there is no end to the possibilities it holds for future after all the sensors now can measure PH, residual chlorine, turbidity, suspended solids, COD, BOD, conductivity, and dissolved oxygen and relay this data on a mobile app on a real–time basis. The technology to track leaks, identify pollutants, and monitor water treatment processes is available across many applications.

Different industries have different needs when it comes to measuring and monitoring wastewater. For example, semiconductor manufacturers have to ensure that their wastewater has no trace metals in their wastewater Similarly Chemical or pharmaceutical plants must ensure no trace chemicals. This also applies to industries such as food and beverage, Textile manufacturers, and pharmaceutical plants. The good news is that there are now many different kinds of sensors that exist in the market, putting them together and customizing them for particular industry needs capability and innovation, which is where innovation and digitization come into the picture. The only issue is that it may not be the cheapest option available however the benefits outweigh the funding challenges in the long run. After all, the benefits are real, it is a game–changer at multiple touchpoints, while it can help the operations team tremendously to run their plant better and bring down the cost of maintenance, it can also help end–users access the real–time data, and AI application can be a game–changer as we move to predictive and eventually prescriptive analysis mode, in fact, the benefits are too many to count. To add to the gloss Sensors in the water and wastewater treatment industries are an emerging technology market area, forecast to grow to $2Bn+ in 2030 as per recent estimates by IDTechEx

Metering

Non–revenue water (NRW) which is defined as the difference between the amount of water put into the distribution system and the amount of water billed to consumers has been a major challenge in the water industry across the world. A World Bank study puts, half of which occurs in developing countries. Water utilities suffer from the huge financial costs of treating and pumping water only to see it leak back into the ground and the lost revenues from water that could have otherwise been sold. If the water losses in developing countries could be halved, the saved water would be enough to supply around 90 million people. Unidentified Leakages, manual or mechanical meters, thefts, and user–level unawareness are a few reasons why having a SMART meter can be a good fit here, While Smart Metering is no silver bullet to such a burgeoning problem, it has its well–defined benefits.

With greater monitoring of the entire network, it can become more efficient. It can help a water company to identify the source of a contaminant, coupe with sensors can narrow down the location. It can also create more accurate records of water use, allowing pressurization of water pipes to occur when needed, reducing damage from over pressurizing the system. Not only can it show the end–users their water usage on a real–time basis creating more awareness amongst consumers. Water and wastewater companies are adopting these technologies, and therefore it is an exciting area to diversify into.

AI (Artificial Intelligence)

AI is very much the at the core of the SMART water, as we get more and more into sensors and smart metering, and data analytics, AI is already emerging as a powerful tool in the wastewater management domain, AI has the power to revolutionize water–use efficiency and sanitation management in terms of engineering, mapping, and forecasting while widely improving sustainability and scalability of water and sanitation services. Many new–age companies and startups have been coming in there are and making an impact. Take for example clean water AI Clean Water AI is a device that uses a deep learning neural network to detect dangerous bacteria and harmful particles in water. Users can see drinking water at a microscopic level, just like they would view footage from a security camera, with real–time detection and contamination mapping Or plutoshift which offers a predictive performance monitoring solution for industrial processes and assets, their platform uses analytics and AI to work with water facilities and better administer their process. Pluto's

predictive analytics for industry enables wastewater systems to optimize process automation technologies for greater energy efficiency and lower operational costs.

AI enables online platforms along with Smart Metering can also help take the responsibility to the individual level by offering consumers a tailored, attractive, and informative way to view real–time water consumption, pay bills and access information about dynamic water resources conditions.
There are many noteworthy startups who are working towards optimization and loss reduction and this space is only going to go north with time and technology evolution.

Robotics

Although yet to become mainstream this is an area to watch for given that micro bots or mini bots are now being used in several industries and have already found their use case in the Water Industry in many different ways, for example, A company called Watchtower Robotics based in the US built a prototype of a soft–sided robot that can move along the inside of a pipe. Its sensors detect changes in force caused by water escaping due to a leak. It can also confirm the location of a leak within a couple of feet. That's far superior to current methods that often require water utility workers to dig up substantial sections of streets to find the source of a problem.
Another Australian firm Watertight Robotics is developing robots to clean up the water storage tanks. All the robots in its fleet are oil–free or use tiny amounts of food–grade oil. Also, when the robots take care of the cleaning, they do not stir up the water or otherwise harm the supply.

