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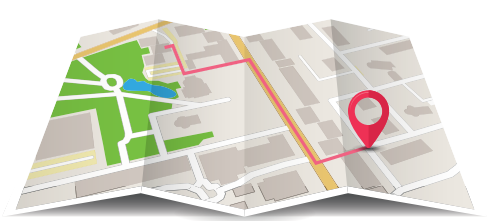

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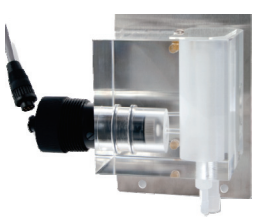
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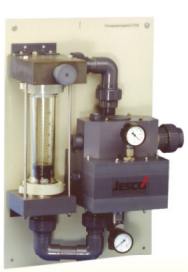

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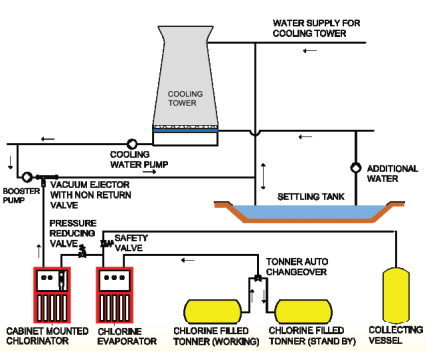

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NEED TO ADVANCE TECHNOLOGIES IN WASTEWATER MANAGEMENT

Change is in inevitable across the universe and our water and wastewater sector is no different. With the advancement of the industries and country's infrastructure, the need for advance, efficient and sustainable water solutions is ever increasing. Each year we are faced with some new challenge for which an out of the box solution is required. Be it the environmental issues, sustainable and cost effective solutions in end user industry, concern of space and adaptability in Municipal and State projects or up gradation of existing projects. Futuristic new technologies are always an area of interest for the water professionals across the world. As a community we also learn from each other's experiences and also from the trial and error methods of others.

Since the fresh water availability is limited and not all countries have been blessed with fresh water resources throughout the world. Thus the wastewater management becomes crucial than it ever was in the history of mankind. Despite widespread claims about the need for water conversion, treatment and recycling, it is an accepted fact that the water sector has not seen a breakthrough technology in the last decade. Discontinuous advancements in the industry like membrane technology, nano technology or plastic material introduction all happened over a decade back. Significant research and efforts have been made to make incremental improvements like energy recovery or higher recovery. These are laudable and not at all to be discredited. But, generation changing innovations need out of the box thinking and a fresh approach.

Being a multi-discipline field, there is a need to think beyond rigid boundaries of engineering disciplines. It is also possible that new untested technologies do not get the kind of financial backing and management support that us needed at an initial stage. But as an industry we need to form a sustainable environment where such new technologies can be developed to be financially viable options for mass implementation.

Innovation is a truly difficult thing to explain. It comes out in the most unexpected situations and locations. One theory is that studying too closely and applying scientific analysis to it, might itself defeat the purpose of innovation. From my end, all I would like is that we create the right environment for it to nurture and flourish. That should benefit everyone.

magazine **contact**

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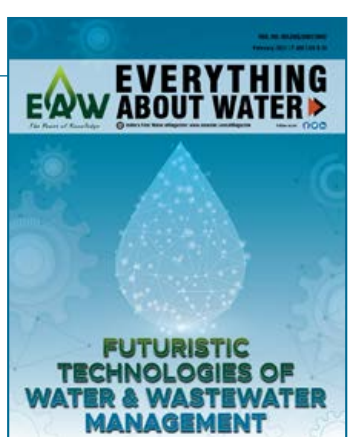

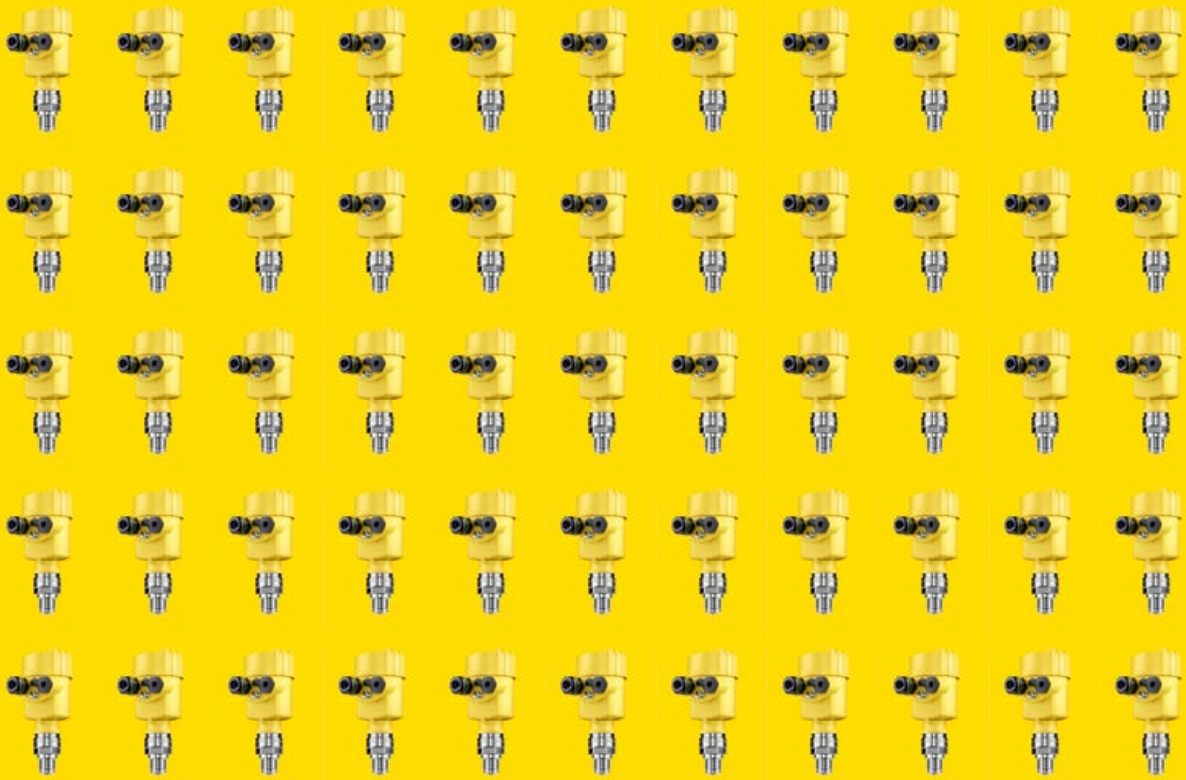

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LANXESS India celebrates 10 successful years of operations at its Jhagadia manufacturing site

Specialty chemicals company LANXESS India celebrated the 10th anniversary of operations of three of its Business Units - Material Protection Products, Rhein Chemie and High Performance Materials at its state-of-the-art Jhagadia manufacturing site in Gujarat this month. In view of the COVID-19 pandemic, the milestone was celebrated virtually.

Jhagadia site is a key manufacturing base for LANXESS globally and one of the large production sites of the company in India. It has been built adhering to global standards and is equipped with all necessary technologies to ensure safe and environment-friendly operations. This site hosts the production facilities for four of its business units - High Performance Materials (high tech plastics), Material Protection Products (biocides), Rhein Chemie (business line FTA and business line SRP) and Liquid Purification Technologies (ion exchange resins).

Danfoss India and CII- GBC develops a blueprint to support India's decarbonization goals

Chennai (India), 12th March 2022: Danfoss Industries Pvt Ltd., a leader in energy efficient technologies in its efforts to support India's roadmap to decarbonization, in association with CII- Godrej Green Building Council launched a report on "Decarbonization of Indian Industrial Sector" at MMA Annual Conference 2022, Chennai.

Abengoa awarded the contract to expand Tan-Tan desalination plant in Morocco

March 15, 2022 - Abengoa, an international company that applies innovative technology solutions for sustainable development in the infrastructure, energy and water sectors, in consortium with ATNER (Atlas Energie), a company with more than three decades of experience in the service of water, has been awarded the contract for the expansion of the water treatment plant at the ONEE, has been awarded the contract for the extension of the Tan-Tan desalination plant in the Guelmim-Oued Noun region (Morocco) by the Office National

WELTEC BIOPOWER Commissions Fourth Biogas Plant in Japan

A biogas plant of WELTEC BIOPOWER recently went live in Saitama Prefecture, 40 km north of Tokyo. The facility - which is equipped with a 450-kW cogeneration power plant - is the fourth project to be rolled out by the German manufacturer in Japan. In terms of substrates, the operator makes use of organic leftovers from the vicinity. Since the raw material mix varies, WELTEC ensures a steady biogas output with its biological service. This special service of the biogas specialist also comprises another plant of the same customer

Even after the reactor accident in Fukushima back in 2011, Japan continues to use nuclear power. However, renewable energies are consistently expanded and already account for a fifth of the power generated. Above all, leftovers are the preferred substrates in Japan. The biogas plant in Saitama, too, digests some 12,000 t of organic waste into energy. The substrate mix consists of organic waste and cattle manure from a nearby farm that belongs to the operator. The largely liquid organics are introduced to the digester by means of a central pump. Solid feedstocks are transported by a dosing feeder with a capacity of 27 m^3.

To ensure efficient digestion of this mixture, WELTEC BIOPOWER has set up a stainless-steel digester with a capacity of 2,823 m^3. Its diameter measures 25.34 m, and its height is 6.3 m. The upstream substrate storage tank, which is made of stainless steel, has a capacity of 336 m^3, a diameter of 9.31 m and a height of 5.03 m. The 525-m^3 digestate storage tank (diameter 11.64 m, height 5.03 m), too, is made of high-quality stainless steel.

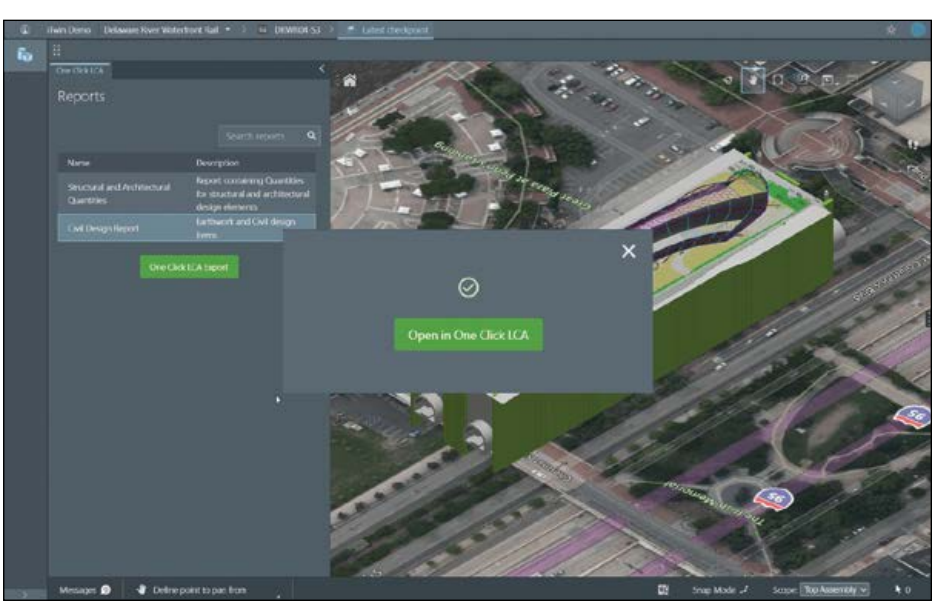
ATER NEWS

Finally, the digestate is separated and the solid phase is dried with special technology in order to further reduce the volume. Most of this residue is used as compost, and some of it as fertiliser. “The Japanese appreciate the custom plant design and the benefits of our modular approach, especially because the plant structure with stainless-steel modules facilitates the consideration of the special risks in areas that experience a lot of seismic activity”, explains Vladimir Bogatov, who is responsible for sales.

All in all, WELTEC BIOPOWER has provided the customer with an all-inclusive package in “made in Germany” quality along with individual after-sales service. Subsequently, the Japanese operator also entrusted WELTEC with the biological supervision of its other biogas plant, which had been set up by a different provider in 2017. As this plant’s yield was above average, the biology experts of WELTEC had the substrate mix of the old plant carefully analysed by a Japanese lab. Based on the results, the raw material mix and the retention time have been optimised. Due to the constantly changing composition of the waste, WELTEC will continue to supervise the two plants biologically in order to maximise the gas yield.

Bentley Systems Announces Availability of Life Cycle Assessment and Embodied Carbon Calculation Capabilities for Infrastructure Digital Twins

EXTON, Pa. - March 8, 2022 - Bentley Systems, Incorporated (Nasdaq: BSY), the infrastructure engineering software company, today announced the availability of integrated workflows for lifecycle assessment (LCA) and embodied carbon calculation capabilities in the Bentley iTwin platform to support the sustainable-development goals of infrastructure projects. This integration is a result of Bentley’s collaboration with One Click LCA Ltd. (www.oneclicklca.com) - the world’s leading construction sector lifecycle assessment and environmental product declaration software. The software can be used for buildings, infrastructure, renovations, construction products and materials,



DROPLETS
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de l’Électricité et de l’Eau potable (ONEE) of the Kingdom of Morocco.

The scope of the project includes the expansion of the Sehb Lharcha demineralization station, from a flow rate of 50 l/s to a final flow rate of 150 l/s. These works are part of an integral project to strengthen the water supply of the city of Tan-Tan.

NDMC planning to set up 5 sewage treatment plants to augment water supply in its parks

In a bid to augment water supply in its parks, the New Delhi Municipal Corporation (NDMC) is planning to build 5 sewage treatment plants (STPs). Reports suggest that the STPS will be set up on PPP (public-private partnership) basis and will be located at BRICS Rose Garden, Singapore Park, Nehru Park, Lodhi Garden and Gole Market will jointly supply 1,600 kilo litres of water on a daily basis.

The action ensues after over 100 borewells were shut down after the direction of the NGT. NDMC has nearly 1,250 acres of green areas and they require 8 MGD of water on a daily basis during the summer season. Owing to the closure of the borewell, through limited resources, less than 4 MLD water could be provided, which included 11 STPs which were functioning.

Singapore honors Kazuo Yamamoto for MBR research

Singapore has honored Japanese scientists Kazuo Yamamoto with the Lee Kuan Yew Water Prize for inventing the submerged membrane bioreactor (MBR). The Lee Kuan Yew Water Prize, sponsored by Temasek Foundation, awards the winning recipient with a USD $ 300,000 (USD $ 221,000) cash prize, a certificate and a gold medallion. “It is a great privilege to be bestowed the distinguished Lee Kuan Yew Water Prize. This award nurtures the spearheading soul and innovative outlook needed to inspire future generations of water leaders to persevere and continue our objective of benefitting communities around the world in the areas of sanitation and water reuse,” said Yamamoto, who is also the 9th recipient of this award.

and portfolios. The One Click LCA platform is used in over 100 countries by manufacturers, consultants, designers, contractors, and investors to decarbonize the entire construction value chain.

The partnership is a natural step in Bentley's strategy for empowering its users to achieve sustainable development goals (SDGs), particularly addressing climate action and decarbonizing infrastructure. Infrastructure digital twin solutions will be an essential enabler and accelerator of carbon transparency and disclosure use cases, and the adoption of digital twin solutions will help accelerate the transformation of infrastructure performance.

With this integration, Bentley's infrastructure digital twin solutions powered by iTwin, and third-party applications built on the Bentley iTwin platform can unlock infrastructure lifecycle assessment workflows. The Bentley iTwin platform is an open, scalable, platform-as-a-service offering enabling an ecosystem of developers to create and bring to market solutions that solve real infrastructure problems by leveraging digital twins.

Kaustubh Page, director of product management, Bentley iTwin platform, said, "We are excited to see developers in the Bentley iTwin platform ecosystem tackling sustainability and carbon reduction challenges. Tracking the environmental impact of an infrastructure project involves a constant stream of design changes coming from various engineering disciplines. By unifying these data streams, users can quickly create a quantity takeoff report at the right aggregation level required for LCA calculations while reducing the lifecycle assessment workflow from weeks to hours. We are excited to see engineering firms build fully automated lifecycle assessment workflows for their infrastructure projects."

Designers and sustainability engineers spend a significant amount of time assessing or reporting on the environmental footprint of infrastructure projects. With multiple design tools used in these projects, a typical lifecycle analysis can be time consuming, especially when manually exporting and aggregating data from bills of quantity and bills of material. It can also be error-prone, requiring additional verification of successful ingestion by LCA tools.

The One Click LCA integration creates time savings and improves accuracy. Users can incorporate engineering data created by diverse design tools into a single view using the Bentley iTwin platform, generate a unified report of materials and quantities and share it with One Click LCA via cloud synchronization. This integration gives users the ability to analyze environmental footprints, accelerate environmental reporting, perform project optioneering, and optimize the selection of materials and products.

Rodrigo Fernandes, director ES(D)G (empowering sustainable development goals), said, "Infrastructure engineers are at the forefront of disrupting climate change. And our collective conscious is that climate change and its effects won't be solved without strong collaboration and ecosystem partnerships. One Click LCA can actively contribute by helping our users accelerate their low-carbon pathways - adopting low-carbon materials and products, minimizing resource consumption, and optimizing structural design - in every type of infrastructure, not just vertical infrastructure."

With the ability to integrate lifecycle assessment workflows with the Bentley iTwin platform, users will be empowered with new opportunities for environmental intelligence around embodied carbon and environmental footprints of linear infrastructure projects.

Panu Pasanen, CEO, One Click LCA Ltd., said, "We are very pleased to work with Bentley Systems to automate carbon accounting and reduction using the Bentley iTwin platform. Bentley's focus in civil engineering and infrastructure with this integration make automated lifecycle assessment finally a reality also for public works. This partnership allows infrastructure designers and contractors, as well as contracting authorities anywhere in the world, to coordinate, calculate, and reduce carbon, as well as other environmental impacts of their projects. The speed and ease of the automation will also be greatly appreciated by projects pursuing third-party environmental certifications, such as PAS 2080, CEEQUAL, Envision, LEED, and BREEAM or regulatory tools. We keep working with Bentley to develop further innovations in this space, such as circularity assessment tools."

Kelvin Saldanha, associate at WSP, said, "iTwin has quickly become an indispensable platform on some of our largest projects. It has made our federated models even more accessible and has brought a new simplicity to multidisciplinary coordination, making for more robust design reviews, conflict detection, and issue resolution. The integration between iTwin and One Click LCA is a potential game-changer in offering unprecedented efficiency to our carbon calculation and lifecycle analysis workflows. We are so excited to see iTwin services continue to evolve and are keen to see how this will bring us another step closer to realizing WSP's Net Zero ambitions."

LANXESS significantly increases sales and earnings in fiscal year 2021

Mumbai, March 11, 2022 - LANXESS closed fiscal year 2021 successfully. Despite immense increases in energy, raw material and freight costs, the specialty chemicals company significantly improved its sales and earnings.

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Group sales amounted to EUR 7.557 billion in 2021, up 23.8 percent on the previous year's figure of EUR 6.104 billion. EBITDA pre exceptionals increased by 17.2 percent to EUR 1.010 billion compared with EUR 862 million a year earlier. Earnings were therefore within the guided range of EUR 1 billion to EUR 1.05 billion. The good results across all of the Group's segments were mainly driven by strong demand from customer industries such as automotive, construction, transport and manufacturing. Influenced by significantly higher costs and one-time effects, the EBITDA margin pre exceptionals was now 13.4 percent after 14.1 percent in the previous year.

"We promised that 2021 would be a year of growth - and we delivered this against all the odds. We largely passed on the extreme cost increases to the market. In addition, we accomplished four acquisitions in the middle of the pandemic and thus massively expanded our Consumer Protection segment. All this shows the strength and stability that LANXESS now enjoys," said Matthias Zachert, Chairman of the Board of Management of LANXESS.
At EUR 218 million, net income from continuing operations was significantly down on the previous year's figure of EUR 908 million, as expected. In 2020, high extraordinary proceeds were generated from the sale of the stake in chemical park operator Currenta.

Significant growth expected for 2022 - impacts from war in Ukraine not yet considered

Zachert was optimistic about the current fiscal year 2022 despite a further increase in costs. "We expect energy and raw material prices to continue to rise in the first half of 2022. Global supply chains also remain fragile. Nevertheless, we would anticipate further significant earnings growth in this fiscal year." However, the impact of the war in Ukraine is yet unforeseeable. LANXESS anticipates an earnings jump in the first quarter of 2022 and expects EBITDA pre exceptionals to come in between EUR 280 million and EUR 320 million (previous year: EUR 242 million).

Dividend to increase again

The dividend is to increase again for 2021. The Board of Management and Supervisory Board will propose a dividend of EUR 1.05 per share - five percent more than in the previous year - to the Annual Stockholders' Meeting, which will be held virtually on May 25, 2022. This corresponds to a total dividend payout of around EUR 91 million.

Four acquisitions in the middle of the pandemic

Despite difficult conditions due to the coronavirus pandemic, LANXESS made four acquisitions in fiscal year 2021 and thus considerably strengthened the Consumer Protection segment. With the acquisition of the French biocide specialist INTACE, the specialty chemicals company expanded its range of fungicides for paper and packaging. LANXESS significantly expanded its product range for the growing animal health market with the portfolio of the disinfectant and hygiene provider Theseo. In August, the Group completed the acquisition of the U.S. specialty chemicals manufacturer Emerald Kalama Chemical and thus became one of the leading providers of products for flavors and fragrances. LANXESS likewise contractually agreed the acquisition of the Microbial Control business from U.S. corporation International Flavors & Fragrances Inc. (IFF) - one of the leading providers of antimicrobial active ingredients and formulations for material protection, preservatives and disinfectants - in August 2021. The transaction is scheduled to be completed in the second quarter of 2022.

Growth in all segments

In the Advanced Intermediates segment, LANXESS successfully passed on the increases in raw material prices. Due also to good demand, sales increased by 19.6 percent from EUR 1.629 billion in the previous year to EUR 1.949 billion. At EUR 333 million, EBITDA pre exceptionals was 7.8 percent higher than the previous year's figure of EUR 309 million. High energy and freight costs particularly burdened earnings and margin. The EBITDA margin pre exceptionals of 17.1 percent was therefore below the margin of 19.0 percent posted in the previous year.