Another company Hi–Bot USA sends robots into the pipes to assess their condition and the appropriateness of the assigned grade for repairing and maintenance. The company believes its system can predict future failure rates with an 80 to 90% accuracy rate. Then, companies could better allocate their resources and target the pipes that are most likely to cause problems soon.

These three different use cases give us an insight into the many possibilities the usage of robotics coupled with sensors and AI can create in the water industry.

Technology

The last of SMART has to be technology, after all, it is the technology that is driving the Smartness in water. While the entire water industry is set on string technical fundamentals, the recent development in technological space has added many dimensions to the industry, it has created opportunities and new business models, who would have imagined SAAS–based products in the water industry a few years back.

As technology evolves so do the use cases, for every problem, there is a solution, and technology makes the solution agile and easy to implement. That is what truly adds the SMART in Smart water.

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To get all updates about the happenings in the Water World, you can now subscrib our monthly magazine "WaterAge" which finds its readership among thousands of leading industries, government bodies, consultants and contractors based worldwide.

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BACK WASH WATER RECOVERY FILTER BY NEERWAY PROJECTS PRIVATE LIMITED IN RO SYSTEM

Back washing of MGF & ACF are necessary in RO system, but drainage excess of water is not necessary, NEERWAY Disc filter are most suitable system for water recovery from MGF & ACF Reject.

By Sachin Maurya (Business Head)

Sachin Maurya is Business Head of NEERWAY PROJECTS PRIVATE LIMITED. He is a master's in business administration from Dr. A.P.J. Abdul Kalam Technical University with entrepreneurial skills and 14 years of field experience. He has good industrial and institutional network for business implementation all over India.

www.neerway.com

About Organization

Neerway Projects Private Limited (NPPL) are an ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 certified leading EPC company and importer & Exporter of state–of–art technological water products in overseas market for advancement in water infra management. NEERWAY has produced and offered broadest range of innovative water & irrigation products to industries, municipal water, farms, golf courses, commercial developments and homes.

Many Industries are under water crises and looking for new proven technology for reducing water waste. Thus creating an edge in the water and wastewater treatment for the industries NEERWAY has successfully installed Disc based filtration technology system along with auto flushing control for no manpower requirement. This state of art technology is now a days most demanding in to bottling plant where every water drop are countable.

Many leading bottling plant Company using Disc filter for same purpose and system which automatically clean itself with reduced water reject utilizing less space. Disc filter emerged as an appropriate solution for such house. Disc Filters are fully automatic, equipped with automation for backwash based on pressure differential and time both, without any axillary sources/pumps. Units are modular type, skid mounted, ready to installation on site and are available with all accessories like Inlet, outlet and drain headers, multiport valves, control panel etc.

Backwash reject water is less than 2% based on water quality and are capable of efficient backwashing even at pressure as low as 2.5 Bar, The design and position of product are convenient for maintenance, cleaning and supervising the component for service, replacement any repair whenever necessary.

Each filter module is equipped with automatic control system (panel), solenoid valves, inlet and outlet pressure gauges, differential pressure system for filtering and backwashing operations, drain pipe with provision for manual back flushing arrangement.

For efficient installation at project site, the inlet and outlet manifolds are provided with flanged cone connections which also facilitate maintenance.

Filter element consists of especially designed Grooved Discs which provides required degree of filtration. Filtering element thickness and designs are appropriate for working up to water temperature of 60°C, and quality material of elements are appropriate for cleaning.

The filtration cycle arrangements are on continuous production basis and design of panel and programming on individually/cycle performance basis. Whenever one filtration module goes into backwashing mode, the other filtering element modules will provide enough backwash water for cleaning. Backwash Cycle is based on sequence basis i.e. only one filter shall backwash at a time to provide regular supply of water without interruption.