The Specialty Additives segment benefited from the incipient recovery in the aviation industry and the good demand from the construction, oil and gas industries. The significantly increased raw material prices were successfully passed on. Sales amounted to EUR 2.295 billion, up 16.8 percent on the previous year's figure of EUR 1.965 billion. EBITDA pre exceptionals grew by 16.2 percent from EUR 278 million to EUR 323 million. Increased

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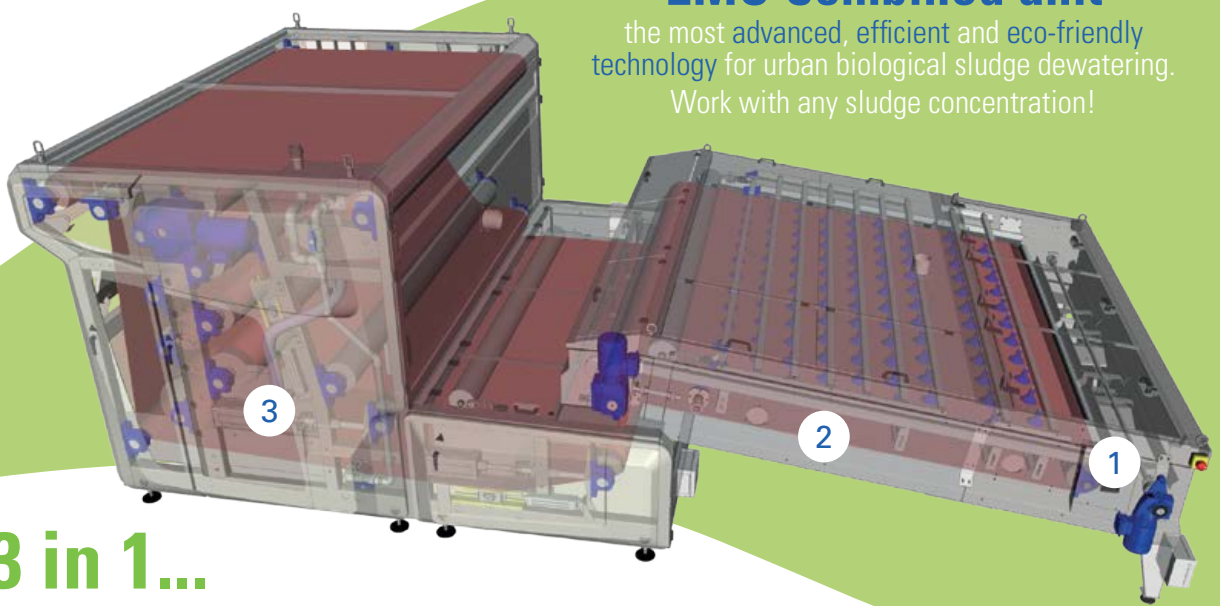

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energy and freight costs also had a negative effect on earnings. The EBITDA margin pre exceptionals remained unchanged year-on-year at 14.1 percent.

The businesses in the Consumer Protection segment performed very positively throughout the year. The segment benefited highly from the portfolio effect from the acquisition of the company Emerald Kalama Chemical. Together with the benzyl products of Advanced Industrial Intermediates, the new specialty chemicals businesses were integrated into the new Flavors & Fragrances business unit. Sales and earnings were also increased by the acquisition of the biocide companies INTACE and Theseo. Due also to higher volumes and selling prices, sales amounted to EUR 1.515 billion, up 21.9 percent on the previous year's figure of EUR 1.243 billion. EBITDA pre exceptionals grew by only 3.4 percent from EUR 266 million to EUR 275 million, due in particular to high energy and freight costs and unscheduled plant shutdowns. The EBITDA margin pre exceptionals reached 18.2 percent, against 21.4 percent a year ago.

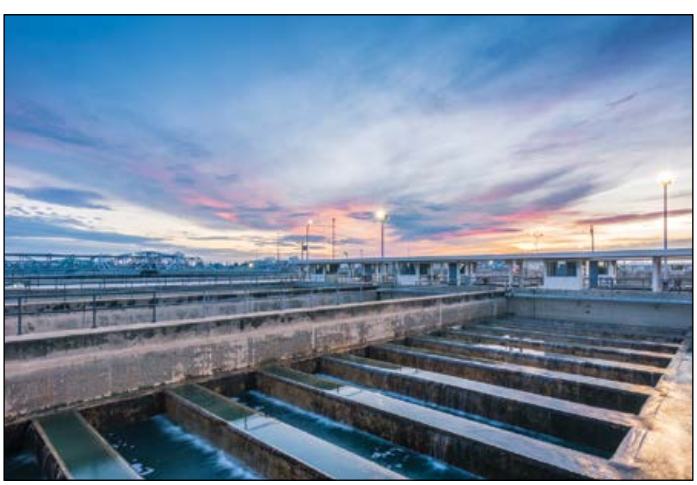
Thanks to the recovery of demand in the automotive industry and the passing on of increases in raw material prices, sales in the Engineering Materials segment rose sharply. At EUR 1.708 billion, sales were up 43.5 percent on the previous year's figure of EUR 1.190 billion. EBITDA pre exceptionals grew by 59.6 percent from EUR 151 million to EUR 241 million, although high energy and freight costs had a negative effect on earnings. The EBITDA margin pre exceptionals amounted to 14.1 percent after 12.7 percent in the previous year.

New ion exchange resin from LANXESS for lithium extraction

Mumbai, March 15, 2022 - Specialty chemicals company LANXESS is adding Lewatit TP 308 to its range of selective ion exchange resins, which are ideally suited for the purification of lithium salt solutions. "Purification processes of this type play an important role to create the ultrapure lithium salts needed in the production of lithium batteries and rechargeable lithium-ion batteries," said Dirk Steinhilber, Technical Marketing Manager at the Liquid Purification Technologies business unit at LANXESS.

Economical softening of diluted lithium brine

The use of ion exchange resins offers a number of advantages over the traditional method of final polishing for lithium brine, which is based primarily on precipitation operations. As Steinhilber explained, "Using ion exchange processes for calcium removal cuts both the time and expenditure needed by a significant margin." The macroporous Lewatit TP 308 has been developed specifically to treat low-concentration lithium salt solutions (cLi < 2 g/l) containing alkali, alkaline earth and heavy metals at relatively high concentrations ranging from 100 mg up to several grams per liter. Such solutions occur, for example, during the treatment of geothermal brine following the desorption from primary adsorber material.



The removal of the polyvalent ions - mainly calcium - from these solutions takes place very efficiently, with low leakage, and at high flow rates owing to the exceptional exchange kinetics. At the same time, the pressure drop across the resin bed is low. Laboratory testing has demonstrated the superior performance of Lewatit TP 308 compared with various products from competitors.

One particularly impressive feature of the resin is its high total capacity of more than 4.3 eq/l (equivalents per liter). This means better service lives and thus longer intervals between the regeneration phases than is the case with standard resins. Consequently, the specific need for regeneration chemicals and scarce water is reduced. This results in an overall improvement in system availability coupled with lower operating costs. "A specially modified polymer structure for the resin ensures a long lifespan even in the case of frequent regeneration and makes the process a much more attractive prospect in financial terms," said

Steinhilber.

Tailor-made resins for different lithium concentrations

LANXESS also offers tailor-made ion exchange resins for purifying concentrated lithium salt solutions, adding to the range of applications of Lewatit TP 308.

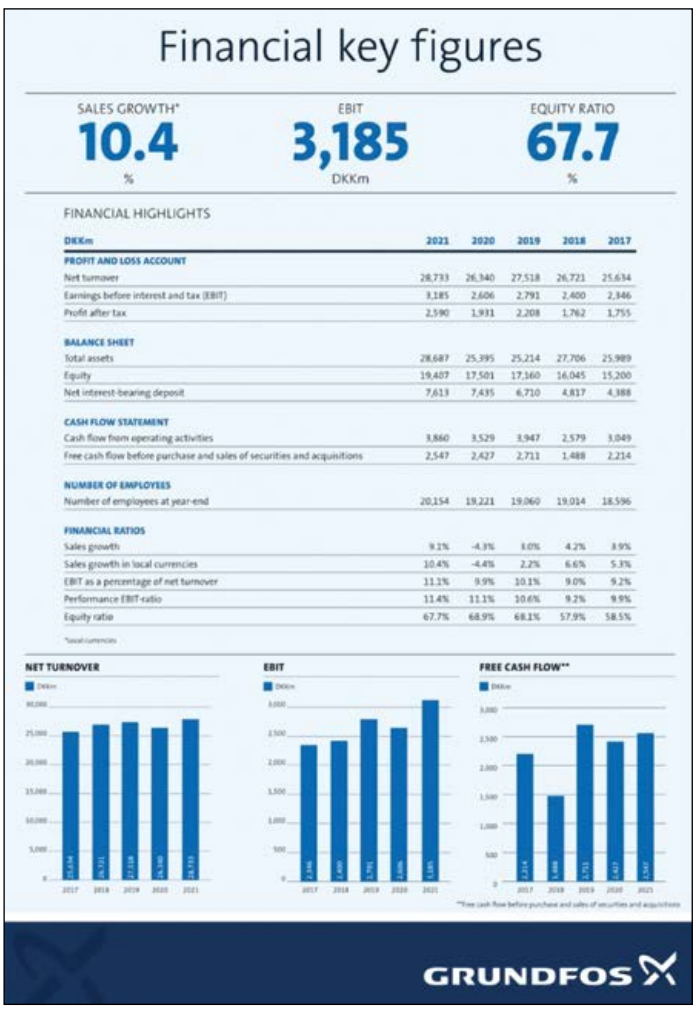
The Lewatit MonoPlus TP 208 and Lewatit MonoPlus TP 260 monodisperse resins can thus be used to remove divalent ions, namely calcium, magnesium, strontium and barium, in a concentration range of 1-100 mg/l from brine with a typical lithium content of 10 g/l. Lewatit MonoPlus TP 208, a resin with chelating iminodiacetic acid (IDA) groups, is best suited for lithium chloride, lithium hydroxide and lithium sulfate solutions.
In addition to the monodisperse resin types in the MonoPlus range, LANXESS offers MDS types of both resins, with polymer beads that have a diameter of approximately 0.4 mm, smaller than that of standard types (0.6-0.7 mm). As a result of the considerably larger specific surface, MDS resins exhibit faster exchange kinetics and a significantly higher usable capacity. They are also more stable both osmotically and mechanically.

They enable impurities to be removed almost entirely. For example, in a concentrated solution of lithium chloride and sodium chloride containing 10 ppm of calcium, only trace amounts of calcium in the ppb range remain after treatment with Lewatit MDS TP 208.

Ultrapure lithium salt solutions obtained in this way are mainly needed for the direct production of LiOH by chloralkali electrolysis, in which expensive membranes need to be protected from the formation of deposits and blockages.

Grundfos announces 2021 results with record sales and earnings, through challenges lie ahead

In 2021, Grundfos returned to strong sales growth of 10.4%, net turnover thereby hitting a record 28.7bn DKK and highest ever earnings (EBIT) of 3.2bn DKK. In 2021, Grundfos set a new sales record with a full year net turnover of 28.7bn DKK. Grundfos' full year return on sales (EBIT/Net turnover) reached 11.1%



representing Earnings before Interest and Tax (EBIT) of DKK 3,185m. Adjusted for items not related to the operations of the company, Grundfos' return on sales landed at 11.4%. The annual customer satisfaction survey showed world-class levels and was the highest score since Grundfos started conducting customer satisfaction surveys. The employee motivation and satisfaction survey continued to show strong results on par with the previous year.
Throughout second half of 2021, Grundfos was increasingly challenged by supply chain constraints and sharp price increases on materials, energy and logistics services which added pressure on profitability. "Our record results give us a strong foundation to face what will be a challenging 2022. The invasion of Ukraine is first and foremost a tragedy for the Ukrainian people. The global repercussions are immediate and far reaching and have led us to pause all business activities in Russia. On top of this, the inflationary
pressures and supply chain constraints are aggravated, making the outlook for 2022 very uncertain. We will continue to do our

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33. PH test 34. Phosphate 35. Phosphonate
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utmost to overcome these challenges in collaboration with our customers and partners. Further, we will continue to passionately pursue our sustainability agenda and deliver on our purpose to solve the worlds water and climate challenges and improve the quality of life for people," says Group President & CEO of Grundfos, Poul Due Jensen.

Financial highlights full-year 2021:
Net turnover of DKK 28,733m
Sales growth in local currencies versus last year of 10.4%
Return on sales of 11.1%

IIT-Kanpur Invents Novel, Eco-Friendly Nano-Adsorbent for Waste Water Treatment

The IIT-Kanpur has invented a novel nano-adsorbent for wastewater treatment. This nano-adsorbent would help in the selective removal of antibiotic and metal-resistant bacteria from polluted water with a rapid method to synthesise.

The research was conducted by Dr Archana Raichur and Dr Niraj Sinha from the department of Mechanical Engineering. The uniform cubical nano-adsorbent is eco-friendly, reusable, bactericidal, and multi-layered and will help in the selective removal of harmful bacteria from water.

It is a significant development regarding the current methodologies used to synthesise nano-adsorbents that have been researched in recent years for wastewater treatment to address water pollution and related health concerns.

Professor Abhay Karandikar, Director IIT-K, said: "The world is reeling under several environmental hazards and water pollution is one of them. It bears direct implications on the health of humans and animals. At IIT-Kanpur, our research in the field of nanotechnology is broad and diverse and this invention bears testimony to that. This crucial invention in the form of these novel nano-adsorbents would not only curb water pollution, but would also be crucially beneficial for humankind."

Raichur said that in current times, water contamination due to drug and pharmaceuticals residues is on the rise. Nanoparticles are being used greatly to curb water pollution by new emerging pollutants. The nano-particles act as adsorbents to remove the pollutants from water.

Along with growing water pollution, Antimicrobial Resistance (AMR) is a major public health issue that threatens the effective treatment of bacterial infections. Antibiotic-resistant bacteria are contagious in community and hospital settings.

The nano adsorbents developed at IIT-Kanpur have unique physio-chemical properties that can deactivate and separate the anti-biotic resistant bacteria (ARBs) from water. Sinha said that the innovation has application in wastewater treatment which improves water filtration and removes pathogens and bacteria selectively from drinking water. It can be used as a tool against microorganisms without any side effects and is compatible for the human body.

These nano-adsorbents have potential in near future to be used as a component of membrane filters and tested for clinical evaluation and application on bio-remediation which is ready to be commercialized, said Sinha.

Bengaluru can now treat all its sewage

With an aggressive thrust over the last decade for proper disposal and reuse of sewage, Bengaluru has finally reached a stage where it has the potential to treat all the waste generated by its residents. The recent operationalisation of a Sewage Treatment Plant (STP) at Rajarajeshwari Nagar, the second here, has helped the city attain this landmark.

The new Vrishabhavathi Valley Plant, adjacent to the Metro station,

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GLOBAL WATER NEWS

can treat up to 150 Million Litres Per Day (MLD) of sewage. The waste generated reaches the STP by gravity. It begins at Sankey Tank and then flows via Malleswaram, Okalipuram, Deepanjali Nagar, Nayandahalli, Hosakerahalli and Banashankari.

The attractive landscaping all around the vast campus of this secondary treatment plant is a sight for sore eyes. It has been built at a cost of Rs 470 crore under the Mega City Revolving Fund for which the Centre, State and the Bangalore Water Supply and Sewerage Board contribute.

BWSSB Executive Engineer Rahul Priyadarshi explained that all the STPs together have the capacity to treat 1,523 MLD of sewage. "The sewage generated daily in Bengaluru is around 1440 MLD. For the first time in the city's history, the ability to completely handle the water we generate has been made possible after this plant started working," he added.

The two plants here can treat up to 330 MLD. The smaller downstream STPs at Mailasandra (75 MLD), Kengeri (60 MLD), Dodbele (60 MLD) and Kempambudhi (1 MLD) have now ensured 526 MLD can be treated per day, Priyadarshi said.

The Vrishabhavathi STP adheres to stringent norms of the National Green Tribunal that are almost on par with that for a tertiary treatment plant, he said. Two other mega STPS which became operational this year - at Hebbal and K&C Valley - have played a critical role too. These three major STPs will generate 6-7 MW of power per day.

PMC plans to install 11 sewage treatment plants to clean Mula-Mutha River

The Pune Municipal Corporation (PMC) plans to increase its sewage treatment facility to improve the water quality and ecology by ensuring no untreated sewage water is released into the Mula-Mutha River, recognised as a "polluted" river by the Central Pollution Control Board (CPCB). The city, excluding the newly merged 34 villages, generates more than 744 million litre per day (MLD) sewage while there are 10 Sewage Treatment Plants (STPs) installed by the PMC with a capacity of 567 MLD. The gap in treatment is over 200 MLD. The civic body plans to bridge the gap by installing 11 sewage treatment plants of capacity 396 MLD at different locations.

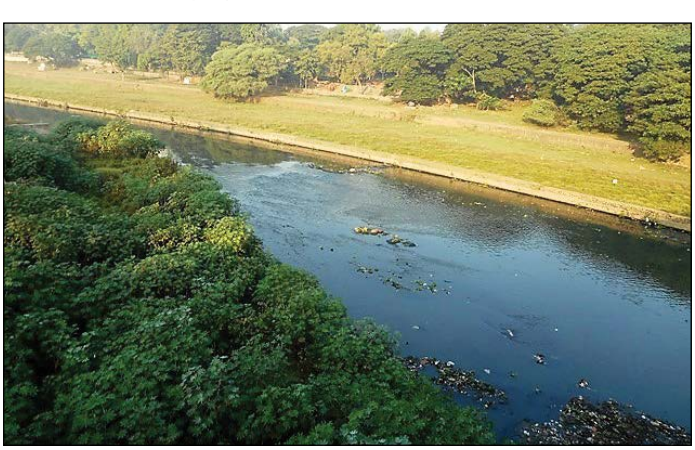
A 20 MLD plant is being set up by the Pune Cantonment Board and the PMC would be building 10 MLD STP in Botanical Garden, 25 MLD in Baner, 28 MLD in Warje, 26 MLD in Vadgaon, 15 MLD in Tanajiwadi, 127 MLD in Naidu hospital area, 33 MLD in Dhanori, 75 MLD in Bhairoba Nala, 20 MLD in Mundhwa, 30 MLD in Kharadi and 7 MLD in Matsyabij Kendra. It is estimated that the increased capacity of sewage treatment would be able to cater to the estimated rise till 2027.

The project also includes laying new sewer lines of 113.6 km in addition to the existing 2,200 km across the city. However, it does not include the area of the newly merged 34 villages in civic limits.

"The significance of the project is to intercept, divert and treat the domestic sewage generated which is discharged in the river. It will help in improving the hygienic condition of the city and surrounding areas and aesthetics of the river by mitigating biological and bacterial pollution," said a civic body official.

The effluent of proposed STPs will be utilised for irrigating nearly 21,000 hectares of land by pumping 515 MLD of treated water into the canal network of the irrigation department as it has given a discount on raw water usage to PMC, he said.
The revamping of the sewage network will be done as they are 90 years old in the central part of the city and a threat to groundwater pollution in case of leakages.

The Union government signed an agreement with the Japan International Cooperation Agency (JICA) in January 2016 for providing a soft loan for the treatment of the Mula-Mutha River and completing the project by January 2022. However, the delay has escalated the project cost to Rs 1,511.34 crore.



SMART WATER MANAGEMENT AND FOCUS ON WATER QUALITY AMONG TRENDS DRIVING DIGITAL TRANSFORMATION IN GLOBAL WATER AND WASTEWATER SECTOR

By Nideshnavaratharajan, Senior Consultant, Energy & Environment Practice, Frost & Sullivan

The COVID-19 pandemic has revitalized the importance of resilient and future-ready water and wastewater infrastructure across application segments. To become sustainable, resilient, and future-ready, end users have started to adopt net-zero, decarbonization, and circularity goals across their operations, products and service offerings. Digital solutions have become a critical element in helping end-users achieve sustainability and circularity targets. Globally, utilities and industries have significantly increased investments in digital and IoT solutions to reduce energy consumption and improve operational efficiency. Digital technologies such as Artificial Intelligence (AI), analytics, cloud, and digital twin play a key role in transforming the water industry. The application of these advanced technologies helps water resource authorities (both municipal and non-municipal authorities) to address various challenges related to the monitoring of water quality, the improvement of infrastructure asset management, the reduction of leakages, and the reliability of water supply, thereby ultimately ensuring efficient water management.

Global trends transforming the Water and Wastewater Sector are:

Centralized Digital Water Operations: Emerging technologies move siloed water operations to a centralized approach. The data generated from various operations through SCADA, CRM, and ERP are consolidated and analyzed to obtain an integrated view. A centralized repository ensures that data is available in real-time for all operators and can be quickly accessed from any device. The centralized process reduces data lags and accelerates decision-making.

Smart Water Management: Big Data is proving to be a game-changing technology for water utilities for efficient water management. Utilities generate large data volumes collected and analyzed to detect issues in various areas, including pumping stations and water reservoirs. Big Data creates robust analytics solutions that can power water utilities to predict water-related problems accurately and diagnose defects/issues that can cause significant damage.

Asset Optimization and Management: Water asset management is a significant focus area involving substantial initial investments. Detection defects in water assets, including pipes, reservoirs, and pumps, are challenging as water network infrastructure is highly complex and spread across a large geographic area. A virtual environment can be created by leveraging AI/Machine Learning (ML)-based solutions and digital twin, which will help operations managers troubleshoot process efficiencies, detect leaks, and assess the condition of water pipes. The process is safe, consumes less time, and saves costs.

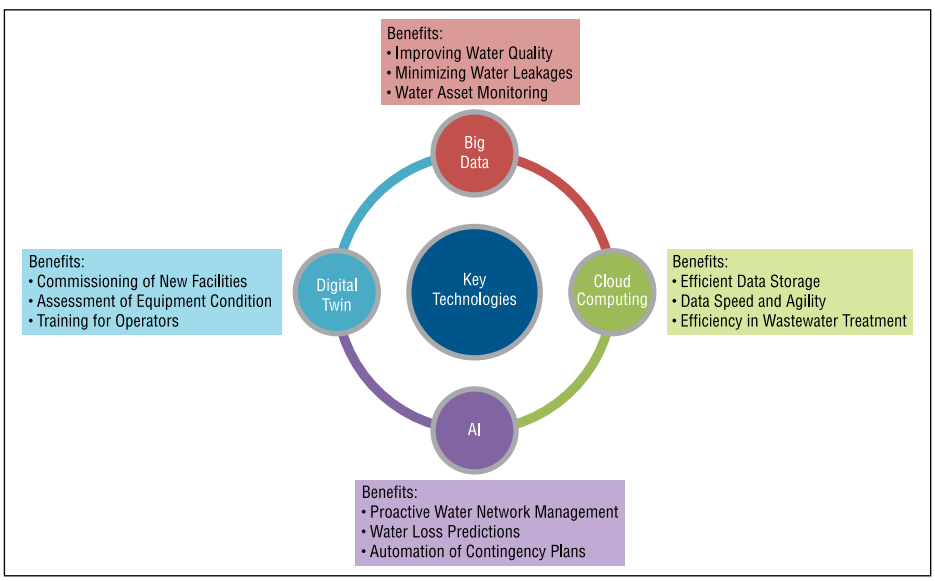
Focus on Improving Water Quality: Owing to the increasing pollution and other environmental factors such as the rising temperature and sewage discharge, water utilities struggle to maintain water quality. In addition, the expanding population, the increasing trend of industrialization, the rapidly growing economic activity, and the intensification of agricultural activity have led to water pollution. Implementing advanced technologies like IoT and digital twin will progressively improve water quality. These technologies can proactively identify pollution levels in water and significantly enhance the process of water quality treatment through the regular generation of predictive insight.

Zero-Carbon Footprint:

Water utilities worldwide are exploring various options to implement the climate action Net Zero plan. They reassess existing water infrastructure and implement advanced technologies to enable water management and energy efficiency plans as a significant step. Utilities are also looking for water- and chemical-efficient solutions. Efficiency has become a fundamental requisite in most new greenfield projects. Furthermore, sustainability and circular economy are pushing the adoption of advanced technology solutions. The above trends are driving the demand for digital solutions in the water industry, and four key technologies are expected to witness high adoption in the long term. Big Data, cloud, AI, and digital twin are four key technologies playing a crucial role in efficient

water management. These technologies are transforming the management of water utilities by empowering operators to manage and analyze large data volumes, take informed decisions through AI-generated insight, and improve overall operations through digital replicas of equipment.