The construction materials of the filtration system are heavy duty, long lasting and suitable for filtering raw water with higher concentration of biodegradables. Filter body are suitable grade Polyamide with fiber glass for avoiding algae formulation during outdoor installation. Fiber grade are effective for handling higher temperature of water up to 60°C. Filtering element rings construction of Poly Propylene and filtering elements frame are heavy duty, suitable for working up to 8 bar working pressure.

WORLD ENVIRONMENT DAY: EARTH REQUIRES HEALING

Mohammed Abdul Rahman
CEO, Sahara Industry

50 M3 hr Reverse Osmosis Plant Installed in Logistic Park, Hyderabad

Mohammed Abdul Rahman is the Founder & CEO of Sahara Industry established with the sole purpose of providing technologically advanced, most economical and best quality water and wastewater treatment solutions. The young entrepreneur with an MBA in marketing & finance, he leads the organization with strong people management and development vision. With his guided approach and dynamic leadership, the company has achieved enormous success with group turnover surpassing INR 1000 million.

www.saharaindustry.com
bit.ly/AbdulMohammed

Where are we going to live, on planet Earth or Mars?

Today, on World Environment Day, this question is more relevant than ever. "Only One Earth" is precisely the theme of World Environment Day 2022, very thoughtfully selected by the United Nations. It calls for living sustainably and in harmony with nature.

Moreover, 2022 is a very significant year as normalcy is returning to our lives after two years of global disruption caused by the coronavirus pandemic, frequent and longer periods of induced lockdowns which also gave the much–needed break to planet Earth. It helped reset the planet, giving the environment a chance to recover from the wear and tear of human activity.

The infamous polluted air in Delhi was cleaner, the meltdowns of glaciers were halted, rivers and canals became clean due to not receiving the dirty waters from people and industries and one could see the marine life swimming through them. Even the catchphrase "The Earth is healing, we are the virus," was widely circulated on social media as a meme.

THE THEME OF THIS YEAR, "ONLY ONE EARTH", CALLS FOR LIVING SUSTAINABLY AND IN HARMONY WITH NATURE

Ultra–Pure Water Tretament Plant

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Water is one of the natural resources of greatest concern under constant risk from human activities and global warming.

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Water is not only necessary for the survival of living beings, but it is a must for environmental sustainability. We have taken for granted all natural resources including water and the result is now evident in the form of a severe crisis of clean water across nations. India which had an abundance of water available not so long ago is facing a historical crisis with almost half of the population missing access to safe water for drinking. Almost 3 years ago when Niti Ayog reported that 600 million people suffering from extreme water stress in the country, the numbers must have increased substantially. If that is not alarming, it was also reported that India is placed at 120th position among 122 countries in the water quality index, reason: nearly 70% of freshwater sources are contaminated and about 200,000 people die every year due to inadequate access to safe water.

A number of large cities in India are grappling to manage their water supply, suffering from acute scarcity and requiring "immediate action" as growing scarcity will also hit India's food security. Come 2030, over 40% of India's population will have no access to drinking water. India holds about 4% of global freshwater for almost 18% of the world population and is the largest user of groundwater sources. The Earth needs fresh water to feed people's needs, preserve ecological balance, help all species to survive, and maintain the synergy of nature.

Sahara Industry, as a conscious decision has adopted modern systems and processes that are helpful in the cleaning of unsafe water to make it pure and safe while at the same time not wasting many resources. With high–quality products and excellent service standards, it has the crucial technical expertise and in–depth understanding of the water sector to offer the best integrated and strategic approach to industrial and municipal water and wastewater treatment systems which is aligned with environmental consciousness.

4272 & 4872 FRP Vessels

ONLY ONE EARTH: HELP IT SURVIVE

Mohammed Naser Azeez
MD, Aquality Water Solutions Pvt. Ltd.

Mohammed Naser Azeez is the Managing Director of acclaimed Aquality Water Solutions Pvt. Ltd. that provides technologically advanced solutions for water treatment. With ardent interest in providing clean drinking water facilities, he contributed immensely that has helped in improving quality of life of citizens with commitment, technological innovations and quality excellence.

www.aquality.co.in
www.linkedin.com/in/naserazeez/

6 M³–Hr Sofeteners at CPF Plant

World Environment Day 2022 is celebrated under the theme 'Only One Earth' set out by the United Nations to convey the message that in the universe, there are millions of galaxies and their planets, but there is Only One Earth.

The global campaign of this year calls for collective and transformative action to celebrate, protect and restore our planet. For most nations, a healthy environment has become more important than the economy itself as the devastating effect of environmental imbalances is far and wide and affecting livelihood. World Environment Day on 5th June is celebrated since 1973 and it has grown into the largest global platform for environmental consciousness, awareness, and protection. The United Nations Environment Programme (UNEP) is leading the initiative and pursuing governments

THE THEME OF THIS YEAR, "ONLY ONE EARTH", CALLS FOR LIVING SUSTAINABLY AND IN HARMONY WITH NATURE

across the globe to take real and effective steps in safeguarding the environment.

Our environment requires urgent solutions. The triple planetary crisis: climate change, nature, and biodiversity loss, and the increase in pollution and waste, need urgent attention and proper action to protect the planet, and it is now more important than ever. Our water sources which are the lifeline of the ecological system is declining and getting polluted due to increased human activities. The fresh water sources are shrinking and remaining ones have become contaminated leading to loss of human lives and the surrounding environment.

Half a century later, the planet earth is now facing multiple emergencies. Climate change is happening too fast for humans and nature to adapt to it. Natural disasters are happening frequently leading to the loss of habitat and many other pressures on the earth's ecosystem. These events led to the estimated one million species being under threat of extinction. Air, soil, and water are continuously polluted.

600 KLD Water Treatment Plant

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'Only One Earth' theme has put sustainable development on the global agenda again, as it was also the slogan of the first United Nations conference on the human environment, held in Stockholm in 1972.

>>

The world is inching towards an 8 billion population and one–in–four people do not have access to safe drinking water. Unsafe water is responsible for 1.2 million deaths each year. Over 6% of deaths in low–income countries are the direct result of drinking from contaminated water sources. Clean and safe water has become very precious and lots of regional conflicts are happening regarding access to water.

India is grappling with the dual challenge of fast–shrinking freshwater sources and increasing water pollution. The water stress is felt across the country and India's biggest cities are more affected leading to water supply disruptions and compromising quality.

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

Solar Power Portable Water Treatment System

The Transformation

Time is running out and nature is in emergency mode. If the necessary actions are not taken, exposure to air and water pollution outside the safety level will further increase by 50% over the decade, and plastic waste going to water bodies will almost triple by 2040 leading to a severe ecological crisis. To keep global warming below 1.5°C this century, it is necessary to halve annual greenhouse gas emissions by 2030.

The way out of such a situation is the transformation of the economy and society to become more inclusive, reasonable, and more connected with nature. It is necessary to move from any practices causing damage to the planet for it to heal and restore. The technology has been developing and there are solutions available now to implement the transformation in greater magnitude towards a sustainable system.

Aquality Water Solutions Pvt. Ltd. has been working for over a decade to provide sustainable water treatment solutions that are aligned with nature. The systems and processes it advocates and implements involve identifying the issue, developing robust solutions, building support, and bringing issues to address, and together with advanced technology to ensure that the desired outcome is sustainable and according to environment mindfulness.

Water Intec
9–11 April, 2022
Venue: CODISSIA Trade Fair Complex, Coimbatore, Tamilnadu, India
Website: www.waterintec.codissia.com

SRW India Water Expo 2022
5–7 May, 2022
Venue: Trade Centre, Tamilnadu, India
Website: www.waterexpo.in

Water India – Water Expo Pune
14–16 April, 2022
Venue: Deccan College Ground, Yerwada, Pune
Website: www.waterindia.net

World Conference on Soil, Water, Energy and Air
26–27 May, 2022
Venue: Bordeaux, France
Website: www.eurasiaweb.com

World Environment Conference (WEC 22)
04–05 June, 2022
Venue: Pragati Maidan, New Delhi, India
Website: www.worldenvironment.in

Aquatech China
8–10 June, 2022
Venue: National Exhibition and Convention Center, Shanghai, China
Website: www.aquatechtrade.com