Exhibit 1: Global Technology Trends and Benefits, 2022



Although advanced technologies hold significant potential in improving operational efficiencies, the global water industry remains slow to adopt digital technologies. This is mainly due to the fragmented nature of the industry, which makes it challenging to implement new technologies across the entire ecosystem. However, traditional water management means will no longer suffice with the rapidly changing landscape, and digital technologies will gain traction soon.

The Indian water and wastewater market is growing, with industrial and municipal segments offering growth opportunities. High industrial growth, rapid urbanization, associated economic activities, and groundwater depletion are expected to outweigh growth restraints, resulting in market growth in the coming years. The Indian water and wastewater market has a potential of more than Rs 350 billion by 2030.

Burgeoning demand for water, climate change, aging water infrastructure system, contamination or depletion of water sources are the key challenges the Indian water and wastewater sector faces. Digital transformation would play an important role by enabling utilities and industrial companies to address their key challenges. Key global trends witnessing adoption in India are smart water management and focus on improving water quality.

The Government of India announced multiple smart cities projects and focused on leveraging IoT technology to create a sustainable environment in the country. The implementation of smart cities is expected to increase digital adoption of water and integrate new, smart technologies into the water ecosystem. Several municipal corporations have adopted Smart Metering technology to measure water consumption and prevent water loss, which directly impacts revenue generation. Smart meters and monitoring hubs allow real-time water consumption measuring. Further, it helps identify excessive usage and waste points, correct usage patterns, and make predictions for future consumption. With smart meters and other smart solutions, utilities would cut down on the non-revenue water, which will eventually help them bill people on their actual water consumption. Municipal bodies or water utilities in India are increasingly focusing on incorporating smart meters and other cutting-edge technologies to significantly cut down on non-revenue water.

Sensor technology is gaining prominence, particularly for components such as Pumps used in water and wastewater treatment plants. Pumps are critical equipment in the system and high energy consumers, and hence adopting digital solutions would enable remote condition-based monitoring, preventive maintenance, and improve energy efficiency.

Digital solutions would greatly benefit the Indian water and wastewater sector by addressing their critical issues, such as declining water resources, climate change, and poor water management practices, which significantly impact the Indian economy. Although data analytics and AI are in their nascent stages today, it is expected to evolve in a more significant way in the long term, leading to new business models and service delivery models, which would transform the Indian market into an attractive growth opportunity in the world.

About the Author

Nideshna is a Senior Consultant with Frost & Sullivan's Energy & Environment Practice. With over 15 years of experience in Environment and Sustainability industry, she closely analyzes emerging trends, technologies, and market dynamics in South Asia and Middle East markets. She specializes in water, wastewater & waste management segments and provides advisory on go-to-market, new business models, product & channel strategy, and competitive positioning.

She has strong competency in analytical problem solving, and over the last decade has advised key international and regional environment companies on their growth strategies and best practices adoption.

Nideshna has published industry whitepapers and presented sector outlook at industry events. She has also been quoted in leading domestic and international publications on trends, challenges, and best practices in environmental markets.

She has done her Executive Program in Strategy Management from the Indian Institute of Management Kozhikode (IIM-K) and a Bachelor's in Engineering (Electrical and Electronics) from Madras University.

To know more about the contributor of this case study, you can write to us. Your feedback is welcome and should be sent at: deepak.chaudhary@eawater.com

FUTURISTIC TECHNOLOGIES OF WATER & WASTEWATER MANAGEMENT

By Dr. Kantha Deivi Arunachalam, Professor and DEAN, Centre for Environmental Nuclear Research, SRMIST

One of the primary reasons that has driven the inception of new or improved wastewater treatment technologies is the legislation and hefty fines that are attracted when the disposal of wastewater does not meet the set discharge limits. This impact on the financial wellbeing of factories and industries has fueled the emergence of new or improved treatment technologies. The nature of the wastewater primarily dictates the choice of technology to be adopted, and thus it is crucial to characterize streams to determine key wastewater characteristics, such as heavy metal, organic dyes, oil and volatile organic compound contentamong others. The main thrust of this chapter is premised on emerging technologies, that is membrane technologies. These technologies can be employed independently or in series as a treatment mechanism.

1. Electrospun Nano fibrous membranes

Many salable polymer membranes are mass-produced by process overturning in which a polymer is skillfully converted from a liquid to a solid process Figure 1. Electro spinning has turned out to be a protuberant tool for the production of polymeric Nano fibrous membranes over the last decade. Electrospun membranes are self-possessed of alternating Nano fibres with diameters dejected to a few nanometers separately from membranes produced by other processing techniques[1], and designs to acquire multifunctional Nano fibrous composite membranes by modification and are scattered. The next section discusses the uses of these complex Nano fibrous membranes in water motion, with a focus on past achievements and latest Electrospun membrane advance tasks for particular applications[2]. Membrane processes, such as microfiltration (MF), ultrafiltration (UF), nanofiltration (NF), forward osmosis (FO), reverse osmosis (RO), pressure retarded osmosis (PRO), gas separation (GS), membrane bioreactor (MBR), pervaporation, membrane distillation (MD), and liquid membrane separation, can be divided into procedures according to leave-taking concepts and membrane properties.

1.1. Pressure-driven membrane processes

In the filtration processes MF to RO are the approximate permeability and selectivity of membranes. There's an ongoing study on the role and potential of membrane methods in the water industry[2].The pressure exerted ranges from raw water to the type of procedure, suspended particles, divalent ions, and even monovalent ions oil emulsions, bacteria, cells, colloidal threats, viruses, macromolecules, proteins, organic classes, sub-molecular, may be used.

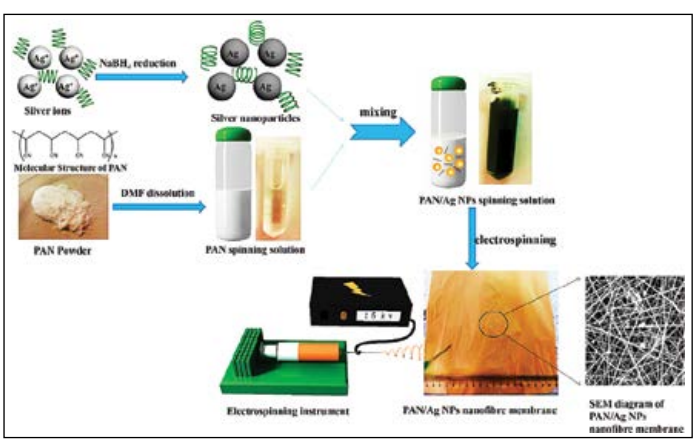


Figure 1: Electrospining processes liquid polymer to a solid fiber

1.1.1. Ultrafiltration (UF)

Ultrafiltration (UF) is a membrane filtration creation of pores in the 0.01-0.1µm (10–100 nm) sequence in which hydrostatic pressure pushes a liquid over the membrane. In UF, water and small molecular solutes cause the membrane to travel, and a critical factor to remove bacteria, colloids and viruses from the water and wastewater by water treatment and recyclingusing MBR before RO desalination.

Dissimilar coating materials such as PVA and chitosan have been used to create barrier sheets on the ENMs surface to produce more novel Nano fibrous complex membranes for UF. The composite Nano fibrous membranes obtained from a PVA Nano fibrous supply and a choosy layer of PVA hydrogel coating were created for the sample[3]. The composite Nano fibrous membrane displayed a high degree of rejection (> 99.5

percent) while retaining a high flux (> 130 L m-2h-1) when an oil / water emulsion was extracted. Because of its hydrophilicity and high water penetrability in which the chitosan is a versatile coating material. This composite membrane with albumin demonstrated high efficiency in water-protein filtration. In count, the membrane had verified good antifouling properties over the 24 h action time. The electrospun is immediately used as the porous substrates for UF membrane assembly by both hydrophobic and hydrophilic polymers, whereas hydrophilic substrates are likely to be good for most antifouling-accredited applications. To improve water permeability, hydrophilicity and antifouling properties, additional improvements are needed to change the network layout and thickness of the top coat layers.

1.1.2. Nano filtration (NF)

The lower end of UF and the higher end of RO are captured by Nano filtration (NF). The characteristic dividing size of NF varied from 100 to 1000 Dain molecular weight cut-off (MWCO) [4]. NF is commonly used in water treatment because it is capable of softening and purifying water and eliminating color, taste, scent, certain trace organic compounds, and divalent ions. The NF farewell entails both the influence of sieving (steric hindrance) and Donnan (electrostatic) and a high trans-membrane pressure[5]. The distinction between NF and RO is that RO can shed monovalent salts, such as sodium chloride, while NF is mostly involved in the trapping of divalent ions and multivalent salts such as sodium sulphate.

The unique effects of the structural properties of Nano fibers support, demonstrating that the TFNC membrane flux increased as the surface pore size and porosity of the substrate enlarged[6] by increasing the Nano fiber diameters. However, there was an upper edge for the diameter of the Nano fiber and the surface pore size of the membrane, outside of which the Nano fibrous membrane may not care for the Nano fiber membrane. It was also experiential that the rejection was simultaneously small, while increasing the size of the Nano fiber increased permeation flux. On the additional side, the permeation flux can be upgraded by lowering the thickness of the Nano fibrous membrane due to a reduction in hydraulic battle of Nano fibrous protection. Second, the effect of post-treatment heat pressing on the properties of Nano fibrous membranes and subsequently salt separation after IP has been inspected[7]. The TFNC membranes with heat-pressed substrates can withstand a trans-membrane pressure up to 13 bar and regulated a higher flux than a conventional NF membrane while retaining a 2000 ppm MgSO4 rejection of over 88 per cent.

Thin film composite (TFC) membranes with an ultra-thin skin layer formed on top of a permeable substrate through IP are the most recent NF membranes. For the production of high performance TFC membranes, the surface porosity of the substrate is extreme as it regulates the successful current direction through the layer of the skin. For TFC membranes, Nano fibrous scaffolds, which have a high surface and internal porosity has modest pressures and compressive forces.The filtration act of a PA-covered PAN TFNC membrane paired with a lab-produced TFC membrane made up of commercial UF is an example of the possible benefit of using a Nano fibrous substratum. The initial TFNC membrane disclosed more than 2,4 times advanced permeate flux while retaining the same denial (98 percent)[8].

1.2. Water-oil separation

Due to the opposing consequences of global oil spills, growing care is haggard for the separation and reprocessing of oil / water brooks through energy- and cost-effective, environmentally-responsive techniques. For separating oil / water emulsions by de-emulsification, coalescence filtration is involved. The coalescence filter has three major stages to remove emulsions.

1. The filter media remove solid particles from the fluid stream.
2. Inside the fibrous network, the fibrous bed arrests droplets and the captured droplets coalesce. As they make through multiple layers of Nano fiber filters in coalesce system, tiny oil / water dewdrops are combined into big ones.
3. The division of gravity separates the current into an oil layer and a water layer.[9].

When processing water-in - oil emulsions, the immense water droplets relax and massive oil droplets swing to the outside. The act of coalescence depends on current pace, bed depth, surface properties of Nano fibers and droplet magnitude.In addition to coalescence, Electrospun membranes were manufactured to filter out emulsions from water / oil [10]. Such ENMs have been validated to successfully extract immiscible varieties of kerosene / water, gasoline / water and hexane / water, and Dodecanese-in-water emulsions into their components. The inclusion of silica nanoparticles in PSF electrospun Nano fibers has greatly improved the separation skills. The membrane flux decreased in quantity to the increase in oil-in - water emulsion concentrations[3]. The membrane flux decreased in quantity to the increase in oil-in - water emulsion concentrations[11]. The ENMs produced many times greater flux and equivalent removal in comparison to a marketable membrane of the same pore capacity.

Developments of the pressure-driven membrane, such as UF and NF, are the suitable alternatives for separating oil / water, testing their high level of ejection and simple operation. The oil droplets are detached from oil-in - water emulsions using these techniques. However, because of minimal porousness, commercial NF and UF membranes typically suffer from brief fluxes. For oil / water separations, TFNC membrane chains were formed by coating a thin hydrophilic non-porous layer on nano fibrous substrates[12].

1.3. Heavy metal ion adsorption

Since heavy metal ions tend to accumulate in water, cannot be biodegraded and inflict dangerous environmental and human impacts, the removal of these ions is of considerable importance[13]. Strong metal ions may be extracted by adsorption based on ionic interactions between positively charged metal ions and functional group negatively charged material, or by coordinating bonds between metal ions and the functional environment by chelation[14]. Since the amount of adsorbed ions is partial by the surface area provided for ionic interactions, a matrix

with a huge surface area and a large number of functional groups is essential to adsorb high-efficiency heavy metal ions, construction ENMs is a desirable applicant. A significant amount of research on the assembly of electro-spinning metal-ion removal membranes has been published. By grafting functional units, adsorption persistence of polymeric Nano fibres can be upgraded. PAN Nano fibres have been reformed to adsorb metal ions with amidoxime groups[15]. Maximum adsorbed metal ions may be desorbed within 1 h in a 1 mol / L HNO3 solution, reflecting the ability for effective nanofibres to reprocess metals from wastewater. Diethylenetriamine was used to modify PAN Nanofibres to adsorb copper ions[16]. The findings revealed that the adsorption adeptness of enhanced nanofibres was three times greater than that of microfibers and that the extent of saturated adsorption was five times greater than that of other indicated materials.

Efficient methods to prepare functionalized Nanofibres for metal adsorption are applied to the assimilation of reactive nanoparticles into Nanofibres. Polycaprolactone (PCL) and nylon-6 Nano fibrous membranes remained impregnated with nanoboehmite particles, which are commonly used for contaminant sorption, to prevent liberation of particles into the atmosphere[17].

Nano fiber mats were also used to electrolessly retrieve Au from aqueous (Au(III)Cl4)-1 solutions based on a system of non-stop flow membrane separation[18]. Once a (Au(III)Cl4)-1 solution was approved by the polypyrrole(PPy)-coated PVDF Nano fibrous membrane, the Au(III) ions remained transformed into elemental Au and the enhanced gold was left on the Nano fibrous membrane[18].

In short, electro spinning is a potential technique for producing hopeful substrates for membrane progressions with high surface permeability and interconnected pore assemblies. Since electro spinning is not clever in one step to generate compressed membranes with pores of nanometer size, much of the earlier work has concentrated on manipulating and creating nano-fibrous membranes to decide their uses[19]. Nevertheless, the lack of readings on the durability of the chosen layers under high strain, the anti-fouling properties of as technologically advanced Nano fibrous membranes in current water handling and the growing scaling of Nano fibrous membranes for large-scale development have limited their practical use.

Conclusion

To end, we analyzed recent advances in the submission of Nano composite, Electrospun Nano fibrous as a groundbreaking nanostructured membrane debate. Membrane technology successfully replaced traditional water action technologies with its substantive water quality offering, while holding the values as low as possible.

In order to improve the probability of adsorption of a large variety of species with dissolved organic toxins, heavy metal ions, dyes, oils and chemicals, the full spectrum of possibilities for surface functionalization of hydroxyl group chemistry has been revealed. The theory of hybrid membranes has arisen to mitigate these new challenges, which basically provides joint architectures of polymeric and ceramic membranes by incorporating the inorganic particles into organic polymer matrix. In terms of its selectivity, permeability and performance, this advanced form of membrane is believed to be effective, the unique characteristics of Nanofibers, including high specific surface area, high permeability of up to 90 percent, one-dimensional prearrangement, simple integration of functional Nano-materials and varied designs, make them highly smart for both educational and industrial studies.

Electro spinning was used to create fine, distinct usable nanostructures such as hollow nanotubes and fibers of Nano with fine regulated orientation and scale. Nevertheless, it is quietly thrilling to create these special Nano fibers manageable and durable. The strategy and architecture of electrical spinning machinery for continuous mass production are critical and needs further research.

Reference

1. S. Agarwal, A. Greiner, and J. H. Wendorff, “Functional materials by electrospinning of polymers,” Progress in Polymer Science, vol. 38, no. 6. Elsevier Ltd, pp. 963-991, Jun. 01, 2013, doi: 10.1016/j.progpolymsci.2013.02.001.
2. A. G. Fane, R. Wang, and M. X. Hu, “Synthetic membranes for water purification: Status and future,” Angew. Chemie - Int. Ed., vol. 54, no. 11, pp. 3368-3386, Mar. 2015, doi: 10.1002/anie.201409783.
3. X. Wang, D. Fang, K. Yoon, B. S. Hsiao, and B. Chu, “High performance ultrafiltration composite membranes based on poly(vinyl alcohol) hydrogel coating on crosslinked nanofibrous poly(vinyl alcohol) scaffold,” J. Memb. Sci., vol. 278, no. 1-2, pp. 261-268, Jul. 2006, doi: 10.1016/j.memsci.2005.11.009.
4. X. L. Wang, C. Zhang, and P. Ouyang, “The possibility of separating saccharides from a NaCl solution by using nanofiltration in diafiltration mode,” J. Memb. Sci., vol. 204, no. 1-2, pp. 271-281, Jul. 2002, doi: 10.1016/S0376-7388(02)00050-9.
5. K. Sutherland, “Developments in filtration: What is nanofiltration?,” Filtr. Sep., vol. 45, no. 8, pp. 32–35, Oct. 2008, doi: 10.1016/S0015-1882(08)70298-2.
6. S. Kaur, S. Sundarrajan, D. Rana, T. Matsuura, and S. Ramakrishna, “Influence of electrospun fiber size on the separation efficiency of thin film nanofiltration composite membrane,” J. Memb. Sci., vol. 392-393, pp. 101-111, Mar. 2012, doi: 10.1016/j.memsci.2011.12.005.
7. S. Kaur, R. Barhate, S. Sundarrajan, T. Matsuura, and S. Ramakrishna, “Hot pressing of electrospun membrane composite and its influence on separation performance on thin film composite nanofiltration membrane,” Desalination, vol. 279, no. 1-3, pp. 201-209, Sep. 2011, doi: 10.1016/j.desal.2011.06.009.
8. L. Yung et al., “Fabrication of thin-film nanofibrous composite membranes by interfacial polymerization using ionic liquids as additives,” J. Memb. Sci., vol. 365, no. 1-2, pp. 52-58, Dec. 2010, doi: 10.1016/j.memsci.2010.08.033.
9. N. L. Lala et al., “Fabrication of nanofibers with antimicrobial functionality used as filters: Protection against bacterial contaminants,” Biotechnol. Bioeng., vol. 97, no. 6, pp. 1357-1365, Aug. 2007, doi: 10.1002/bit.21351.
10. M. Obaid et al., “Effective polysulfone-amorphous SiO2 NPs electrospun nanofiber membrane for high flux oil/water separation,”

1. Chem. Eng. J., vol. 279, pp. 631-638, Nov. 2015, doi: 10.1016/j.cej.2015.05.028.
2. H. Ma et al., "High-flux thin-film nanofibrous composite ultrafiltration membranes containing cellulose barrier layer," J. Mater. Chem., vol. 20, no. 22, pp. 4692-4704, Jun. 2010, doi: 10.1039/b922536f.
3. L. T. S. Choong, Y. M. Lin, and G. C. Rutledge, "Separation of oil-in-water emulsions using electrospun fiber membranes and modeling of the fouling mechanism," J. Memb. Sci., vol. 486, pp. 229-238, Jul. 2015, doi: 10.1016/j.memsci.2015.03.027.
4. Z. Tang et al., "UV-cured poly(vinyl alcohol) ultrafiltration nanofibrous membrane based on electrospun nanofiber scaffolds," J. Memb. Sci., vol. 328, no. 1-2, pp. 1-5, Feb. 2009, doi: 10.1016/j.memsci.2008.11.054.
5. K. Yoon, B. S. Hsiao, and B. Chu, "High flux ultrafiltration nanofibrous membranes based on polyacrylonitrile electrospun scaffolds and crosslinked polyvinyl alcohol coating," J. Memb. Sci., vol. 338, no. 1-2, pp. 145-152, Aug. 2009, doi: 10.1016/j.memsci.2009.04.020.
6. C. S. Ki, E. H. Gang, I. C. Um, and Y. H. Park, "Nanofibrous membrane of wool keratose/silk fibroin blend for heavy metal ion adsorption," J. Memb. Sci., vol. 302, no. 1-2, pp. 20-26, Sep. 2007, doi: 10.1016/j.memsci.2007.06.003.
7. P. K. Neghlani, M. Rafizadeh, and F. A. Taromi, "Preparation of aminated-polyacrylonitrile nanofiber membranes for the adsorption of metal ions: Comparison with microfibers," J. Hazard. Mater., vol. 186, no. 1, pp. 182-189, Feb. 2011, doi: 10.1016/j.jhazmat.2010.10.121.
8. P. Kampalanonwat and P. Supaphol, "Preparation and adsorption behavior of aminated electrospun polyacrylonitrile nanofiber mats for heavy metal ion removal," ACS Appl. Mater. Interfaces, vol. 2, no. 12, pp. 3619-3627, Dec. 2010, doi: 10.1021/am1008024.
9. G. Hota, B. R. Kumar, W. J. Ng, and S. Ramakrishna, "Fabrication and characterization of a boehmite nanoparticle impregnated electrospun fiber membrane for removal of metal ions," J. Mater. Sci., vol. 43, no. 1, pp. 212-217, Jan. 2008, doi: 10.1007/s10853-007-2142-4.
10. J. A. Platts-Mills et al., "Pathogen-specific burdens of community diarrhoea in developing countries: A multisite birth cohort study (MAL-ED)," Lancet Glob. Heal., vol. 3, no. 9, pp. e564-e575, Sep. 2015, doi: 10.1016/S2214-109X(15)00151-5.

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FUTURISTIC TECHNOLOGIES OF WATER & WASTEWATER MANAGEMENT

By Dushyant Jindal, Co-Founder, Hitech Enviro Solutions

As the global population hurtles towards 9.7 billion people by 2050, it has never been more important to produce more with less. As the water supply and sanitation (WSS) sector continues to face increasing pressures, especially due to the impacts of climate change, governments in the developing world will need to increase the sector's resilience and sustainability. Innovation and technology have a vital role to play in scarcity and safety, water efficiency, utility operations, monitoring and treatment and data and analytics. Global entrepreneurs are witnessing a greater willingness by utilities and business to test and adopt promising technologies: the remote sensing of water, which can help with water accounting, non-revenue water remediation and much more; the internet of things, which enables smart irrigation, water quality control, and which, when coupled with new computing capacity, allows us to develop complex models for water management.

The importance of wastewater management innovation

One person's trash is another one's gold. This saying is particularly relevant when we talk about wastewater management and its circular economic nature. Innovation within this industry is imperative as the average family wastes around 9,400 gallons of water per year, while farming and agriculture account for 70% of the world wide consumption of freshwater.
Mix this in with poor recovery technologies, pollution, and contaminants and freshwater recourses can expect to see issues with growing scarcity, environmental degradation, and potentially irreparable damage. The long-term solution lies not in drastically cutting water usage, but rather in innovative technologies and practices in wastewater management and wastewater treatment.

The innovative startups in wastewater management

Drinkwell, India: It is the inaugural winner of the Imagine H2O Urban Water Challenge, which the Water Global Practice connected with the Chittagong Water Supply and Sewerage Authority, leading to the first deployments of four water ATM booths providing safe drinking water access to 5,100 people. In cooperation with the utility, Drinkwell will be rolling out an additional 96 systems in 2020 and 2021 across Bangladesh's second largest city.

Smarter Homes, India: It is a company that produces the WaterOn device, which is a smart metering and automated leakage prevention system. Thus far, the device has been used on apartment buildings in India and has helped save 40,000 households an average of 35 percent of water consumption.

Ignitia, Africa: It is a company that uses machine learning and remote sensing to send text messages to small-scale farmers with hyper-local information on climates and weather forecasts. The company has over one million subscribers in Ghana and other West African countries, and its technology has greatly benefitted farmers, which in turn can trickle down to consumers.

Oneka is another company that helps consumers obtain safe drinking water without utilizing land or emitting greenhouse gases. With a focus on Small Island Developing States.

Arable, United States: Sensor and analytics platform that provides real-time, actionable insights with predictive capabilities for agriculture and food systems.

Cloud to Street, United States: Flood risk detection through global satellites, machine learning and community intelligence. Targets 90% of households in emerging markets who are currently uninsured.

Drinkwell, Bangladesh / India: Water ATMs for arsenic and fluoride affected communities through patented filtration technology, IOT enabled operations and pay-as-you-go cards.

Ecosoftt, Singapore: Fit-for-purpose, low-cost wastewater and reuse solutions for communities not connected to water and sewer networks.

Electrolytic Technologies, United States: Onsite chlorine generation eliminating costs and risks from transportation of chemicals to water and wastewater treatment plants.

Fluid Robotics, India: In-pipe robotic mapping and assessment tools to detect leaks in distribution systems and prevent pollution runoff in urban waterways.

Oneka, Canada: Wave-powered desalination for autonomous drinking water production targeting small island communities.

SatSure, India: Satellite remote sensing-based irrigation monitoring and decision making platform for governments.

SmartTerra, India: Operational intelligence for water and wastewater utilities to reduce losses, assess network health and improve revenue.

Vassar Labs, India: Water management and forecasting platform for state government agencies using satellite imagery, in-situ sensors and predictive analytics.

Veracet, United States: DNA fingerprinting technology and analytics platform to identify the source of contamination in water.

Wonderkid, Kenya: Mobile water management platform for water utilities to improve the quality of their customer care and billing services.

Hydra Water, Sweden: Hydra Water provides solutions to water and wastewater treatment plants. It is specialized in robust mechanical sludge and solids removal from inlet to outlet, and its offering includes installation, service, and production of high-quality equipment.

SOFI Filteration, Finland: Sofi Filtration is a company specialized in industrial water filtration. It targets industries with large water streams with fine particle contaminations, providing a microfiltration technology adapted to various applications.

Anue Water Technologies, USA: Anue Water Technologies is a wastewater treatment company providing solutions for wastewater odor, industrial corrosion control, municipal sewage water, and process water applications. Its technologies reduce operational costs for sustainable water treatment.

Apx10, Denmark: APX10 helps water, wastewater, and district heating utility sectors to leverage the rapidly growing amount of data via its big data analytics platform. Their products provide actionable, data-driven insights through dynamic presentations, including GIS maps, heat maps, and charts.

Aquagreen, India: AquaGreen is a CleanTech company that promotes a sustainable approach to wastewater treatment as it destroys microplastics, medicine residues, and other harmful organic compounds and captures heavy metals. To this end, the company's technology dries and pyrolysis wet biomass residue, turning it into biochar and thermal energy.

Aqua Robur Technologies, Sweden: Aqua Robur Technologies offers an IoT-based system and wastewater management solution that leverages the technology to detect leaks and other potentially harmful malfunctions in public water systems through data collection and measurement. The system uses prospective communication technologies such as Narrow-Band IoT, LTE-M, and LoRa-WAN.

C-Green Technology, Sweden: C-Green Technology develops an alternative sludge wastewater treatment. The company offers OxyPower HTC, a process that converts sludge to biofuel and thus promotes a cost-efficient and sustainable approach.

Kando, Israel: Kando is a smart wastewater solution provider that detects early-stage water events within the wastewater network and offers real-time insights for the wastewater management team to help them prevent damage to the network. It provides a SaaS platform that provides the clients with well-informed management of wastewater networks.

Puraffainity, United kingdom: Puraffinity develops and creates biologically derived purification materials for water and wastewater treatment. It specializes in designing and developing bio-based novel absorbents capable of removing pollutants from contaminated water and wastewater. The company's Customised Granular Media is significantly more efficient in eliminating PFAS than traditional methods like advanced oxidation processes, adsorption resins, ultraviolet treatment, and carbon nanotubes.

Ostara Nutrient Recovery Technologies Inc., Canada: Ostara Nutrient Recovery Technologies is a sustainable water treatment and nutrient recovery solutions, provider. Applying a more systemic approach to managing nutrient flows, the company produces solutions that facilitate cyclical phosphorus utilization while contributing to clean water and food security.

Trea Tech, Switzerland: TreaTech is developing a patented wastewater solution for the disposal and recycling of sewage sludge and all types of wet waste. TreaTech's solution enables the disposal of liquid waters, turning them into byproducts such as biogas, clean water, and mineral salts that can further be upgraded to phosphorus products such as fertilizers.

Oxymem, Ireland: OxyMem is a spin-off company that has developed a technology based on MABR (Membrane Aerated Biofilm Reactor), patented and commercialized in 2013. It replaces the traditional activated sludge process in wastewater treatment which reduces the costs of wastewater treatment plants, thus enhancing their system's efficiency.

Pharem Biotech, Sweden: Pharem Biotech is a biotechnology profit organization that produces enzymatic products to remove organic pollutants in water. Its filtration system removes harmful organic and pharmaceutical components from wastewater through enzyme neutralization occurring in the filter chambers.

Axine Water, Canada: Axine Water leverages advanced electrochemical oxidation technology for industrial wastewater treatment. The company developed an in-house proprietary reactor that eliminates water pollutants through oxidation, creating byproducts that can be further used and water that can be reused in industrial processes.

Nexom, Canada: Nexom is a company that provides its clients with biological and filtration-based technologies for wastewater treatment and nutrient removal. Its offering contains several different technological processes for the removal of nitrogen, phosphorus, and select metals.

Orego, France: Orege is a cleantech company that develops, manufactures, and markets municipal and industrial sludge treatment solutions. Orege's SLG (solid, liquid, gas) changes the rheology and properties of the sludge,

allowing for better and quicker isolation of sludge solids from the filtrate.

Sekisui, Japan: Sekisui Aqua Systems develops multiple engineering and wastewater treatment solutions for various industries. Their flagship product, AQYACUBE, is a microorganism fixing carrier that can capture a high concentration of bacteria. The polyolefin material it is made of makes it less prone to amortization and more resistant to water than other solutions on the market.

Epic Clean Tec, USA: Epic CleanTec provides individual buildings with a circular wastewater treatment system, enabling the clients to recycle their water. It uses the solids from wastewater to produce a high-quality, carbon-rich, and endlessly renewable soil product, while the remaining water gets returned for toilet flushing or watering lawns.

Kuraray Aqua, Japan: Kuraray Aqua is a company that provides wastewater treatment solutions. Their flagship product is the PVA-Gel, made for aerobic treatment, nitrification, and denitrification of wastewater.

Grenex, South Korea: Grenex offers a wide range of environmental products and services related to the water and wastewater industries. It develops advanced biological treatment systems, falling into four categories: filtration systems, biological nutrient removal processes, aeration, mixing equipment, and solid waste management services.

Amdus Technologies Pvt Ltd, India: Amdus is developing next generation of piezometers for ground water level monitoring and waste water monitoring sensors with better connectivity and accuracy for data transmission.

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Dushyant Jindal is an Engineer with MBA has an extensive experience working on environmental project for different sectors of Government and non-government organizations in India. He is the Co-Founder at Hitech Enviro Solutions, engaged in environmental monitoring services and consultancy.

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WATER MANAGEMENT THROUGH EFFICIENT IRRIGATION & WATER TRANSFER

By S.K. Mazumder, Former AICTE Emeritus Professor& Dean, Faculty of Technology, Delhi University

1.0 INTRODUCTION

In 1947 when India woke to freedom, the country was facing stark realties of recurring famines and floods. There were hardly any moisture conservation or watershed programs or any storage to meet the demands for domestic use, irrigation, industries and hydro-power generation. Based on limited experience and inadequate technological strengths, the country embarked on its journey into water world of the future. Several multi- purpose river valley projects like DVC, Bhakra-Nagal, and Nagarjun sagar etc. were completed. A national water mission has now been set up by the Govt. of India to explore pathways and future option to reduce emerging water stress and to meet increased demands from different sectors and chain management of agricultural production of rice, wheat, edible oil, pulses etc. Steps are being taken to improve soil health, seeds, organic farming and GM crops etc. In spite of all the progressive measures and investment over the last 12 five year plans, the country is lagging behind China and some neighbouring countries in regard to land and water management. Fig.1 illustrates yield of cereals in India vis-a-vis some other countries. In this paper, Author wishes to emphasize on two important aspects of water management in regard to irrigation efficiency and water transfer through river links.

2.0 AVAILABILITY AND DEMAND OF WATER

As per the report of the National Commission on Integrated Water Resources Development (NCIWRD-1999), India has roughly four percent of the world's fresh water resources to feed its 17% world population. India receives an average precipitation of about 1170 mm which corresponds to an amount of annual volume of 4000 billion cubic meters (BCM). There is considerable variation in precipitation both in time and space. Nearly 75% of precipitation i.e. 3000 BCM occurs during the south-west monsoon season confined to 3 to 4 months (June to September) in a year. Average annual water availability of India is 1869 BCM from different river basins in the country (CWC, 1993).The utilizable water with conventional approach is 1121 BCM which comprises of 690 BCM of surface water and 431 BCM of replenish able ground water. The remaining water i.e. 748 BCM is lost to the atmosphere through evapo-transpiration from rain fed agriculture, barren lands, forests, natural vegetation, floods, natural ponds and lakes etc.

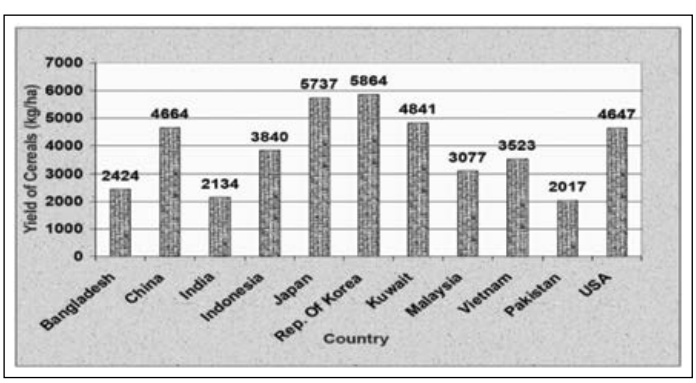

Fig.1 Comparison of Yield of Cereals in India vis-a vis Other Countries in the World

Table-1 shows per capita water availability of some of the countries in the world as on 2011. With rise in population, the per capita water availability by conventional methods in India have further reduced to about 1343 m3 per year as on 2021. India will face acute shortage of water by the year 2050 onward when utilizable water resources of Indiai.e.1121 BCM by conventional methods will be insufficient to meet the total demand i.e. 1180 BCM from different sectors e.g. Irrigation, municipal consumption,

industries, power etc. given in Table-2 ((INAE,2008). It may be seen that irrigation sector consumes about 70% of the total demand of water. Out of 113 mha area under irrigation in India today, 58 mha is by major and medium surface irrigation schemes, 15 mha area by surface minor irrigation schemes and 40 mha by minor ground water schemes (IWRS-2007). Because of the timely irrigation development, India is self sufficient in food today, producing 300 million tons of food grains for our 1300 million people. Fig.2 indicates the rise in population, food production and area irrigated by conventional method during the period 1951-2050.

Table 1: Per Capita Water Availability in Different countries in The World (as on 2011)

USSR	USA	China	Australia	India	Ethiopia
19500	9900	5000	2420	1545	250

Table 2: Water Demand for Different Uses in India

S. No.	Total Water Requirement for Different Uses (in BCM)			
	Uses	Year 2010	Year 2025	Year 2050
		High Demand scenario	High Demand scenario	High Demand scenario
1.	Irrigation	557	611	807
2.	Municipal	43	62	111
3.	Industries	37	67	81
4.	Power (Energy)	19	33	70
5.	Others	54	70	111
	Total	**710**	**843**	**1180**
	Irrigation Demand	**78%**	**73%**	**68%**

3.0 NEED FOR PROPER MANAGEMENT OF IRRIGATION WATER

Our meagre storage capacity built so far is only 305 BCM which corresponds to about 30% of the utilizable water (mostly in surface reservoirs), is inadequate to fight drought like situations arising occasionally in different parts of the country. Moreover, loss of live storage (Singh, A. & A. Kanwal, 2021; Mazumder, 2016) due to silting of reservoir is estimated as 53 BCM by 2050. There are only a few storage reservoirs like Bhakra which can hold flood waters in high rainfall years to fight consecutive droughts due to scanty rainfall. Assured Irrigation coverage is around 90 mha out of 130 mha of arable land. It is very difficult to build dams like Bhakra because of stiff opposition of environmentalists. The only way left is to properly manage the available water resources in a judicious and efficient manner (CWC, 2010).

Currently, there is a lot of loss of water in irrigation sector primarily due to heavily subsidized irrigation water supply policy and poor on-farm development (Ministry of Agriculture,1979). Even a marginal increase in irrigation efficiency will generate enough water to meet the requirements for our future need of food and other requirements, provided of course our population can be stabilized at 1850 million by the year 2050.

4.0 LOSS REDUCTION FOR IMPROVING IRRIGATION EFFICIENCY

The overall efficiency of irrigation projects (also called project efficiency) in India is too low at an average of 35% in the case of major and medium irrigation projects (INCID, 1998) as compared to 55% in China and

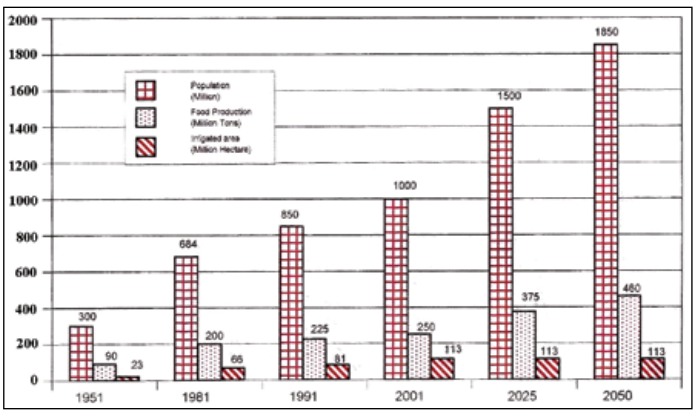

Fig. 1: Growth of Population, Food production and Irrigated area in India during 1951-2050

70% in Japan. The average project efficiency in three major river-valley projects, determined by the author, was found to vary from 18.6% to 38.8% (Mazumder, 1984). Most of the irrigation water was found to be lost in conveyance and field application and extremely poor management of water (Mazumder-1986) at the farm level. While emphasizing the present day need of intensive irrigation for maximizing yield per unit of area, Bharat Singh (1991) identified the following major shortcomings of our present surface irrigation schemes:

- Gap between the creation of irrigation potential and its utilization
- Unreliable and inadequate supply of water
- Inequitable distribution of water between head and tail enders.
- Non-responsive and authoritarian administration
- Lack of control and malpractices
- Low efficiency of canal systems and poor on farm management of irrigation water.

Planning Commission (2007), renamed as Niti Ayog by Govt. of India, recognized the three major shortcomings responsible for poor performance of irrigation schemes in India, namely,

- Unlined channels
- Lack of land consolidation, improper levelling and sizing of irrigated land
- Poor on- farm management of irrigation water beyond outlets.

However, majority of our farmers are poor and incapable of investing huge funds needed for land improvement, land levelling, canal lining, irrigation automation etc. for improving productivity of land.

Zimermann (1966) examined several drawbacks of protective type extensive irrigation practice being followed in India where available water is spread over vast areas through a widely spaced unlined canal networks. Most of the water in such a system is lost in conveyance and most of the remaining water is lost because of inefficient irrigation management (IWRS,2007). Several steps for improving irrigation efficiency by reducing avoidable losses have been outlined by Mazumder (2007).

5.0 CHANGE IN CROPPING PATTERN & IRRIGATION RATE FOR IMPROVING IRRGATION EFFICIENCY

Unlike wheat, rice is a water loving crop since rice is found to have highest growth rate at soil moisture equal to field capacity requiring submergence irrigation and causing huge amount of percolation losses. In the case of conventional irrigation supply through canal networks, gross delta for rice varies from 1200 to 1500 mm. Water requirement for wheat and pulses is substantially less as the irrigation water is applied up to field capacity of soil and there is no percolation loss. Consumptive requirement of Rabi crops is substantially less as evapo-transpiration is low and growth is not affected due to depletion of soil moisture up to an optimum moisture content determined by type of crop. Rice cultivation by canal irrigation should be discouraged in rainfall deficit areas like Rajasthan and confined to areas only with high rainfall. Currently, irrigation water rates are so low that only 15% of the total cost of operation, maintenance, administrative and overhead expenditure can be met from the meagre revenue income (Mohile,et.al ,1994).This has resulted in utter negligence in maintenance of the canal system resulting in profuse amount of water loss and poor irrigation efficiency. In long distance irrigation canals, farmers at head end draw more water than needed since irrigation rates are not charged on volumetric basis but on area-crop basis. As a result, farmers at tail end of the canal receive meagre amount canal water forcing them to resort to pumping of ground water. The surface irrigation schemes were planned to make conjunctive use of ground water to the extent of about 30% of irrigation requirement. Presently, 70% of command areas are irrigated by ground water due to poor efficiency of surface irrigation schemes in India resulting in serious problems of ground water depletion and consequent escalation of pumping cost. Overdrawing of ground water has resulted in emptying of shallow aquifers, land subsidence and other harmful effects besides rise of pumping costs. Several states and Govt. of India formed Command Area Development Authorities (CADA), Water Users Association (WUA) etc. with a view to improve upon the performance of irrigation schemes but they have miserably failed to improve upon the efficiency due to several reasons discussed above.

6.0 ROLE OF SERVICE TANKS TO CONSERVE IRRIGATION WATER

In most of the surface irrigation schemes, the main and branch canals are so long that it may take days for arrival of irrigation water released from distant reservoirs. Due to lack of proper
co-ordination between regulating authorities and farmers, water arriving at the tail end in the canal system may not be drawn by the farmers if there is rainfall in the intervening period. Huge amount of water is wasted through canal escapes for safety of the canals. Such water can be conserved by construction of service tanks/On-Farm-Reservoirs (OFR) for temporary storage and supplied to farms subsequently. Apart from water conservation, such detention/retention tanks (Mazumder, 2017) are very useful to meet multiple purposes e.g. fish culture, domestic use, recharge of ground water, flood management, sediment trap, water treatment, recreation and above all a flexibility of operation by farmers to apply irrigation as and when needed at their convenience. OFR for storing runoff/canal water for reuse is a very useful method of improving irrigation efficiency and are widely used in Israel where rainfall is scanty. However, their location, storage capacity, inflow and outflow control devices are to be very carefully planned and designed (Zimmerman 1966).

7.0 WATER TRANSFER

Areas with water availability less than 1000m3 per capita per year are designated as scarcity areas. Although, the average figure (1343) for India (Iyer, 1989), if taken as a whole, indicates that India may not be water deficit right now, but looked from the spatial distribution of available water from basin to basin, there is a great deal of non-uniformity due primarily to extreme non-uniform rainfall over the country. Rapid rise in population growth in India will soon render many of the surplus basins in India to be water scarce basins (IWRS, 2007). Water transfer from surplus to scarce basins for sustainable development of water resources in India has been found necessary to fight recurring floods and droughts in many parts of the country. Only way we can address the recurring problems of water shortage in scarce basins is by transfer of surplus of flood water to drought areas. It is estimated (IWRS, 2007) that an additional area of 35 mha of land can be brought under irrigation by river linking, apart from hydro-power, navigation, ground water recharge, flood control etc. Govt. of India has drawn a perspective plan to interlink Indian rivers (Fig. 3) by constructing 30 link canals-14 in Himalayan and 16 in Peninsular regions in India (NWDA, 2005). Few Short distance river links like Ken-Betwa is being implemented. Long distance links by successive transfer of water from one river to another by constructing some 30 small, medium and large reservoirs are under exploration. Mer its and demerits of river linking have been discussed at length elsewhere (IWRS-1996, Mazumder-2011).

Fig.2 Interlinking of Rivers in India (NWDA)

REFERENCES

Bharat Singh (1991), "Management of Irrigation in India - A perspective" pub. in "Water Management" by Water Management Forum, The Institution of Engineers (India), Kolkata

CWC (1993) "Water Resources Potential In The River Basins Of India" chapter-1 : Publication by Central Water Commission, Min. of Water Resources, River Development and Ganga Rejuvenation, Govt. of India

CWC (2010) "Water Use Efficiency for Irrigation Projects" Pub. By central Water Commission, Min. of water Res., River Dev. And Ganga Rejuvenation, Govt. of India, April, 2010

INAE (2008) "Water Resources Management-Role of Water Sector in India", Pub. By Indian National Academy of Engineers, IIT(Delhi), Feb. 21-22

IWRS (2007), "Role of Water Resources Development & Management in Bharat Nirman", theme paper presented on Water Resources Day observed by Indian Water Resources Society (IWRS) at ICID, New Delhi, May 9th

IWRS (1996), Inter-basin transfer of water for national development-problems and Prospects, theme paper pub. on water resources day by IWRS, New Delhi

Iyer, S.S. (1989) "Water Resources of India - An Overview", Journal of Indian Water Resources Society, Vol. 9, No. 2, April.

Mazumder S.K. and L. V. Kumar (2015) "IRRIGATION MANAGEMENT BY LOSS REDUCTION, RECYCLING AND WATER TRANSFER" pub. in the proc. of National Conf. on 'Challenges in Irrigation Mgt. for Food Security', org. jointly by IWRS (Indian Water Resources Society Roorkee), Min. of Water Resources, River Development and Ganga Rejuvenation, Govt. of India, and Jain Irrigation Systems during Dec. 26-27.

Mazumder, S.K. (2017) "Role of Detention and Retention Storage in Controlling Urban Flooding", paper presented and pub in the proc. of All India Seminar on Urban Flood Management: Challenges and Strategies in India, organized by The Institution of Engineers (India), Delhi State Center, jointly with Institution of Public Health Engineers, India (IPHE) and Indian Water Resources Society (IWRS), Roorkee at Engineers Bhawan, June 16-17, New Delhi

Mazumder, S. K. (2016) "Discussion of Revisiting the useful life computation of Gobindsagar Bhakra reservoir by Deepa S Koomullil U C Chaube and Ashish Pandey" pub. in ISH J. of HYD Engineering Vol. 22, No. 2, PP. 124-126.

Mazumder, S. K. (2011) "Interlinking Indian River - Merits, Demerits and Difficulties in Implementation" published in the Journal of Bharati Vidyapeeth

Mazumder (2007), "Irrigation Engineering", pub. Galgotia Publications, 5, Ansari Road, Daryaganj, New-Delhi-110 002

Mazumder, S.K. (2002), Performance of surface irrigation schemes in India, keynote speech pub. in the proc. of all India seminar on water and environment-issues and challenges, org by IWRS and WRDTC, IIT (Roorkee), Oct. 2002

Mazumder, S.K. (2000). "Life of a reservoir in the Himlayan region." J. Water Energy Int., 57(3), 23-27, July-September, 2000

Mazumder, S.K. (1986) "Efficiency of Irrigation in some River Valley Projects in India" Proc. of International Seminar on Water Management in Arid and Semi-Arid Zones, held at Hissar Agricultural University, Haryana, Nov. 25-27, 1986.