Water India Bangalore
9–11 June, 2022
Venue: Manpho Convention Centre, Nagware Ring Road, Bangalore, India
Website: www.waterindia.net

Indian Plumbing and Watertech Expo (IPW India)
7–8 July, 2022
Venue: Delhi, India
Website: www.ipwindia.in

International Water and Wastewater Technology Show
4–6 August, 2022
Venue: Sri Lanka Exhibition & Convention Centre, Paijanindia, Colombo, Sri Lanka

World Water Summit 2022
21–23 August, 2022
Venue: New Delhi, India
Website: www.worldwatersummit.in

Delhi Water Expo 2022
24–26 August, 2022
Venue: Pragati Maidan, New Delhi, India
Website: www.waterex.biz

Renewable Energy India Expo 2022
28–30 September, 2022
Venue: India Expo Centre, Greater Noida
Website: www.renewableenergyindiaexpo.com

India Water Week–2022
1–5 November, 2022
Venue: India Expo Centre, Greater Noida, India
Website: www.indiawaterweek.in

Buyer/Seller: United Nations Industrial Development Organizations

Ref. Number: 49797458
Tender Number: 7000005561

Requirement: Purchase of equipment for pilot demonstration unit for treatment of waste water effluent generated by the indian paper industry.

Closing Date: 07/06/2022
Location: Multi Location – Multi State – India

Buyer/Seller: Balmer Lawrie And Co. Limited

Ref. Number: 50003838
Tender Number: BL/AS/MAN/CP9ETP/PT/202122/0006/Price

Requirement: Price tender for low tds waste water treatment plant with ro as turnkey project

Tender Detail: Price tender for low tds waste water treatment plant with ro as turnkey project

Closing Date: 10/06/2022
Location: Chennai – Tamil Nadu – India
Contact Details: Chennai / 30 May, 2022

Buyer/Seller: Madhya Pradesh Urban Development Company Limited

Ref. Number: 49938296
Tender Number: 2022_MPUDC_207172_1

Requirement: Improvement of waste water management system in sanchi nagar parishad in district in madhya pradesh

Tender Detail: Improvement of waste water management system in sanchi nagar parishad in raisen district in madhya pradesh improvement of waste water management system in sanchi nagar parishad in raisen district in madhya pradesh

Document Fees: INR 34,000
EMD: INR 2,840,000
Closing Date: 27/06/2022
Location: Raisen – Madhya Pradesh – India
Contact Details: Madhya Pradesh Urban Development Company Limited – Mdb Tenders sanchi

Buyer/Seller: Rural Development Department

Ref. Number: 49931579

Tender Number: 2022_AHMED_802270_1
Requirement: Constructing solid waste and waste water management at nighoj, taluka parner, dist– ahmednagar

Tender Detail: Constructing solid waste and waste water management at nighoj, taluka parner, dist– ahmednagar constructing solid waste and waste water management at nighoj, taluka parner, dist– ahmednagar

Document Fees: Rs. 5,600
EMD: Rs. 69,761
Tender Estimated Cost: Rs. 6,976,112
Closing Date: 07/06/2022
Document Sale To: 02/06/2022
Location: Ahmednagar – Maharashtra – India
Contact Details: Rdd–CEO–Ahmednagar–RWS, Ahmednagar

Buyer/Seller: Department Of Forests And Wildlife

Ref. Number: 50082715
Tender Number: 2022_DFWL_223530_1

Requirement: Construction of water body of wet land system including complete maintenance of waste water treatment system for the duration of 05 years at chhatterpur forest ridge land under south forest division

EMD: INR 555,000
Tender Estimated Cost: INR 11,101,950
Closing Date: 24/06/2022
Document Sale To: 24/06/2022
Location: New Delhi – Delhi – India
Contact Details: Department of Forests and Wildlife

Buyer/Seller: Water Supply And Sanitation Department

Ref. Number: 49905104
Tender Number: 2022_COJAL_801886_1

Requirement: Construction of intake well inspection well connecting main open channel jackwell with over head pump house, approach bridge approach road raw water rising main water treatment plant water treatment plant repairing of existing recirculation