Mazumder, S.K. (1984) "Efficiency of Irrigation in the Command Areas of DVC, Mayurakshi and Kangsabati projects in West Bengal", Proc. National Seminar on Water Resources Management for Rural Development, KNIT, Sultanpur, Oct. 18-19.

Ministry of Agriculture and Irrigation, Govt. of India (1979) Manual on "Irrigation Water Management"

Mohile, A.D., Subhas, Chander and Singh, S.N. (1994) "Financial performance of Major and Medium Irrigation Projects" Proc., Fifth National Water Convention, Org. by National Water Development Agency, Ministry of Water Resources, Govt. of India, Faridabad (Haryana), Feb 25-27.

NCIWRD (1999), Annual Report of National Commission for Integrated Water Resources Development, Min. of Water Resources, River Development & Ganga Rejuvenation, Govt

NWDA (2005)," Water for life", 11th National Water Convention, org. by National Water Development Agency, Govt. of India Delhi, May 11th

Planning Commission (2007), "Ground Water Management and Ownership" Report of the Expert Group on Ground Water, CGWB, New Delhi, India: Government of India

Singh, A. and A. Kanwal (2021) "Sustainable Reservoir Sediment Management in Indian River Basins", pub. in J. of Water &Energy International, Vol.64, No.1, Oct. 2021

Zimmerman, Josef D. (1966) "Irrigation", John Wiley & Sons, Wiley International Edition. 7 October 2021, Water Use Efficiency [WUE] for Irrigation Projects

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Prof. S.K. Mazumder, born in 1938, graduated in Civil Engineering in 1959 from B.E. College, Shibpur, Calcutta University (now IIEST, Shibpur). He was Assistant Engineer, (Irrigation & Waterways Dte), Govt. of West Bengal, during 1959-62. He obtained his M.Tech. and Ph.d.in Civil Engg. (Dam & Hydro-power Engg.) from IIT, Kharagpur where he was a lecturer during 1962-67. He was Assistant professor in Civil Engineering at R.E.C. (now NIT), Durgapur, during 1967-75 and Professor of Civil Engineering (Hydraulics & Flood Control) at Delhi College of Engineering (now Delhi Technology University), during 1975-98. He was AICTE Emeritus Fellow during 1998-2000. During Feb-Nov,1991, he was a visiting professor at EPFL, Switzerland. He was Head of Civil Engg. and Dean of Faculty of Technology, University of Delhi. He is Fellows of CBIP, IE(I), ISH & IWRS and members of IAHR, IRC, ISCA, IPHE, CDC, CEAI. He was principal Investigator of several research schemes sponsored by a number of Govt. and Pvt. Organizations.

Prof. Mazumder has published/presented more than 207 technical papers in National and International journals and conferences, written two books, editor in chief of the proc. of a national conference, contributed a chapter in two books by Kluwer and Springer publications. He got several awards for his papers from the Institution of Engineers (India) and Indian Roads Congress. He received life time achievement award in 2009 and best Reviewer Award in 2019 and 2020 from Indian Society for Hydraulics for his immense contribution in hydraulics and water resources Engineering.

After retirement, Prof. Mazumder served several consulting companies in Delhi e.g. ICT Pvt. Ltd., Aquagreen Engg. Pvt. Ltd, Scott- Wilson-India Pvt. Ltd., Mahendra Raj Consultants, B&S Consultants, NOIDA, Rambol India , Infinite Civil Solutions, Ahmedabad and currently retained by Maccaferri India, Gurgaon. in the area of his specialization i.e. Hydraulics and Water Resources Engineering. He is currently, a faculty member of Indian Academy of Highway Engineers (IAHE), NOIDA. He is Member/convener of several committees of IRC and BIS, Govt. of India. For three years, he was an expert member of EAC (Hydro & Irrigation group) , Min. of Env. & Forests, Govt. of India. He was a member of NIH Society, Roorkee, as a nominee of the Minister of Water Resources, Govt. of India. He is a reviewer of several journals published by several societies e.g. Institution of Engineers (India), Indian Society for Hydraulics, ASCE, IRC etc.

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WATER SECTOR IN INDIA

By Subhash Sethi, Chairman, SPML Infra Limited

Water scarcity in India is a manmade problem. Mismanagement of water resources caused the crisis resulting in over 600 million Indians having no access to clean drinking water.

In terms of economic progress, India is competing with developed economies in the world and its growth is expected to hovering around 7-10 per cent in next few years in order to achieve the ambition of world's fourth largest economy with $5 trillion target. Despite being one of the major economies in the world having about 18 per cent of global population, it only contains 4% of the world's fresh water resources, which is also declining in terms of quantity and quality. Drinking water was once considered safe in India, but today providing nearly 1.40 billion inhabitants with access to safe drinking water is a big challenge. The alarming rate of depleting groundwater sources and rapidly polluting surface water requires immediate and focused attention by all stake holders.

Scarce Resource

India is facing the challenge of rapidly growing water demand, driven by ever increasing population, firm economic growth, faster trends of urbanization and increased industrialization activities. The water scarcity problem is not only a result of quantitative or qualitative shortage but also a consequence of inefficient use and poor water management. The 2030 Water Resources Group has calculated that India's water demand will outstrip supply by almost 50 per cent by the year 2030. A significant challenge faced by India; therefore to increase conservation of water across operations and geographies has become imminent.

India's major dependence on groundwater has resulted in over-extraction which is lowering the water table and adversely impacting drinking water supply. India is the world's largest user of groundwater that extracts more than any other country in the world and accounts for nearly 25 per cent of the world's extracted groundwater.

India will have serious implications for the sustainability of agriculture, long-term food security, livelihoods, and economic growth due to severe water scarcity. It is estimated that over a quarter of the country's harvest will be at risk.

- If current trends continue, in 20 years about 60% of all India's aquifers will be in a critical condition.
- India is the largest user of groundwater in the world. It uses an estimated 230 cubic kilometers of groundwater per year - over a quarter of the global total.
- More than 60% of irrigated agriculture and 85% of drinking water supplies are dependent on groundwater.

Since 1980s, its groundwater levels have been dropping considerably. World Resources Institute has ranked India at 41 in global water stress rankings of 181 countries and among the second high-risk nations. The water stress is extremely high in the northwestern region where levels have plunged from 8 meters below ground to 16-20 meters. Parts of northern region including Delhi face serious water shortages every summer. A decade-long study of wells in Maharashtra shows that over 70 percent of them have declining groundwater levels. Much of the water extracted from the underground sources is non-renewable as the recharge rates are much lesser than the extraction rates.

Central Water Commission is monitoring live storage status of 140 reservoirs of the country on weekly basis and is issuing weekly bulletin one very Thursday. Out of these reservoirs, 45 reservoirs have hydro power benefit with installed capacity of more than 60 MW. The total live storage capacity of these 140 reservoirs is 175.957 BCM which is about 68.25 per cent of the live storage capacity of 257.812 BCM which is estimated to have been created in the country. As per reservoir storage bulletin dated 17.03.2022, live storage available in these reservoirs is 87.703 BCM, which is 50 per cent of total live storage capacity of these reservoirs. Groundwater and surface water is under high risk from both agricultural and urban uses. Declining rates of natural replenishment are threatening the sustainability of aquifers in the Indo-Gangetic basin, which constitute one of Asia's most densely populated and agriculturally productive regions.

Contamination Issues

India's groundwater sources are not only

overexploited but also contaminated. The deep-level groundwater is contaminated by sewage, fluoride, arsenic, and uranium. Incidence of arsenic contamination has doubled in last few years as measured by number of affected habitations.

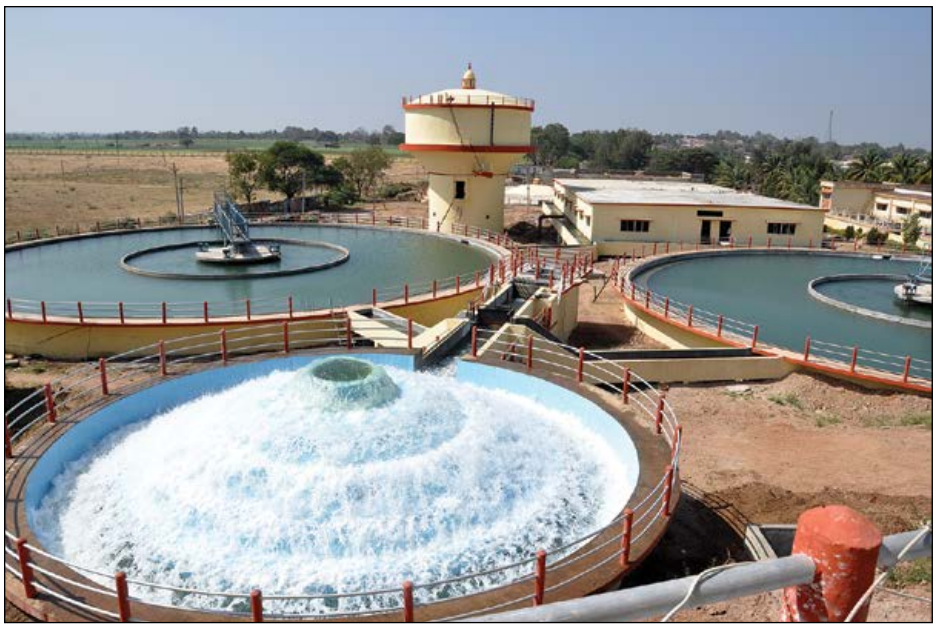
Water Aid, an international organization working for water sanitation and hygiene finds that an alarming 80 per cent of India's surface water

Contaminated drinking-water is estimated to cause 485 000 diarrheal deaths each year.

is polluted. Central Pollution Control Board estimates that 75-80 per cent of water pollution by volume is from domestic sewerage, while untreated sewage flowing into water bodies including rivers have almost doubled in recent years.

India generated 72,368 MLD (million litres per day) sewage whereas the installed capacity of STPs was 31,841 MLD (43.9 per cent), according to the CPCB report. Of this installed capacity, developed and operationalized capacity was 26,869 MLD (84 per cent). Of the total operationalized capacity, 20,235 MLD (75 per cent) was the actual utilized capacity. In other words, out of total 72,368 MLD sewage generated every day, only 20,235 MLD is treated.

India has limited numbers of sewage treatment plants and most of them are performing under their capacity due to poor infrastructure support and lack of funds with local utility bodies. It is estimated that due to lack of sewage treatment



facilities, more than 72 per cent of total sewage is discharged directly into our rivers and other water bodies and further polluting the already limited water resources.

The World Health Organization says that every year more than 3.4 million people die as a result of water related diseases, making it the leading cause of disease and death around the world due to lack of safe drinking water and basic sanitation. 90 per cent of them are children under the age of 5, mostly in developing countries including India. Safe drinking water is a basic requirement and millions of people in India have no access to any source of drinking water.

Water Technologies

The global innovation in water technologies will help in countering water scarcity issues and support utilities with sustainable water management services. The innovative technology has made significant breakthroughs in water supply and distribution, drip irrigation, desalination, waste water treatment, automation, asset management, metering and other aspects of water management. Innovations such as affordable desalination plants are need of the time in water stressed states of Maharashtra, Tamil Nadu and Rajasthan which are investing in such projects for creating drinking water through desalination plants.

Technologies for treating water have also advanced significantly over the past few years as researchers have increasingly focused their efforts on water treatment technologies. Today the availability of clean, safe drinking water is on demand at every location in the world. However, even this highly treated water is subject to degradations in quality once it leaves the treatment plant and enters the distribution system. The new innovations in water treatment technology have enabled us to develop new cities and habitants along with our businesses. Water purification system using nanotechnology offers opportunities to develop next generation water supply systems with advanced level of treatment to improve efficiency as well as to

augment water supply through safe use of water sources.

SPML Infra Limited is quite strong in the Indian water market and the company continues to enhance its presence in new areas with the trust of both clients and stakeholders. Presently, it is executing a number of projects for water supply and management, wastewater treatment, sewerage network, power transmission and distribution, and municipal solid waste management. In a legacy of four decades since SPML Infra is working on water sector in India, it has executed over 650 projects across all segment of water management in the length and breadth of the country and the company is currently involved in providing clean drinking water facilities to over 50 million people in the country.

Smart Water Grid

Smart water grid integrates information and communication technology (ICT) into a single water management scheme. This is a promising solution for resolving critical water problems to ensure the security of water quantity, quality with the help of ICT-based water management solutions. In Singapore, the implementation of a Smart Water Grid system supports the mission to supply 24 x 7 good water supplies to its people. With sensors and analytic tools deployed to provide a real-time monitoring and decision support system, the Smart Water Grid system enables utility to manage the water supply network efficiently, ensuring that all residents will continue to enjoy a reliable and sustainable water supply for generations to come.

The Smart Water Grid system covers the key operational aspects of a water distribution system like asset management, leak and non-revenue water management, water quality monitoring, automated meter reading and water conservation. For going forward in India, we need to consider the implementation of smart water grids in our cities, especially in the planned smart cities to help service provider with real time monitoring of assets and water quality to enhance planning and network operations; it also enables consumers to make informed choices towards water conservation. In addition, the usage data from automated meter readings will enable more accurate demand prediction for optimizing pumping schedules, water turn-over in service reservoirs, and water required to be treated and pumped. The further research and testing are being done to realize the full benefits of a Smart Water Grid.

Investing in enhancing water security protects society and sectors from specific water risks, and can have a profound positive effect on economic growth.

Water Governance

Improving governance in water segment remains a matter of concern since arrangements are generally fragmented which needs a radical transformation to be able to address new challenges. In India, water is being a state subject; water supplies, irrigation and canals, drainage and embankments and storage falls in the state list. There is a need to recognize water as a finite and vulnerable resource. The government should take urgent action to set the stage for enactment of a comprehensive national legislation on water after evolving a national consensus to bring it in the concurrent list and formulate an over-arching national legal framework for effective water management, conservation, development and equitable distribution with regulatory authority to deal exclusively with the matter.

The existing legislations on water should also be comprehensively reviewed. Legislation and executive action must continue to be undertaken as water ranks higher priority than any other. The Uttarakhand High Court has recognized the rivers - Ganga and Yamuna as a living entity, which means that anybody found polluting the river would be seen as harming a human being. It reflects a sense of urgency in containing water contamination and trying to rescue our rivers from rampant pollution.

India's agriculture sector consumes more water to grow same amount of crops compared to global average. Despite being a water scarce country, our agricultural produce is extremely water intensive. While the agriculture sector needed urgent water reforms, non-agriculture use of water also suffers from unplanned usage and wastage. A majority of India's households are using private means such as bore-wells to extract groundwater without any regulation or concern for conservation. The policy planning and implementation must have the participation of principal water stakeholders of our country like

farmers, industry, energy producers, government agencies, rural and urban consumers etc. for improving the governance of water.

Future Course

Management of water supply required to harmonize demands and needs which are getting more and more complex and sophisticated. The first thing we must do is to mitigate the causes of water shortages as much as possible. A strategic and pragmatic approach, based on practical implementation has to be implemented in order to address the key challenges of water management. We need to have smart water management concept with the integration and convergence of modern tech and ICT solutions implemented within the water domain.

The water management requires a collaborative approach between the public and private sectors, and within the different levels of government from centre to state to local levels. Private expertise is essential in closing the water gap across the segment.

Optimism

The Indian water sector is on the crossroads today. In a developing country with huge requirements, there is a vast scope for growth. The total Indian water market is estimated to be about USD 14 billion with a growth rate of about 18 per cent every year. At SPML Infra, we are optimistic of India's water sector's prospects and our role within. We believe that the water infrastructure has not grown even to the extent of 10 per cent of its true potential, which indicates that this single vertical holds out decades of sustainable growth potential.

India has for decades been a consumption-driven economy, but it needs to swing the needle towards infrastructure growth. We are pleased to see that the present Indian government appears to share the same view. Over the last three years, the Indian government has addressed the sector's potential with an unusual but highly effective response in terms of huge budgetary allocations of INR 6.7 trillion under the flagship Jal Jeevan Mission (rural+urban). The government has selected to correct the sectorial framework with the declaration of large projects under several new schemes having dedicated budgets for water sector. We believe that this sequential correction is critical and logical in policy framework and once it becomes a reality, we believe that projects will be completed faster, cash inflows will be quicker, in-project disputes will be addressed and resolved closest to real-time, the unproductive investment in long-drawn arbitration will decline, infrastructure growth will accelerate and the country will benefit.

About the Author

Mr. Subhash Sethi is the Chairman of SPML Infra Limited. A leading water infrastructure & management company in India with a legacy of 650 completed projects providing drinking water facilities to more than 50 million people in the country.

To know more about the contributor of this case study, you can write to us. Your feedback is welcome and should be sent at: deepak.chaudhary@eawater.com

WATER QUALITY OF GANGA RIVER

By Preeti Shinde, Application Specialist, Hanna Equipments India Pvt. Ltd.

The holy river of Ganga is the largest river in India. The Ganges is threatened by severe pollution. This poses a danger not only to humans but also to animals; the Ganges is home to approximately 140 species of fish and 90 species of amphibians. The river also contains reptiles and mammals, including critically endangered species such as the gharial and South Asian river dolphin.

The Ganges River Dolphin can only be found in the fresh water rivers of Bangladesh, India and Nepal. These river dolphins are often known as the 'Tiger of the Ganges', since the river dolphin is an indicator animal, which has the same position in a river ecosystem as a tiger in a forest.

Due to extensive pollution in the Ganges River these Dolphins are getting extinct. The stretch of the Ganges river, also known as Hooghly in West Bengal, is roughly 500 km long and it passes through the densely populated Kolkata before merging with the Bay of Bengal in the Sundarbans, this is where the first community reserve for the mammal has been formed. The two main parameters that largely contribute towards the survival of dolphins is temperature and food. Thus, the conservation team, post treatment of the stretch of the river had to maintain several water quality parameters, such as the pH, the conductivity and DO of the river bodies so that the small fishes and the shrimps could also breed efficiently there.

What is water quality?

Water quality is a measure of water's suitability to be used for a specific purpose, such as swimming, farming, or power generation. Water that is considered unsuitable for one application may be perfectly acceptable for another purpose. Quality is a statement of the physical, biological, and chemical characteristics of water based on key conditions. These conditions can vary by location, such as at different points in a river or by time depending on the climate. Surface water and ground water can also affect the quality of each other, since these two are connected at the water table. It is important to recognize that water quality can be adversely impacted by both natural and man-made factors. Regularly monitoring water sources can help identify potential issues before they cause serious harm.

There are a number of parameters that can be measured to indicate water quality. These parameters can be a measure of physical characteristics such as pH, conductivity, or temperature; a statement of the levels of various nutrients in water, such as nitrates and phosphates; or an indication of key elements and compounds in water, such as dissolved oxygen. Each parameter has some general standards and guidelines for determining if a tested sample should be considered acceptable or hazardous. The results of these tests are not necessarily absolute, since they must be compared in relation to what is considered normal levels for a body of water.

Aquatic organisms such as fish and plankton are cold-blooded, so the temperature of water has a direct impact on their body temperature. These organisms have ranges of temperature in which they can survive, or thrive. As the temperature reaches the high limit of its range for an organism, biological activity will be at a peak. This activity will decrease at the bottom of the range. If the temperature exceeds the acceptable range for an organism, the available supply of oxygen may be too low to sustain life. This is because warm water has an oxygen saturation point much lower than cold water. If temperature is below the acceptable range, not enough activity takes place to grow the species. High temperatures also contribute to the growth of algal blooms. Oxygen is consumed as these blooms are decomposed by bacteria, thus reducing the available dissolved oxygen supply.

Temperature in a water body varies based on the time of day and the amount of sunlight heating the surface of the water. Acceptable temperatures also vary depending on the type of river or stream being monitored. This depends on the watershed feeding the stream. If the stream is fed by a mountain spring, for example, the natural temperature of the stream may be quite cool (less than 68 degrees F). A stream that is considered warm water will have an average temperature greater than 68 degrees F but less than 89 degrees F. Temperature can also be influenced by the flow rate of a body of water. If the flow of water is increased, perhaps as a result of a heavy rainfall, the temperature can be expected to decrease. The increased current has a cooling effect on the temperature of the water.

High concentrations of TDS can lower water quality and cause water balance problems for individual organisms. On the other hand, low concentrations may limit the growth of aquatic life. Some of the effects discussed for the acidity and carbon dioxide parameters have relevance for EC, such as its negative impact on photosynthesis. This is because increased solids make water murkier, which slows down the rate of photosynthesis. EC provides an indication of total dissolved solids, of which total dissolved salts are a component. If the level of salts in TDS is high, this could also contribute to the acidity of the water. However, if the level of carbonates in TDS is high, this

could contribute to an increase in alkalinity, which helps protect against acidity changes. This is a good example of the interrelationships between water quality parameters.

DO levels can help indicate the relative health of a water body. If DO levels are normal or high, the water is a good environment for a variety of aquatic life to flourish. If DO levels are low, it may indicate the presence of pollutants in the water. Some aquatic life can exist in water with a wide range of DO, but others cannot survive in a low DO environment.

DO measurements are expected to have large fluctuations if the water has significant plant life. This is due to the photosynthesis process. Since there is less photosynthetic activity at night, when light is not present, plants and animals in the water consume oxygen through respiration, but not as much oxygen is produced at the same time. As a result, DO levels in early morning are lower compared to other times of day. Once photosynthesis begins, DO levels will rise. This is a good example of the benefits of measuring parameters at various times throughout the day. If only a pre-dawn DO measurement is taken, an inaccurate conclusion may be drawn regarding the healthiness of the water.

While DO levels are partially influenced by photosynthetic activity, a large source of DO is from atmospheric oxygen mixing with water. This happens in larger amounts if the water is turbulent. The turbulence increases the surface area of the water, so atmospheric oxygen can mix with it more easily. Air has an oxygen concentration that is over 20 times higher than oxygen concentration in water. This concentration difference results in atmospheric oxygen dissolving in water when the two meet. If there is more water surface at this interface, then more oxygen from the air will be absorbed.

HI98494 is a meter Hanna can suffice such requirements. The new Multi-parameter pH/EC/DO Portable Meter includes Bluetooth® (HI98494) and optical DO technology. This new product combines Hanna's rugged meter design with advanced digital sensors for testing up to 12 different water quality parameters, making it perfect for environmental testing. With the integrated Bluetooth® connection, users can easily transfer data to a smart device. Hanna's portable meter (HI98494) is stored in a convenient carrying case and is always prepared for successful testing.

The meter offers easy Sensor replacements which are quick and easy with field replaceable,

screw type connectors and are color-coded for easy identification. Tougher by design, this portable meter is waterproof, IP67-rated and can withstand immersion in water of 1m for up to 30 minutes. The meter connects to the multi-parameter probe through a single waterproof connector and makes attaching and removing the probe quick and easy. The meter automatically detects the probe when connected. The meter connects wirelessly via Bluetooth to a smart device with the Hanna Lab App. Bluetooth® 5.0 Connectivity of HI98494 offers the ability to connect wirelessly to a smart device running the Hanna Lap App. Using the app, log lots can be e-mailed or downloaded for review.

Sensor replacement is quick and easy with field replaceable, screw type connectors and

are color coded for easy identification. These meters automatically recognize sensors. The optical dissolved oxygen sensor uses a smart cap that has an RFID tag that stores calibration coefficients unique to each cap. The RFID keeps track of the age of the cap and alerts the user when it should be replaced.

HI98494 can be used to log one data point or do interval logging for continuous logging at a specified interval. All logs have the option to store data into a named lot and the ability to add remarks. Both help to provide for meaningful data including notes on local environmental conditions.

About the Author

Ms. Preeti Shinde is an Application Specialist with Hanna Equipments India Pvt. Ltd. She has been with Hanna for more than 4 years. She supports Pan India technical issues and queries.

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ROLE OF MICRO ALGAE IN WATER & WASTEWATER TREATMENT AND MANAGEMENT

By Dr Anil Kumar Mishra, Bacteriologist, Delhi Jal Board, Govt of NCT Delhi

Algae (Singular alga) is a diverse group of photosynthetic thallophytic (not differentiated into root, shoot and stem) organisms and ranges from unicellular microalgae (such as Chlorella, diatoms etc.) to multi-cellular forms (such as the giant kelp; a large brown alga which may grow up to 50 meters in length). Mostly algae are aquatic and autotrophic in nature and lack many distinct cells and tissues, such as stomata, xylem, phloem etc. which are found in land plants. "Cyanobacteria" are also known as "Blue-Green Algae"; as its characteristics are much more similar to microalgae. Due to wide range and nature of algae, these are useful for different industrial and other purposes like cattle feed, bioremediation, pollution control, transforming sunlight into food materials, other chemicals used in industrial processes, medical and scientific purpose, carbon sequestration (to mitigate climate change etc). Micro-algal species can treat municipal, industrial, agro-industrial, and other type of waste water. Microalgae based systems/strategies are very useful for the removal of toxic minerals such as Arsenic, Cadmium, Mercury, Lead, etc. from the waste water or other sources.

In India and worldwide quantity of good quality of water reducing day by day due to urbanization, industrialization, increasing population, water pollution or some other reasons. According to news published in daily News Paper "Dainik Jagaran" dated 14-06-2018; 13491 Million Quesec Meter (MCM) ground water available in Delhi, out of this 10,284 MCM (~76%) water is not fit for drinking and other purposes due to higher concentration of chemical and other contaminants. Due to lack of sufficient infrastructure of Rain water Harvesting, ground water table decreasing day by day in the rate of 0.5 -2.0 meter/years; as consumers extracting ~392 MCM ground water/year inspite of only recharging 287 MCM/year. It means a huge difference (~105 MCM) observed between rate of extraction and recharging of ground water.

For the achievement of gap between availability and requirements of water, advanced, sophisticated and environmental friendly water and waste water treatment and management related technologies are utmost important. Treatment of water/ waste water by microalgae may be prove as a boon; as it is simple, economical, not required special basic infrastructure, special trained man power etc. This treated water may be utilized for irrigation of crops, recharging ground water, mixing in rivers, ponds, drains or other natural water bodies without any environmental issues as per national and international guidelines. These practices may reduce burden on our surface, ground/underground water sources; resulting water table and quality of water may improved. After proper rejuvenation of these water bodies (by using these micro-algae or some other mixed treatment technologies), may use this treated water for drinking purpose of cattle, birds or other animals and other purposes; as due to lack of sufficient and good quality of water in those water bodies birds and other animals could not get water for drinking purpose and sometimes theirs survival also affected. These water bodied also help in reduction of gaseous and particulate environmental pollutants; as, water bodies absorb gaseous pollutant and particulate matters through evaporation and other natural process and also disperse these pollutants in natural environment in the form of modified compounds which are less harmful for environment. Some pollutants may be utilized by plants and animals living in natural water bodies for theirs metabolic activities. But at present, due to lack of sufficient number of water bodies these pollutants directly reached in our environment and causing air pollution.

Many microalgae species may grow efficiently in different type of wastewater and help in removal of macro-nutrients such as Nitrogen, phosphorus etc. Nitrogen and Phosphorus can be removed by rapidly growing cultures of algae; as these macronutrients directly utilized by microalgae for their metabolism and converted into valuable algal biomass and this biomass may be utilized as bio-fuel, feedstock, bio-fertilizer etc. Composting of algal biomass with green plant waste (leaves, grass, husks, etc.) also helps to control harmful pest and other microbes found in soil/wastewater. Many species of microalgae are able to effectively remove nitrogen, phosphorus, heavy metals, pesticides, organic and inorganic pollutants, and pathogens from wastewater. The main mechanism to remove these pollutants includes accumulating and/or

using them in their metabolism. Many studies have shown that cultivation of several species of microalgae such as Chlorella, Scenedesmus, Phormidium, Botryococcus, Chlamydomonas, Arthrospira etc. are very useful for wastewater treatment. The efficiency of removal of heavy metals depends on algal species. For example, Chromium is removed by Oscillatoria spp., Cadmium, copper and zinc by Chlorella spp., Lead by Chlamydomonas spp., Molybdenum by Scenedesmus sps. etc. Tolerance level of various microalgae for various organic pollutants in wastewater varies from species to species. Green algae, diatoms, Synedra, blue-green algae, Oscillatoria, Scenedesmus, Chlorella, Nitzschia, Navicula, and Stigeoclonium have been studied as the most resistant genera to remove organic pollutants from water and waste water. Chlorella is also used in the treatment of diluted piggery waste and in the detoxification of cyanide from wastewater.

Due to advancement of the industries and country's infrastructure, the need for advanced, efficient and sustainable water/ waste water treatment solutions is ever increasing and is in demand worldwide. Microalgae based wastewater treatment relies on the ability of phototrophic microorganisms to supply oxygen into water bodies required for degradation/ removal of organic, inorganic, microbiological and other type of contaminants/ pollutants by biologically, chemically or other modes from waste water. Algae are economically important in a variety of ways. The natural substance can be used as a food source, a fodder, in fish farming, and as a fertilizer. It also plays a key role in alkaline reclaiming and is used in a variety of other commercial products. Algae are valuable indicators of ecosystem conditions because they respond quickly both in species composition and densities to a wide range of water conditions due to changes in water chemistry (ratio often determines which algae genera are dominant, present or absent in these nutrient-affected water bodies). Microalgae also plays a very important role in Pisciculture (fish farming), because fishes use plankton and zooplankton as food. It helps in maintaining the health of the water body ecosystem because algae are naturally absorbent of carbon dioxide and also provide oxygen in the water bodies. Commercial and industrial algae cultivation has numerous uses, including production of food ingredients such as omega-3 fatty acids or natural food colorants and dyes, food, fertilizer, bio-plastics, chemical feedstock (raw material), pharmaceuticals, algal fuel, and can also be used as a means of pollution control. The lichens (a symbiotic form of algae with fungi) are useful bio-indicators for air pollution, especially sulfur dioxide pollution, since they derive their water and essential nutrients mainly from the atmosphere rather than from the soil.

In conclusion, for solving the problem of sewage treatment, microalgae like Blue Green Algae (Cynobateria) may be grown in slow flowing drains or in sewage collected in ponds or in lagoons. As, these small plants (microorganisms) use organic substances, Phosphorus, inorganic nutrients and heavy metals of sewage for growth and reduce the concentration of heavy metals and other minerals/elements. These algae also increase oxygen concentration (DO) in water bodies and reduce BOD and COD of the sewage without any treatment. These overgrown "Blue Green Algae" (Cynobacteria) may be used for bio-fertilizers, biogas production and in other pharmaceutical and cosmetic industries. The sewage collected into ponds or in lagoons for cultivation of Blue Green Algae may be used for irrigation purpose (after sedimentation of suspended solids and other debris) through pipelines. This will solve the problem of dirtiness of various water bodies, irrigation, increase the productivity of crops without application of any fertilizers, improve the texture of soil etc.

About the Author

Dr. Anil Kumar Mishra is presently working as "Bacteriologist" in Delhi Jal Board, Govt. of NCT Delhi since August 2007. He has qualified CSIR-UGC (NET) June 2002 for Lecturer ship and ICAR (NET) 2004 and 2006 for Lecturer ship. He also qualified UNERA fellowship of Australia government for advance studies in January and June 2006. He secured IInd level prize in senior level comprehension certificate test on Right to Information Act-2005 in the year 2011 conducted by Govt. of NCT Delhi. He is also the recipient of Best Employee Award for the year 2019-2020 for Delhi Jal Board by Chief Minister of Delhi.

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IMPLEMENTING CIRCULAR ECONOMY IN SEWAGE TREATMENT PLANT COUPLED WITH CARBON CAPTURE AND UTILIZATION.

By Sameer Dohare, EnviroChem Services (OPC) Pvt. Ltd.

Introduction

As the urban areas are growing, society and businesses are moving towards a circular economy. Circular economy (CE) is the concept in which raw materials remain in the economy as long as possible and generated wastes treated as secondary raw materials, which are recycled back into the economy. As estimated, by 2050, the worldwide urban population will nearly double, the total global demand is expected to increase by 30%. Consequently, this rise in urban water demand will also lead to more wastewater generation. Further, urban area development demand and climate change stress the existing available water sources. Hence, an effect on urban water management has to be applied before urban areas run out of water.

As CE is a win-win concept, many water management systems are implementing the concept and adopting an anaerobic treatment process in Sewage Treatment Plants (STPs) or Wastewater Treatment Plants (WWTPs).

As both the treatment process, aerobic and anaerobic, rely on microorganisms to treat sewage/wastewater, the principal difference between them is that aerobic systems require oxygen, while anaerobic systems do not require oxygen.

The aerobic treatment utilizes oxygen (O2), present in the air, to oxidize the organic and inorganic compounds present in the wastewater and generate carbon dioxide (CO2), and water. However, the anaerobic treatment process, in absence of the O2, degrades the organic and inorganic compounds present in the wastewater and generates Methane (CH4), and CO2. In both cases, we have ignored the generation of Nitrous Oxide (N2O).

This further gives an advantage of comparatively low Capital Expenditure (CAPEX) and Operating Expenses (OPEX) of the anaerobic treatment process over the aerobic treatment process.

However, considering the nutrient removal, temperature sensitivity, odour, post-treatment requirement, startup period, and sludge production the aerobic treatment process has an advantage over the anaerobic treatment process.

In CE, the direct Greenhouse Gas (GHG) emissions such as CO2, CH4, and N2O from the anaerobic treatment process are utilized for energy generation, as the methane share in GHG is about 50%.

However, the direct GHG emission from the aerobic treatment process contains negligible methane concentration, hence the same can't be utilized for energy generation using currently available technologies.

Moreover, implementing CE in the aerobic treatment process will give a better Return On Investment (ROI) than an anaerobic treatment process. We moving further in implementing CE in STPs/WWTPs, have coupled the Carbon Capture and Utilization (CCU), which is the process of capturing carbon dioxide (CO2) and utilizing the captured CO2 for further usage.

The concept of implementing CCU coupled with STP ensures the implementation of CE, as the CCU generates the secondary raw materials which can be used within the STP or sold to the market. The said was the missing link for implementation of CE in STPs/WWTPs designed and operational on the aerobic treatment process, reported by many experts in the segment. Moreover, the said system will further reduce the Carbon Footprint (CF) of the STPs/WWTPs.

The Challenge

The principal sources of GHGs in the STPs/WWTPs are pre-treatment units, aerobic reactors, sludge sump/tanks, and sludge dewatering units. The GHGs generated from pre-treatment units are rich in CH4 due to the generation of anaerobic conditions in the long sewer lines. New sewer lines have already overcome these constrain by standardizing the pipe size and slopes.

The GHGs generated from sludge sump/tanks and sludge dewatering

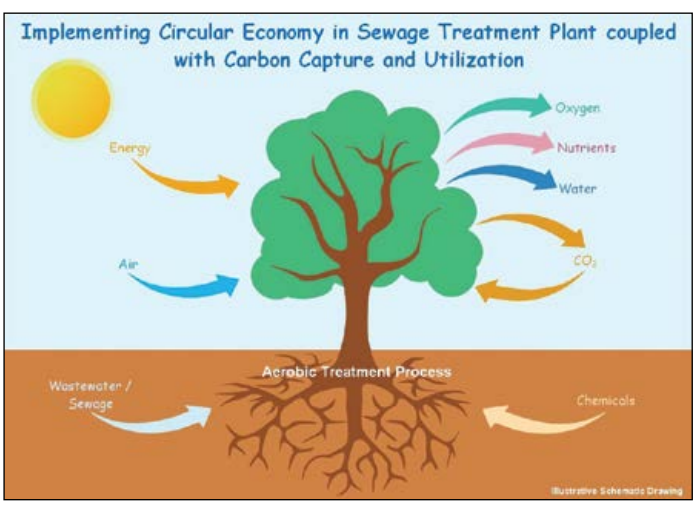
units are also rich in CH4 due to the same reason. New STPs/WWTPs or refurbished treatment units have already overcome these constrain by standardizing the process of sludge handling.

By adopting the above-said measures, treatment units have reduced GHGs emissions significantly.

Further, both the above-said locations are now equipped with odour control systems, ensuring nearly zero malodors emission into the atmosphere.

Currently, the GHGs emission from the aerobic treatment process has no commercially available solution.

Hence, there is a need to develop a sustainable solution to utilize the GHG emitted from the aerobic treatment process.



Concept of CE in STP coupled with CCU

The Solution

The capturing of generated CO2 through CCU which can be coupled with STPs/WWTPs and ensure the utilization of captured CO2 within the STPs/WWTPs seems to be a good approach.

Based on studies conducted elsewhere, the global average atmospheric CO2 can be assumed as 400 ppm.

To implement the CCU, direct air capture of CO2 from the atmosphere has been proposed, due to the lean concentration of CO2, the system will give satisfactory results in comparatively rich concentration.

However, to implement the CE, the CAPEX and OPEX have to be maintained to reach an ROI of more than about 40%.

To achieve this, the CO2 is stored chemically in a chemical mixture and utilized in the STPs/WTPs treatment process.

In 2020, we had already successfully implemented a natural draft odour control measure in the 40 KLD STP, treating kitchen wastewater and sewage. The same was running odour free since it's commissioning.

As the said STP is located in Hazira, Surat, Gujarat is best for the implementation of the CCU system.

Implemented Offsite CCU for Ambient Air Carbon Capturing and Utilization.

Based on studies conducted elsewhere, organic carbon of 375 gm per kilogram of Chemical Oxygen Demand (COD) will emit about 260 gm CO2/kgCOD removed. Hence, there is a possibility of capturing about 4 kg CO2/Day.

For the said capacity of 4 kg CO2/Day, a lean gas CCU was developed and implemented offsite.

The developed soup of different chemicals has been dosed into the offsite CCU unit.

The said CCU unit has a capacity of 5.4 kgCO2e/Day based on CE is the 4th commercial CCU Plant of India, operational since 1st March 2020.

The indication of saturation of the Carbon Capture Soup (CCS) is pH. Hence, an operator can measure the efficiency of the system in real-time.

The Results

The change in pH of CCS justifies the capturing of the carbon from the atmosphere.

After one week of operation in continuous recycling of the CCS, the significant change in pH further justifies the carbon-capturing from the atmosphere.

The efficiency of capturing the lean gas CO2 mixture i.e. atmospheric air was about 40%.

The efficiency will increase up to 80 to 90%, as the concentration of CO2 will increase by many folds in the STP.

Conclusion

The benefits of CCU coupled STP is not limited to simultaneous carbon-capturing utilization and sewage treatment. It also allows the designer to consider the aerobic wastewater treatment process in place of the anaerobic treatment process for implementing CE.

Moreover, acceptance from Clients enables us to provide our best services to them and aid us in “Engineering Environment for Better Tomorrow”.

About the Author

Sameer Dohare is the Director of EnviroChem Services (OPC) Pvt. Ltd., the environmental and process consultancy, engineering environment for better tomorrow. Before this assignment he held leadership position in several leading water infrastructure companies. He is a chemical engineer and has done postgraduate in chemical engineering. He has more than 8 years of experience of which over 5 years is at the EnviroChem Services as a R&D, Design, Engineering, Environmental, and Process Consultant.

EnviroChem Services (OPC) Pvt. Ltd. is established in the year 2016 with a vision of “Engineering Environment for Better Tomorrow.” ESPL is solely working towards Air, Water, Soil, and Noise Pollution Abatement. EnviroChem Services takes up Wastewater Treatment Projects (ETP, CETP, WWTP, STP, ZLD, etc.), Water Treatment Projects (RO, DM, PSF, ACF, Advanced Membrane Filtration for Silica, Metal, etc. Removal, etc.), Water Conservation Projects (Rain Water Harvesting, Water Leakage Detection & Repairing, etc.), Air Pollution Control Systems (Cyclone Separator, Bag Filter, Volatile Organic Filters, Odor Control Systems, Air Purifiers, etc.), Municipal Solid Waste Management, Biogas Plant, Solar Power Projects, Waste-to-Energy, Soil Remediation, & Noise Reduction Measures.

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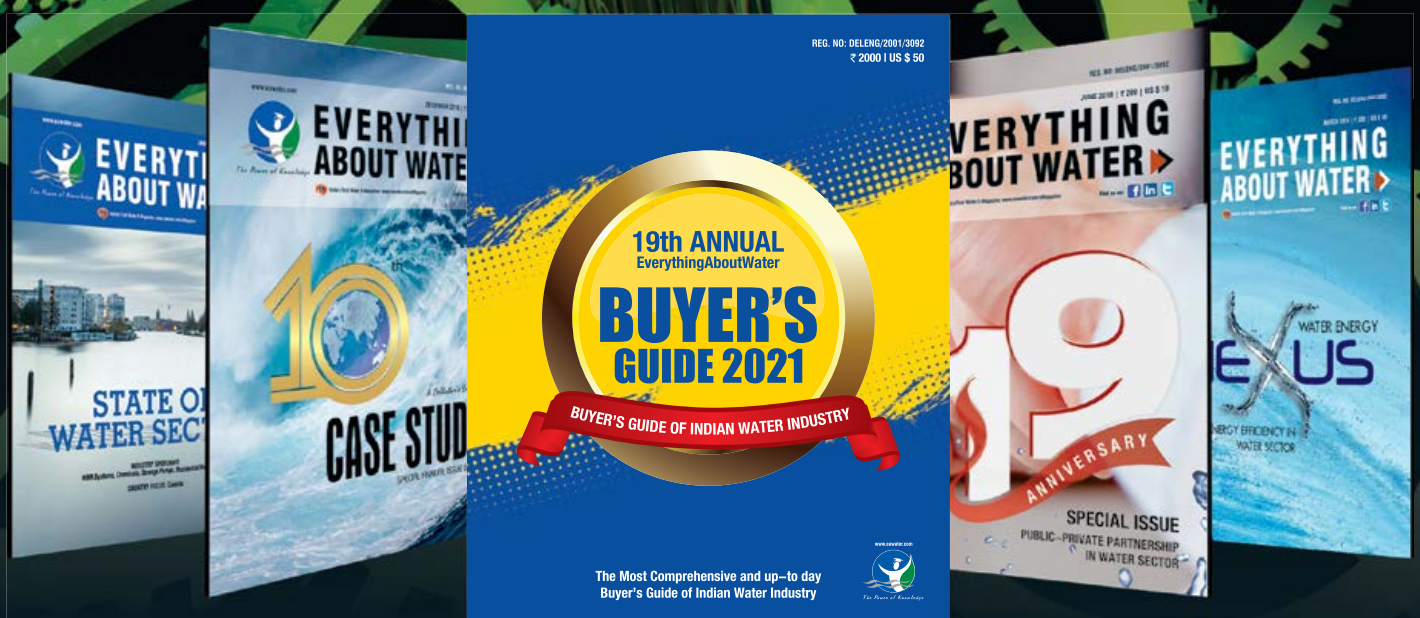

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TRANSMOGRIFICATIONS: OPEN CANAL TO HDPE PIPE

By Dilip Yewalekar and Manisha Kinge, Jain Irrigation Systems Ltd., Jalgaon India

Introduction

Glasgow, 10th Nov 2021-The UNEP, and India signed an agreement on climate change and committed to achieving the target of SDG6 and Water Conservation, Sanitation, Energy Conservation, Environmental Protection Green Energy, Health are the task to achieve in the world. This can be achieved by using the latest infrastructural technology (hardware & software) for the transportation of various natural resources like water, oil, gas, etc. From the second green revolution Nehruji's era, huge investment had been done on irrigation infrastructure-construction of dams and canals to transport water to various farm levels for irrigation-agriculture purposes. Over the period it has been assessed that such infrastructure projects suffered from various operational, maintenance expenses, efficiency, social, environmental & revenue issues because of lack of awareness and technology available. Distinctly talking to irrigation, earthen or concrete-lined canals have been used to transfer water from dam or reservoir to farm level but now various Government departments - Water Resource, Irrigation, CADA are taking intuitive to convert open canal to buried PE pipes. However, to achieve SDG objectives, it is necessary to convert open canals to buried PE pipes. The said article highlights the comparative study of open canal vs PE Pipes.

Irrigation Background

India is one of the water stress countries in the world and out of 90% water is used only for agriculture, 7% for the municipality, and 2% for the industry. So far most of the water is conveyed thru canal networks and more than 50% water of is just wasted thru water transportation systems. If the canal system is converted to the piping system, then there will be direct savings in water by 50%, and this remaining area can be brought under agriculture and help to improve the GDP of the country.

Since independence, the Government of India has spent a considerable amount of funds, time, and energy on the development the of command area and still has not been successful in utilizing 100% of the potential created. There is always a gap between potential created and potential utilized.

Lower utilization of irrigation potential results in lesser area cover than what is targeted within the same quantum of available water. This has ultimately resulted in poor recoveries of water charges and also lower water use efficiencies. In order to make irrigation projects self-sustainable, improvement in the efficiencies of water distribution systems in essential. This is possible only by the modernization of existing canal command areas through the adoption of piping networks.

The available surface waste from the rivers is stored in dams and let out by open canals for irrigation, drinking water supply, and industrial use near the river banks on either side. As the open canal is either earthen and or concrete-lined and is susceptible to several water losses like evaporation, percolation, and breakages of canal bunds either natural or manmade increases the losses of water in the canal conveying system. The conveyance efficiency is up to 50-70% in canal system whereas in Piped conveyance network it is up to 95%.

The water losses in the canal system can be effectively minimized by replacing ng open earthen canal with buried PE Pipes. Jain Irrigation is the first company in India that started manufacturing PE pipe up to 2500 mm diameters, which can be easily used in place of an open earthen canal. As the canal is replaced in with the network of underground HDPE pipelines there is no requirement of farm-land acquisition from marginal farmers for the construction of open canals.

Potential of Irrigation

India's irrigation-covered crop area was about 22.6 million hectares in 1951, and it increased to a potential of 175 mha at the end of 2005, inclusive of canals and groundwater wells. However, the potential irrigation relies on a reliable supply of electricity for water pumps and maintenance, and the net irrigated land has been considerably short. According to 2001/2002 Agriculture census, only 58.13 million hectares (Table 1. State wise area under irrigation) of area actually irrigated in India. The total arable land in India is 160 million hectares (395 million acres). According to the World Bank, only about 35% of total agricultural land in India was reliably irrigated in 2010.