Tender Detail: Group villages detailed tender under jal jeevan mision dist yavatmal construction of intake well inspection well connecting main open channel jackwell with over head pump house, approach bridge approach road raw water rising main water treatment plant water treatment plant repairing of existing recirculation

Document Fees: INR 56,000
EMD: INR 4,740,000
Tender Estimated Cost: INR 947,962,776
Closing Date: 16/06/2022
Document Sale To: 16/06/2022
Location: Amravati – Maharashtra – India
Contact Details: Member Secretary(Wssd), Mumbaillce (MJP) Amravati Region Amravatillse (MJP) Circle Amravatillee (Mjp) Division Yavatmal Pusad Kelapr Mahagaon

Buyer/Seller: Water Supply And Sanitation Department

Ref. Number: 49901927
Tender Number: 2022_COJAL_801876_1

Requirement: Jalgaonjamod150 villagesregional rural water supply schemeintq. jalgaonjd. sangrampurdist.. (under jjm) construction of raw water sump,pccp raw water gravity main,water treatment plant 19.0 mld,with scada and automation,pure water sump at tun

Tender Detail: Jalgaon jamod 150 villages regional rural water supply schemes jalgaonjamod150 villagesregional rural water supply schemeintq. jalgaonjd. sangrampurdist.buldhana. (under jjm) construction of raw water sump,pccp raw water gravity main,water treatment plant 19.0 mld,with scada and automation,pure water sump at tun

Document Fees: INR 56,000
EMD: INR 8,996,400

Tender Estimated Cost: INR 1,799,280,148
Closing Date: 16/06/2022
Document Sale To: 16/06/2022

Location: Buldhana – Maharashtra – India
Contact Details: Member Secretary(Wssd), Mumbaillce (Mjp) Amravati Region Amravatillse (Mjp) Circle Akolallee (Mjp) Division Akola Jalgaon Jamod 150 Villages Regional Rural Water Su

Buyer/Seller: Water Supply And Sanitation Department

Ref. Number: 49995103
Tender Number: 2022_COJAL_802982_1

Requirement: Approach channel jack well with overhead pump house approach bridge raw water rising main raw water gravity main rcc bpt water treatment plant with allied works pure water rising main mbr rcc sump with mechanical work etc complete
Tender Detail: Gondia grid water supply scheme under jjm programme tah dist gondia approach channel jack well with overhead pump house approach bridge raw water rising main raw water gravity main rcc bpt water treatment plant with allied works pure water rising main mbr rcc sump with mechanical work etc complete

Document Fees: INR 56,000
EMD: INR 9,901,660
Tender Estimated Cost: INR 1,980,331,585
Closing Date: 20/06/2022
Document Sale To: 20/06/2022
Location: Gondia – Maharashtra – India
Contact Details: Member Secretary(Wssd),Mumbaillce (Mjp) Nagpur Region Nagpurllse (Mjp) Circle Nagpurllee (Mjp) Division Gondia

Buyer/Seller: Military Engineer Services

Ref. Number: 49953401
Tender Number: 2022_MES_499141_2
Requirement: Provision of sewage treatment plant of capacity
Document Fees: INR 3,000
EMD: INR 1,500,000
Tender Estimated Cost: INR 235,700,000
Closing Date: 22/06/2022
Document Sale To: 22/06/2022
Location: Secunderabad – Telangana – India
Contact Details: E–in–c Branch – Military Engineer Servicesllce Sc and Ce Chennai Zone – Mesge South Secunderabad

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SERVICES TO PROVIDED BY CONSULTANT

- Detailed survey of proposed network of sewar line.
- Preparation of sewer network showing GL/IL.
- Location type design of manholes, intermediate sump well/lift well.
- Calculation of sewage generation.
- Type of treatment of sewage.
- Specification of mechanical and electrical equipment of sewage network STP & ETP.
- Preparation of drawing.
- Preparation of bill of quantities, detailed estimates BOQ and estimate based on MES SSR – 2020 and market analysis for Non-SSR items for sewage network STP & ETP.

FIELD OF EXPERTISE

SEWAGE

WATER

INDUSTRIAL

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