Table 1: State-wise irrigation types, capacity, and actual

State	Total crop area (million hectares)	Groundwater irrigation crop area (million hectares)	Canal irrigation crop area (million hectares)	Total crop area actually irrigated (million hectares)
Andhra Pradesh	16.6	2.5	2.7	4.9
Arunachal Pradesh	0.4		0.07	0.05
Assam	3.2	0.13	0.1	0.22
Bihar	6.4	2.2	1.3	3.5
Chhattisgarh	5.1	0.17	0.74	0.85
Goa	0.1		0.1	0.1
Gujarat	9.9	3.1	0.5	3.2
Haryana	3.6	1.99	1.32	3.26
Himachal Pradesh	1.0	0.02	0.09	0.11
Jammu & Kashmir	0.9	0.02	0.38	0.37
Jharkhand	3.2	0.11	0.13	0.24
Karnataka	12.2	1.43	1.33	2.38
Kerala	1.5	0.18	0.21	0.39
Madhya Pradesh	15.8	2.74	1.70	4.19
Maharashtra	19.8	3.12	1.03	3.36
Manipur	0.2		0.05	0.05
Meghalaya	0.3		0.06	0.06
Mizoram	0.1		0.01	0.01
Nagaland	1.1		0.1	0.07
Odisha	4.9	0.17	1.07	1.24
Punjab	4.0	3.06	0.94	3.96
Rajasthan	21.1	3.98	1.52	5.12
Sikkim	0.1		0.01	0.01
Tamil Nadu	6.5	1.61	1.43	2.66
Tripura	0.3	0.02	0.05	0.07
Uttar Pradesh	17.6	10.64	4.21	14.49
Uttarakhand	0.8	0.22	0.14	0.35
West Bengal	5.5	2.09	1.22	2.98
All India	159.6	39.43	22.48	58.13

The drawback in Open canal system (see Album 1. Canal - Damages, Bursting, Accident)

Over the period following drawbacks, challenges and limitations were observed in the Open canal system in India as well as overseas.

- Conventional Open Canal Systems achieve abysmally as low as 30% irrigation efficiency.
- It is the supply-based rotational irrigation system.
- It involves losses through evaporation, seepage, deep percolation, and conveyance.
- It offers large coverage but decreases productivity and mono-cropping.
- Long gestation and lengthened execution results in no / or poor ROI.
- Inherent huge challenges such as land acquisition and rehabilitation of communities.
- Very high annual maintenance costs.
- Excessive use of water, leads to land degradation, making it uncultivable in the long term.
- Water distribution is unequal and non-uniform, leading to social injustice and inefficiencies.
- All the water from a source does not reach the root zone of the plants. A part of the water is lost during transportation through canals and fields. Only part of the water is used efficiently, the rest of the water is lost. The Irrigation water losses in canals are due to evaporation from the water surface, deep percolation to soil layers underneath the canals, seepage through the bund of the canal, bund breaks, run-off in drains.
- Wastage of water through evaporation, deep percolation, seepage.
- Excessive use of water in crops like Paddy, Sugarcane, leads to soil degradation & infertility.
- Unreliable water supply is often is not reliable and may be supplied at the whims of the valve man.
- Non-Uniformity of water applications is observed in canal irrigated areas.
- Rotational water supply may suffer crops under stressed conditions and resulted in lower yield.
- Hydraulic gradient to be maintained by giving uniform slope to the canal, which attracts more cost.
- Period of construction of open canal system is longer, resulting in cost escalations and longer gestation period.
- More maintenance cost because of silt in the canal and also because of vegetation growth in the canal, requires more maintenance which results in poor efficiency and higher cost.
- Shorter effective life: The canal systems generally have a shorter effective life because of more maintenance issues and actual poor maintenance.

Album 1: Canal - Damages, Bursting, Accident.


Bursting of canal


Damages of canal

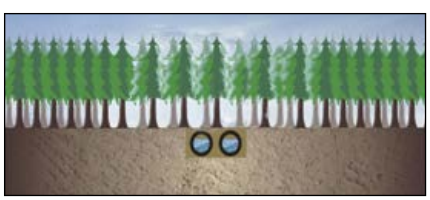
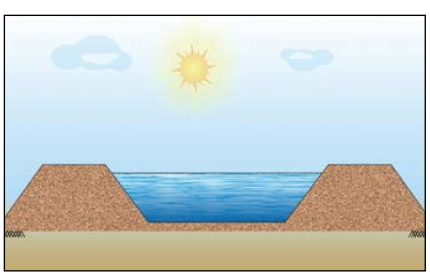
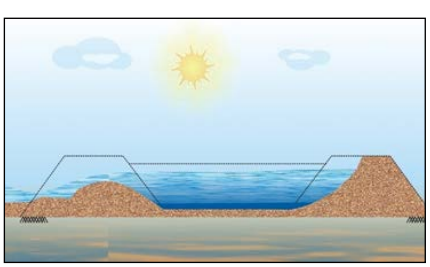

Risk of Accident in canal


Bursting of Canal in Bihar

Replacement of open canal to HDPE Pipes.

Since the discovery of PE material, PE has grown to become one of the world's most widely used and recognized thermoplastic materials because of its high level of permeability, stronger molecular bonds & compatible engineering properties and is most suitable to replace open canal for irrigation projects. Table 2. Comparison - Canal vs HDPE piping is shown and Album 2: Replacement of canal to HDPE pipes is provided in this article.

Table 2: Comparison - Canal vs HDPE piping System

S. No.	Heads	Open Canal System	Piping System
1.	Utility of land		 There is no loss of water on account of Seepage or evaporation Due to conduit, no question of any Soil erosion or Canal bursting.
2.	Losses of water through evaporation and seepage		
3.	Soil Erosion & Bursting of canal		
4.	Life Cycle Cost	Limited up to 30 years. The limited life leads to multiple time higher CAPEX.	The designed life is 100 + years. The overall CAPEX + OPEX is considered the life cycle cost is lower than Open Canal system.
5.	Land Acquisition	Required. If Canals network is passing through the third parties land, in that case land acquisition is essential. land acquisition is cumbersome process. Similarly there are many Right of Way - ROW issues to be resolved to complete the job. Because canal is constructed on ground surface so lot of land is utilised.	Not required. Because Pipes are buried underground more than 1.0 m depth. So question of acquisition of land does not arise.
6.	ROW and Compensation for Land Acquisition	Required. ROW is big issue and results in long time to complete the projects. The Compensation is also very sensitive issue, generally delays the project execution.	Not required. As there is no land acquisition, and this being a underground pipeline: only access for limited period is necessary to pass the pipes through the land.

7.	Soil Erosion & Settlement	Naturally Soil erosion and settlement takes place, which affect the functioning of canal and recurring as well as maintenance cost goes up. The efficiency is reduced/ affected leading higher cost.	Being a piped conveyance, no question of soil erosion. Similarly HDPE Pipe joints are stronger than pipes itself so NO impact of soil settlement.
8	Surrounding Land	Can't be used for farming. So Land use area is reduced. In long term this can be upto 20%	Entire land can be utilised effectively.
9	Deposition of silt	Because of trapezoidal shape and low velocity, silt deposition takes places at various level & places.	Because of round shape and high velocity, silt deposit chances are minimized.
10	Water logging	Water logging takes place. In long term, patches in kilometres can't be used due to waterlogging along both sides of the canal land. Over the period soil degrades.	No question of any Water Logging. The entire farm land remains dry and can be used for cultivation of crops. Quality of soil remains unchanged & Soil health is maintained.
11	Hydraulic flow capacity	Because of trapezoidal shape, rough surface and non-uniform velocity of water, obstructions, output from canal becomes low over the period. Soil and foreign matter block the passage of canals and reduces the water conveyance capacity.	Because of smooth surface & circular cross sectional area, uniform velocity is maintained in pipe length and thereby output from pipeline remains uniform.
12	Evaporation losses	Water surface is exposed directly to solar radiation, result in more evaporation. So it is accounted as wastage of water.	Water is flowing thru closed conduit and there is no chance of evaporation. So it is accounted as saving in water.
13	Seepage losses	Due to typical design of canals, seepage take place. With time seepage can reach up to 50%	There is no chances of any seepage or water losses as water is conveyed through pipeline.
14	Collapse & Bursting	It happen in Open canal & leads to losses.	NO. As Design of HDPE pipe is made to tolerate bursting pressure.
15	Leakages & water wastage	Due the design of canal and gates/ branches etc. Leakages & water wastage happens. With time, these increase drastically, leading to wastage of water & Irrigation schedules/ frequency gets affected.	Interconnections of HDPE piping network, Sluice Valves, Branches etc are water tight and hence there is no scope for leakages of water.
16	Operation	Operation of canal system is very cumbersome and difficult to maintain the schedule of water schedule.	Operation is very simple and easy and operation schedule can be properly maintained.
17	Automation / Mechanization	Due to the nature of Open canal networks, Mechanisation and/ or Automation is difficult. In many cases it is not feasible.	This being piped conveyance, automation and/ or mechanisation of operations is feasible.
18	Maintenance cost	Is higher due to Periodic cleaning of canal, removal of silt, debris, trashes, and solids to ensure smooth flow of water in canal. Also leads to break in irrigation and overall efficiency is reduced.	Cost is negligible or Nil
19	Impact of seismic activity	Open canal gets destroyed.	HDPE Pipes and Joints are not affected at all.
20	Bridges /Cross Drainage works	Bridges /culverts are required to cross the canal at many places and size & capacity of bridges are dependent on traffic load.	There is no need to construct bridges or culverts to cross the pipeline for transportation.
21	Construction cost	The construction cost of canal is high because maintaining precision level, orientation of canal.	Comparatively laying, jointing / welding of HDPE pipes are much easier than Canal construction and hence overall cost of construction is less than open concrete canal.
22	Prone to Accident	Many accident happening in canal like falling of vehicles, motorcycle, animals, people, overflow of canal, submergence of locality and farm.	There is no scope of accident because HDPE pipes are buried under ground.

23	Opex Cost	Opex is very high	Opex is low or negligible
24	Delays & Cost Escalation in cost	As construction is time-consuming and due to land acquisition and ROW issues, works are delayed resulting in escalation of overall cost of project.	No escalation in cost because of no legal procedure and land acquisition
25	Energy Consumption	Energy Consumption is higher. Due to aging, consumption increases.	Due to smooth wall surface of the pipe, the energy consumption is reduced upto 30%. And it is maintained throughout the life cycle.
26	Evaporation losses	@ 3,000 litre per year per sqmt of canal surface area.	Negligible
27	Percolation / Seepage losses	Roughly 25-30% of canal discharge (earthen canal)	Negligible
28	Slope to maintain	Every time slope has to be maintained to flow water easily)	No need to maintain slope. As it is directly connected to existing motor pumpset.
29	Manning's coefficient of roughness	0.025	0.009
30	Water volume & Head required	The water volume will not be constant. Need more head to flow water by gravity	The desired volume can be constantly delivered.
31	Estimated volume of silt	5 to 10% of the volume	less than 5%

Conclusion

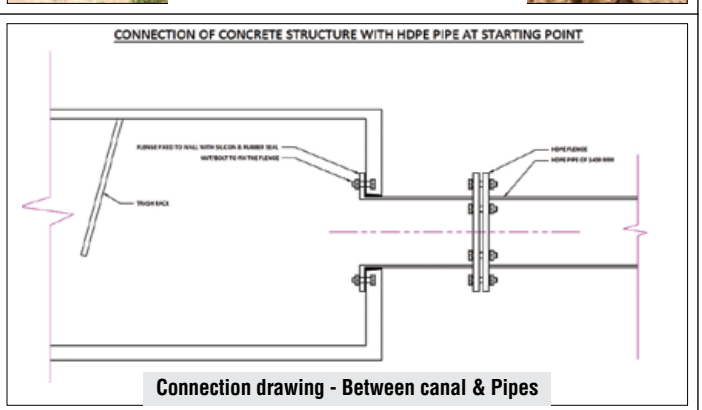
Considering the endless advantages & benefits of PE pipes, it is highly essential all State & Central Government should focus on replacement of existing canal to PE piping system for making sustainable growth of India's GDP as well as to meet requirement of SDG.

Album 2: Replacement of Canal to HDPE Pipes


Replacing Existing Earthen canal to PE Pipes


Canal before connection to HDPE Pipes


Connection of HDPE Pipes to Existing Gravity Earthen canal



Connection drawing - Between canal & Pipes

About the Author

Dilip Yewalekar is the Senior Vice President of Jain Irrigation Systems Ltd. He has over 36 years of experience. He has done M.Tech - Civil - Structural Engg, PG Diploma in Piping Engg, AMIE,UK, ASAE, USA. He is a Google scholar, Member of ICID.

He also has Fellowship of World Bank and Mashav, Israel and is a Faculty at Govt College of Engg, Jalgaon. He is also a faculty at Micro Irrigation Course of ICID & CWC, Govt of India. He has been awarded the EEF Global Water Leadership Award - Global Water foundations. Strategic Leader in Micro Irrigation - ABSA Award, Professional Excellence Individual Award - Aqua foundations and Best Innovative Article in Sabujeema International Magazine. He has 70+ papers/publications at national/international conference/magazines/books to his name.

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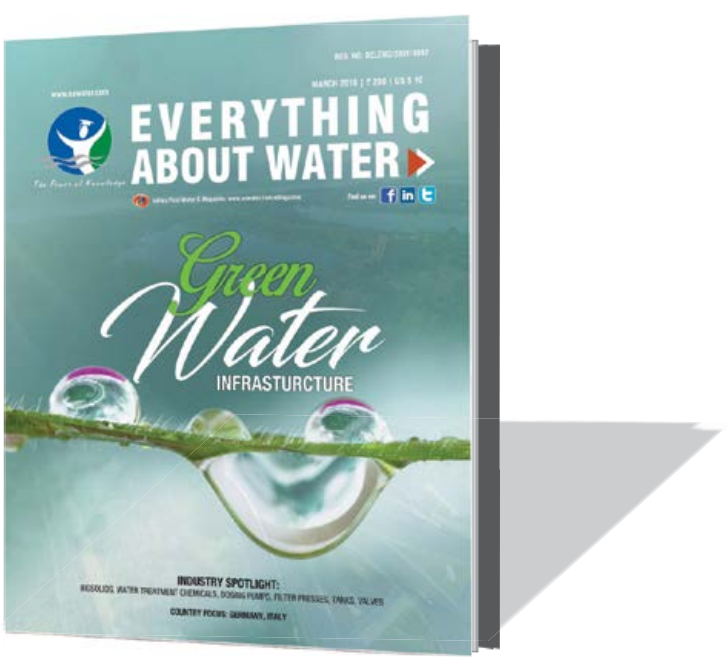
To know more about the contributor of this article, you can write to us. Your feedback is welcome and should be sent at:
deepak.chaudhary@eawater.com

The only bad thing about good luck is..
you never know when it will favor you.

That's why smart professionals make informed decisions.



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INNOVATIVE ASSET MONETIZATION PROGRAMME FOR WATER ASSETS UNDER PPP MODEL

By Devipriya Rout, Executive- Business Development, Swach Environment Private Limited and Subhash Sarkar, Commercial Head, Haldia Water Services

India's National Infrastructure Pipeline (NIP) predicts an infrastructure investment of Rs 111 lakh crore over the five-year period (FY 2020-25). Financing of infrastructure investments at such large scale necessitates a re-imagined approach and tapping alternative financing through innovative ways. As estimated by the Report of Task Force for NIP (2019), traditional sources of capital are expected to finance 83-85% of the capital expenditure envisaged under NIP. About 15-17% of the aggregate outlay is expected to be met through innovative mechanisms such as Asset Recycling &Monetization and new long-term initiatives such as Development Finance Institution (DFI).

As per the NIP, asset recycling and monetization mechanism may finance around 5% to 6% of the aggregate capex. In the wake of Covid-19 however, there is a pressing need on the public outlay towards socioeconomic stimuli initiatives, thereby necessitating exploring of alternative mechanisms such as Asset Monetization with an increased robustness.

The Union Budget has clearly laid out the importance of "monetizing operating public infrastructure assets for new infrastructure construction". Towards this, the budget provided for preparing a "National Monetization Pipeline (NMP)" of potential brownfield infrastructure assets and an "Asset Monetization dashboard" for tracking the progress and to provide visibility to strategic investors.

Key Objectives of NMP are:

i. Serve as a medium-term road map for the line ministries and agencies
ii. Providing medium-term visibility to investors on infrastructure assets pipeline
iii. Providing a platform for ministries to track asset performance
iv. Bring in greater efficiency as well as transparency in public assets management

APPROACH TO NMP

The NMP covers sectors like roads, airports, ports, telecom, railways, warehousing, energy pipelines, power generation, power transmission, hospitality and sports stadiums, urban real estate.
For each sector, the NMP has been formulating certain statutory bodies, public sector enterprise and likely undertakings within the purview of ministries / departments of Govt. of India (Public Asset Owners). This is based on three key sets of information: (i) Potential Asset Base, (ii) Assets considered for Monetization and (iii) Indicative Monetization Value. Below listed the brief description of each of the following:

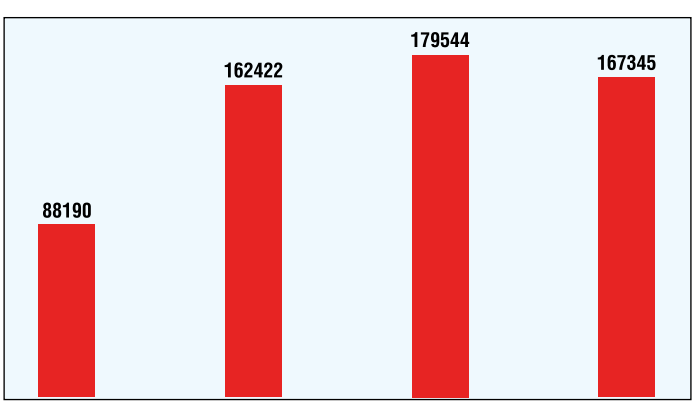


Fig-1: Indicative Value of Monetization Pipeline Year-wise FY 2022-25 (INR Crores)

1. Assets considered for Monetization - The 'Assets considered for Monetization' are a part of the Potential Asset Base which is expected to be monetized over the NMP period. This assessment has focused on revenue streams, utilization levels, investor appetite, ability to tap private sector efficiencies in operations and maintenance, policy focus to tap institutional investment in the sector. These factors differ from sector to sector as per the criteria.

2. Indicative Monetization Value - This key set is the value expected to be realized by the all the public asset owner through the asset monetization process, either the same in specific form of upfront accruals or by any

private sector investment, which has been referred to as the Indicative Monetization Value. Many brownfield asset classes are proposed to be monetized through Operate Maintain and Develop (OMD) based models or assets where significant capex may be involved over transaction life towards augmentation or rehabilitation of assets.

3. Potential Asset Base - 'Potential Asset Base' refers to the assets concerned under the central line ministries and CPSEs covered as part of the NMP exercise.

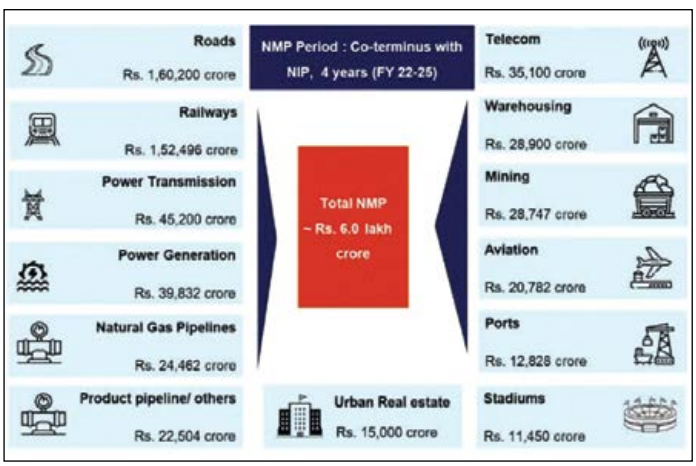


Fig-2: Sector-wise Monetization Pipeline over FY 2022-2025

AN EXAMPLE OF ASSET MONETIZATION:

Ports

India comprises of a significant size maritime sector with 12 Major and more than 200 Non-Major Ports situated along its 7500 km long coastline and a vast network of navigable waterways. This sector plays a crucial role in its overall trade and growth, with 95% of the country's trade volume and 65% of the trade value being undertaken through maritime transportation. Port development in India is guided and developed by the flagship Sagarmala programme and the recently unveiled Maritime India Vision 2030.

The assets considered under this sector for monetization from FY 2022 to 2025 are spread across 9 of major ports out of 12. For this, 31 projects have been identified for private sector participation for improved operational efficiency and capacity utilization of existing port assets.

A CASE STUDY: DEVELOPMENT THROUGH QUALITY WATER SUPPLY

Brief Project Description - Haldia Water Services:

Haldia is an important industrial town in Eastern India with a residential population of 200,762 as per 2011 census and with presence of several important industries

Haldia Development Authority ("H.D.A") is the nodal agency for providing water supply to various categories of customers like industrial, commercial, domestic and municipal in Haldia.

PHED, Govt of West Bengal had set up a water treatment facility of 20 MGD capacity at Geonkhali in 1992, which was augmented to 25 MGD in 2005-06. Further, in 2008 a new 25 MGD water treatment plant was constructed. Later the asset was transferred to H D A.

In July 2019 the project for Repair, Up-gradation, Operation & Maintenance and Management of the 50 MGD WTP under PPP model for a period of 15 years was awarded to Haldia Water Services Private Limited, the Consortium of Shristi Infrastructure Development Corp. Ltd. (51%), Swach Environment Pvt. Ltd. (38%) and Ion Exchange (I) Ltd. (11%)

The key responsibilities of the HWSPL would be repair, up-gradation, operation and maintenance, and management of the Haldia Water Supply System including billing and collection of water charges from the customers, with water supply from Hooghly River, with all pumping stations, electrical installations, existing and new WTPs, connecting pipelines and distribution system including cost of all materials, power and labour at Haldia, Purba Medinipur.

Key Indicators

- **Area covered:** Haldia city of about 11000 hectares spreading across 5 assembly constituencies. Total Volume of supply across all sectors estimated 150 MLD.
- **Population served:** Over 250,000 populations with Bulk Water to Municipal Corporation which serves around 50,000 house hold connections.
- **Customers:** Domestic, Commercial and predominantly over 80 Industries viz. Haldia Petrochemcial, Indian Oil Corporation, MCPI, Tata Power, Emami Agro, Electro steel, Kolkata Port Trust etc.
- **Industrial Coverage:** Serving more than 80 various types of industries, supplying about 130 MLD of water, which is about 85% of daily demand of water supply, which also caters to over 100,000 people who are working in the such industries.

Highlights of the Concession Agreement

HWSPL entered the Concession Agreement ("CA") with HDA on August 16, 2019 after payment of an upfront onetime non-refundable and non-adjustable license fee of Rs. 8 crores to HDA.

Asset handed over to HWSPL on November 1, 2019 for a period of 15 years. HWSPL shall continue to be the exclusive and dedicated operator as there is no other perennial source of water in Haldia,

Fees Payable to HDA (Asset Monetization for Local Authority)

- Upfront one-time non-refundable and non-adjustable fee of Rs. 8.00 Cr payable on signing of Concession Agreement towards the right of the concession, refundable in case of termination due to a force majeure event, HDA event of default;
- Performance Security of Rs. 20 Cr in the form of guarantee of Scheduled Bank/ PFI to be issued before takeover / compliance date;

- Fixed Annual License Fee of Rs. 24 Crores payable in equated monthly instalments;
- 65.50% sharing of incremental revenue for water sales beyond 4.47 Cr kl p.a. payable at the weighted average water tariff at the end of each concession year;
- 50% sharing of incremental revenue due to increase in water tariff for Industrial and Commercial incremental revenue beyond Minimum Water Tariff (5% increase p.a.) defined in the CA.
- 50% sharing of savings on power cost due to decrease in power tariff below the Base Tariff (4% increase p.a.) defined in the CA.

Safeguards for HWSPL (Private Concessionaire)

- Take or Pay Clause: Contracts entered into by HDA with customers have "take or pay" clause, wherein, the customers are required to pay for minimum 50% of the contractual volume, at the prevailing water tariff, irrespective of the water consumed.
- Revenue Collection: Revenue collection is over 95% predominantly from Industrial segment (>95%). However, in case of default in water payments for period of more than 120 days from the date of billing and HDA does not issue instruction for disconnection, HDA shall compensate the HWSPL for such amounts in default.
- Minimum Water Tariff: Minimum Water Tariff defined for Industrial and Commercial customers with an escalation of 5% p.a. at the end of each Concession Year. Applicable Tariff for Year 1 and Year 2 given below:

Customer Type	Year 1 (per/kl)	Year 2 (per/kl)
Industrial	18.35	19.27
Commercial	14.31	15.03
Domestic	5.96	5.96
Municipal	3.58	3.58

- Threshold limit for Municipal & Domestic Sales: Combined sales to the municipal and domestic sales beyond 0.99 Cr kl (6 MGD) shall be considered as sale under commercial tariff and the difference in rate is to be paid by HDA/ or adjusted against the License fees payable to HDA;
- Repair & Upgradations Works: A list of Repair and Upgradation works defined in the CA to be completed within first 8 years of the Concession Period.
- Service Area: There remains a restrictive clause on the existing and future customers to setup their own water treatment plant. Further, HDA shall ensure that new industries coming to Haldia are mandatorily required to purchase water from this water supply project.
- Asset ownership to remain with HDA during the term, including any refurbishment or replacement of project facilities excluding any moveavble assets installed to improve operational efficiency not transferred to HDA, all such amount invested by the SPV refundable in case of termination due to a force majeure event, HDA event of default
- Charge on Project Assets: HWSPL cannot assign or create any lien or encumbrance on the Project Facilities excluding creation of a security interest in favour of the Lenders on the grant of this Concession only, thereby giving them substitution rights
- Deterioration in raw water quality: Significant change in the raw water quality causing a failure to meet performance standards is covered through force majeure event under climate change. In case there is a need for repair and/or upgradation in the existing system to treat the poor water quality, the expenses shall be compensated by the HDA.

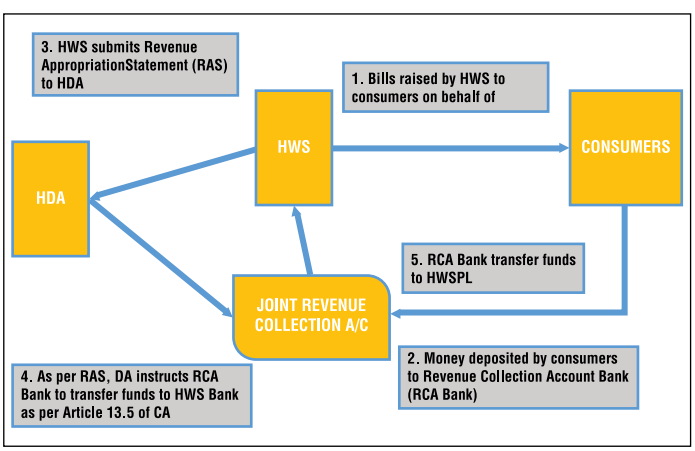


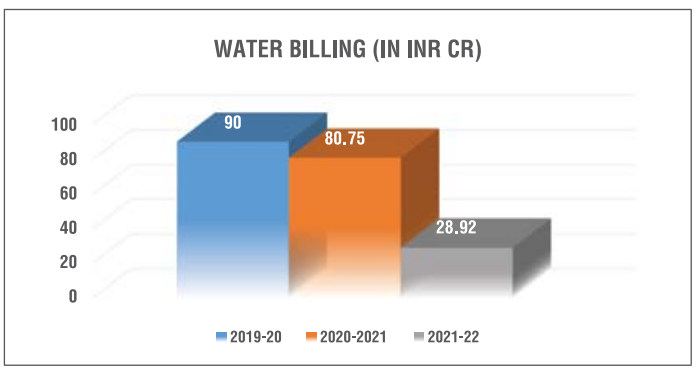
Fig-3: Haldia Billing & Revenue Cycle

POTENTIAL GAINS

Post the takeover, the respective Asset has shown tremendous improvement in terms of:

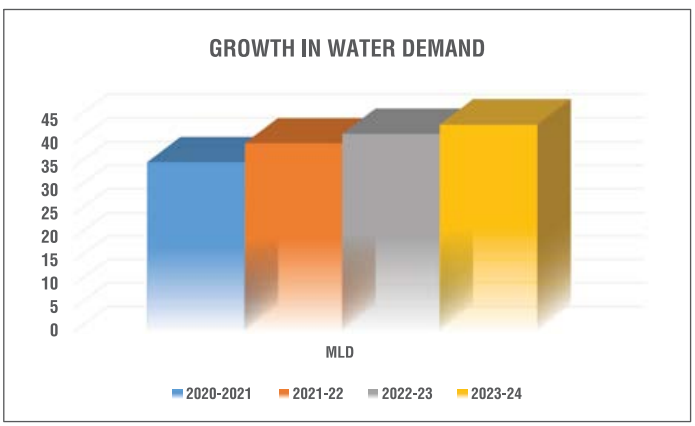
1. Increase in monthly revenue by ~30% from monthly average of Rs. 5.8 cr to 7.5 cr
2. Additional revenue for the local authority on account of increase in water sales
3. Better O&M practices leading to reliability, quality and efficiency in water treatment
4. Reduction in Power consumption through investments in new panels and optimal use of pumps and motors.
5. ~20% reduction in Non-Revenue Water etc. through installation of new meters

Growth in Water Billing:



Source: ©Haldia Water Services Pvt Ltd.

Growth in Water Billing:



Source: ©Haldia Water Services Pvt Ltd.

Haldia Competitive Advantages:

1. HWSPL is poised to achieve double digit CAGR YoY
2. Assured Minimum Revenue Guarantee irrespective of actual supply
3. Reduced NRW increases the service efficiency and enhanced revenue
4. Increase in Demand will generate more revenue

Such PPP projects to upgrade, rehabilitate, rejuvenate and operate and maintain such assets are the order of the day and must be explored for similar utilities to bring in cost efficiencies and effective delivery to end users and at the same time help the owners monetize the assets and prevent cost escalation and asset deterioration as well as recurring costs by ULBs and Govt bodies. Counter party risks play a vital role in ensuring bankability of such PPP projects.

About the Author

Devipriya is from Dhenkanal, Odisha and has completed her MBA from KIIT School of Management in the stream of Marketing and Operation. Prior to her MBA, she had completed her B.Tech from Veer Surendra Sai University of Technology in the stream of Mechanical Engineering.

Devipriya is a keen musician and loves singing. She has passion for social causes and devotes her free time for upliftment of under-priviledged children. Devipriya has parents in Odisha both working for the Health Department in Govt of Odisha.

Mr. Subhash Sarkar is a result oriented professional with 20 years of industry experience, Worked with Synergy, Aditya Birla Group and Reliance in Finance encompassing Accounts, Audit, Procurement, and Vendor Management. Proficient in Accounts, Budgetary Control, Service tax, GST, adherence of statutory compliance, monthly closure of accounts. Adequately exposed in negotiating with Vendor for seamless and cost-effective Operations. Exposure in development of sourcing strategies, analytical assessment, Evolution of cost proposal for strengthen effectiveness. Adept in implementing cost saving measures to achieve reduction in terms of raw materials, procurement costs, and logistics cost. Special focus on ERP Implementation in current company. Experience in vendor evaluation, techno-commercial negotiations and contract finalization & execution. Worked in the SAP R/3 module since 2001and Oracle involving all the supply chain process flow, Accounts Payable, Banking, Report Generation and Analysis. Excellent communication and relationship management.

To know more about the contributor of this article, you can write to us. Your feedback is welcome and should be sent at:
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BRINE COASTAL AQUIFER AS THE ONLY WATER SOURCE ADVERSITY TO OPPORTUNITY-CASE STUDY AT PUDUCHERRY, INDIA

By Dr S Sundaramoorthy, Dr S Saktheeswaran, Muthiah Vincent

Puducherry (Pondicherry) on Bay of Bengal was colonized by French in 1674 who overlooked to harness the 1100 mm rainfall and today 150 bore wells alone (dots in the map) sustain the city.

30% of over drawal as recorded by the Government has resulted in seawater intrusion with TDS from sea and Silica from inland rocks increase defying affordable desalting. Seawater desalination is financially not sustainable. These adversities do not augur well for the future. The article identifies how to overcome these and achieve a circular water economy-affordably.

The Steady Decline of Water Quality

The TDS and Silica Values in typical Bore Wells in Puducherry are as under (1)

Code	Table-1 Total Dissolved Solids (TDS) mg/l											Silica
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2016
a	-			-	-	-	-	-	770	990	1085	33.4
b	389	610	810	1150	990	1470	2232	3081	4850	3805	5127	50.9
c	101	11	110	130	140	160	136	126	150	175	451	48.4
d	293	370	400	410	420	220	580	664	860	920	955	61.6
e	205	210	200	170	200	210	262	238	260	475	272	62.5
f	514	620	600	720							349	
g	243	250	230	220	220	250	256	332	350	335	435	62.5
h	328	420	570	630	-	1320	-	-	1610	-	4731	-
i	-	-	1000	1000	890	1869	1869	3041	2570	4015	3224	61.2
j	-	-	410	530	690	450	1052	2356	3380	3970	5313	60.3
k	-	-	-	380	390	460	610	1002	1600	1575	2058	61.2
l	204	240	260	270	340	320	338	-	430	510	702	63.3
m	-	-	-	-	-	-	-	-	750	-	3310	-
n	807	1450	1360	980	1540	1580	1838	2466	-	-	-	-
o	745	1660	2010	1670	2170	2520	2781	3111	2420	3398	-	68.9
p	-	670	630	680	820	940	1376	1506	1640	1525	-	67.2
q	526	1500	960	1890	1510	1870	2544	3093	3910	3274	-	65.0
r	-	-	700	860	830	-	840	1097	1210	1575	-	65.5
s	-	-	-	-	-	-	-	1028	1001	1095	-	64.2

Index to codes; a-Lenin Nagar; b-Sithananda Nagar; c-Shivaji Statue; d, e-Uralkuttai North; South; f-Maduvapet-1; g-Maduvapet II; h, i-Sudanthira Ponvizha Ngr I; II; j, k, l-Krishna Ngr i; ix; xii; m-Krishna Ngr v; n-Rainbow Ngr vi; o, p, q. r, s-Thirukanji BW 3; BW 4; BW 5; r- BW 7; s- BW 8

Water level depletion and seawater intrusion in the porous sedimentary formations (2) have crept up the total dissolved solids (TDS) past 2000 mg/l, beyond which the palatability decreases and may cause gastro intentional irritation as per Bureau of Indian Standards (BIS) (3). When detected in 2016, desalination was mooted but Silica was encountered as a deterrent and persists till date.

The Silica Phenomenon

Silica is released from chemical breakdown of silicate and sediments by weathering in groundwater or by precipitation of secondary minerals and is irreversible (4), (5). Another factor is pre and post-monsoon concentrations as in the Kali River in Uttar Pradesh as in Fig.1 (6)

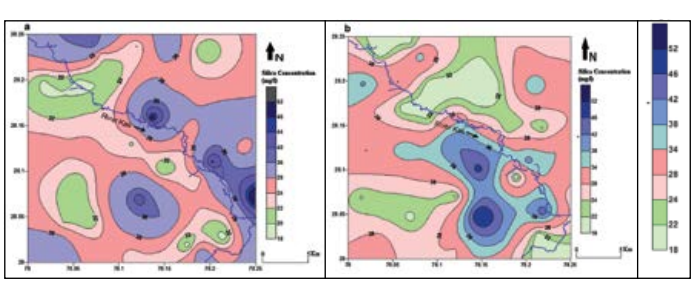


Fig. 1 Spatial Silica in pre (left) and post monsoon (right) in 2012 in Kali River in Aligarh

The values were 18.72 to 50.64 mg/l and 18.89 to 52.23 mg/l in pre and post-monsoon and the spread were different In a related study for Puducherry, it is postulated that less rainfall and depleted water level induces seawater intrusion could result in precipitation of carbonates and addition or dissolution of halites and silicates in this region (7). Another study in shallow groundwater bordering a seasonal river in Malaysia showed chloride or TDS are decisive in demarcating Silica with two distinct “sinks” of contours from 19 to 9 mg/l superimposing the colluvium of the river in Fig. 2. (8). However, specific data are not available for Puducherry

Limitations by Silica in Desalination

The desalination technologies for the TDS values in Table-1 can be Reverse Osmosis (R O), Ion Exchange, Thermal Distillation and Electrodialysis. In

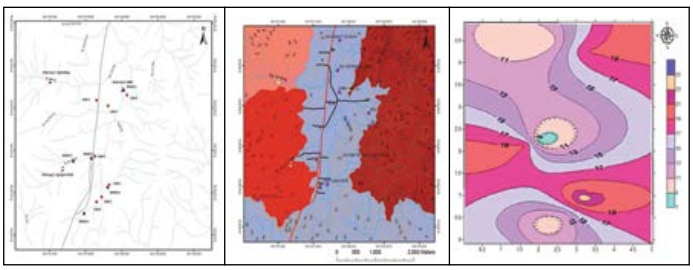


Fig. 2. The Map, Lithology and Silica CFD contours of the study area (8)

the R O and Ion Exchange, when the Silica exceeds the solubility limit of 100-140 mg/l in the rejects / concentrates, it deposits in the membranes/ resins. Thus in the present case, at 60 mg/l Silica, the permeate can be only 40 % and 60 % of precious fresh water is to be rejected (??). Thermal distillation has silica scales on heat exchanger surfaces. Electrodialysis suffers by free radicals coating the electrodes. Thus, the choice has to be pre-treatment for Silica Removal and follow desalination only thereafter. There is the Silica specific anti-scalant but these are not covered by BIS for public water supply.

Pre-Treatment Options for Reducing Silica

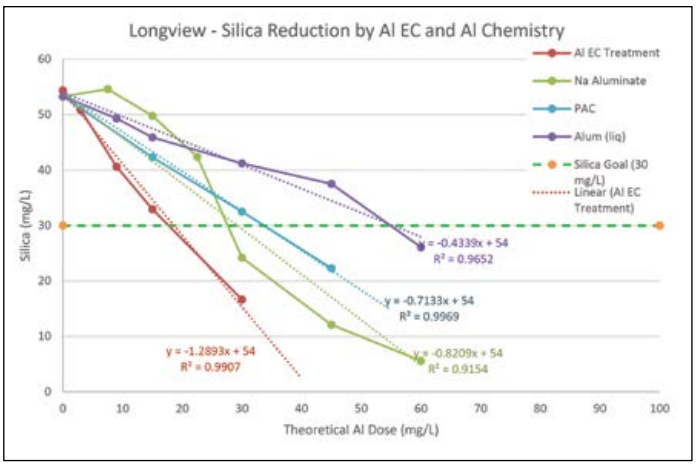
The criteria for precipitation in public water supply can be on the lines evaluated for one other drinking water project reported for a regional water treatment plant is the USA (9) and the summary of evaluation of the options for raw water Silica of 55 mg/l is in Table-2.

Table-2
Evaluation of Silica Removal Alternatives by Combined Weightage Rankings, FOR City of Longview, Washington State, Mint Farm Regional Water Treatment Plant (9)

No.	Criteria	Electro-coagulation	Precipitation	Lime Softening	Ion Exchange	R O
		Weightage Rankings				
1	Environment	0.34	0.30	0.16	0.18	0.12
2	Economic	1.08	1.08	0.51	0.78	0.57
3	Water Quality	1.45	1.45	0.85	0.75	1.65
4	Technical	0.95	1.20	0.95	0.85	0.95
	Total	3.82	4.03	2.47	2.56	3.29
5	Cost in USD(*)	12.32	12.23	27.39	22.00	15.41

(*) For the Operations and maintance (O&M) as cost per Residential Unit / month

Electro-coagulation though attractive in operating cost and weightage factors, cannot be endorsed for public water supply due to impossibility of cannibalizing the electrodes of another manufacturer in due course. Ion exchange is the same. Lime softening or Magnesium Oxide or Alum results in clumsy sludge. In the case of R O, Anti-scalants for Silica were proprietary chemicals besides highest cost. Precipitation as tried was by Poly Aluminium Chloride (PAC) and Sodium Aluminate (NaALO3). The results are in Fig.3. The floc formations are shown in Fig.4. A proposed treatment in a similar situation as proposed is extracted in Fig. 5.



NaALO2

Fig. 3. City of Long View water, Silica Reduction and Regression Lines for Chemicals in (9)

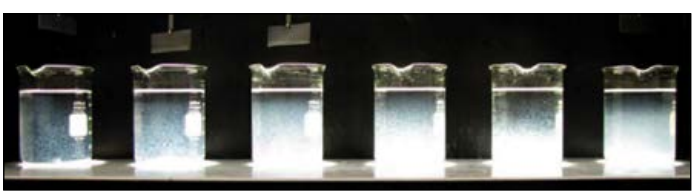


Fig.4. City of Longview, Raw Water PAC Treatments left to right 15,30,45,60,75,90 mg/l Al

Considering that Silica pre-treatment is to be preferred to keep the downstream membranes free from risk of scaling. A classical study reported in the regard as a NF-RO train is shown in Fig. 5

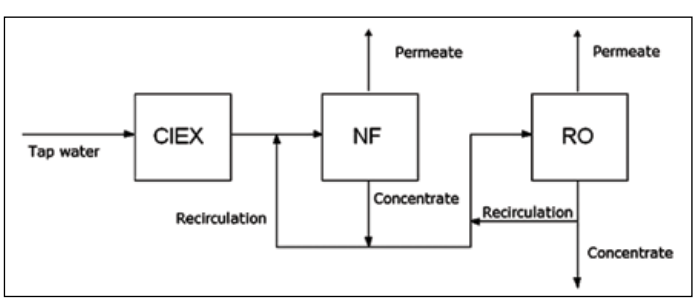


Fig.5. The Silica Pre-Treatment and NF-RO in Literature (10)

Another study has also been reported on the same lines (11) stating that whereas silica passed through NF membranes almost completely, it was mostly rejected by RO membranes.

A similar study was done by third author on Puducherry waters as in Table-3 and Fig. 6.

Table-3
Laboratory Results for Precipitating Silica to less than 20 mg/l in Puducherry Waters

PAC only without pH adjustment										
	Test 1; TDS-1550					Test 2; TDS-2815				
PAC (mg/l)	0	100	120	160	250	0	100	140	180	200
Silica (mg/l)	46.7	32.1	31.2	28.2	21.6	62.9	45.6	52.0	50.9	51.4
pH	7.09	6.48	6.58	6.60	6.37	6.3	5.56	5.34	4.82	4.68
	Test 3; TDS-3040					Test 4; TDS-3250				
PAC (mg/l)	0	100	120	160	240	0	120	160	200	240
Silica (mg/l)	78.3	69.1	68.1	65.5	64.2	82.6	72.79	72.0	66.1	65.0
pH	6.17	6.10	5.90	5.82	5.45	6.50	6.15	5.85	5.60	5.35
PAC with pH adjustment by NaOH										
	Test 5; TDS-1550,					Test 6; TDS-2815,				
PAC (mg/l)	0	100	120	160	250	0	100	140	180	200
Silica (mg/l)	46.7	28.5	21.8	20.5	19.5	62.9	52.5	42.5	22.6	19.8
pH	7.09	6.95	7.18	7.05	7.10	6.3	7.10	6.95	7.15	7.05
	Test 7; TDS-3040,					Test 8; TDS-3250,				
PAC (mg/l)	0	100	120	160	240	0	120	160	200	240
Silica (mg/l)	78.3	62.5	54.3	32.5	23.8	82.6	64.5	53.5	43.5	32.2
pH	6.17	7.10	7.15	7.10	6.95	6.50	7.10	7.15	6.90	6.95
NaAlO2 alone (Inferred dose shown boxed)										
	Test 9; TDS-1550					Test 10; TDS-2815				
NaAlO2(mg/l)	0	25	50	75	100	0	25	50	75	100
Silica (mg/l)	46.7	24.2	22.2	19.8	18.5	62.9	51.8	42.5	23.8	18.6
pH	7.09	7.15	7.85	8.05	8.15	6.3	7.05	7.25	7.85	8.20
	Test 11; TDS-3040					Test 12; TDS-3250				
NaAlO2(mg/l)	0	25	50	75	100	0	25	50	75	100
Silica (mg/l)	78.3	36.5	30.8	23.7	21.8	82.6	42.2	32.5	28.7	19.8
pH	6.17	7.40	7.50	7.85	8.20	6.50	7.10	7.25	7.85	8.15

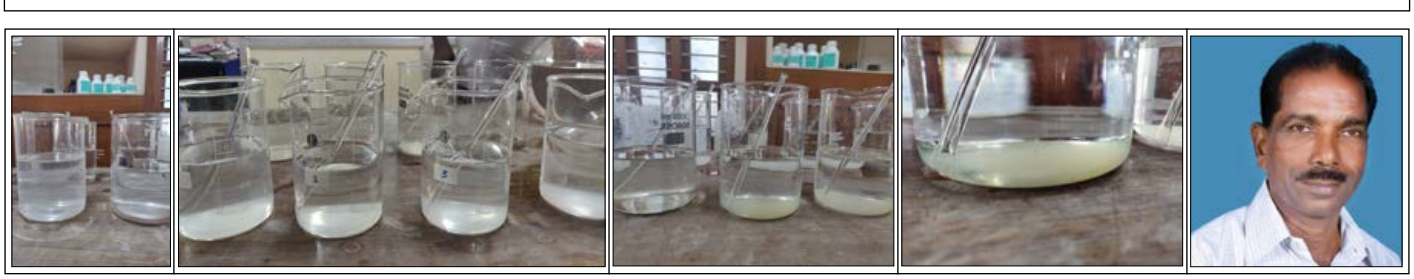


Fig. 6. Initial haziness to blanket settling and final clarity and the third author who did the tests.

Considering the results of both the above studies and the merit of the treatment scheme as proposed in Fig. 5 in that the pre-treated water pass through Nano Filtration membrane (N F) to separate the Calcium and Magnesium and this can pass on to the permeate to retain these valuable minerals which are needed for the human body and Sodium which can be put through the standard R O and the overall recovery can be attained consistent in volume and preserving the two minerals in the product, the optimal scheme for Puducherry will be as in Fig. 7.

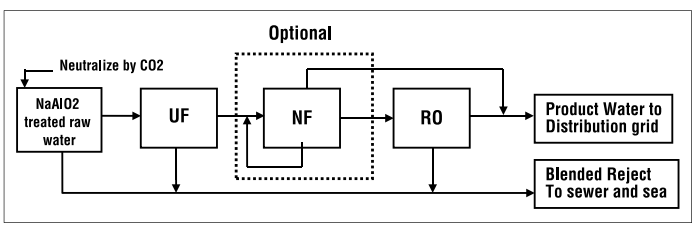


Fig.7. The Optimal Water Treatment Train for Puducherry Silica Water

This has advantages of (a) the UF membrane will take care of any turbidity before the NF, (b) the NF gives resilience to retain the vital Calcium and Magnesium instead of a washout in R O, (c) the R O itself can be bypassed if need be (d) keeping the sludge in its flowable state at just about only 5 cum for every MLD, (e) defending the silica sudge to the sea as even otherwise in the present system, silica is flowing out to the sea, (f) and above all the entire pre-treatment in NaAlO2 segment can be an artificial neural network system as in Fig.8 (12).

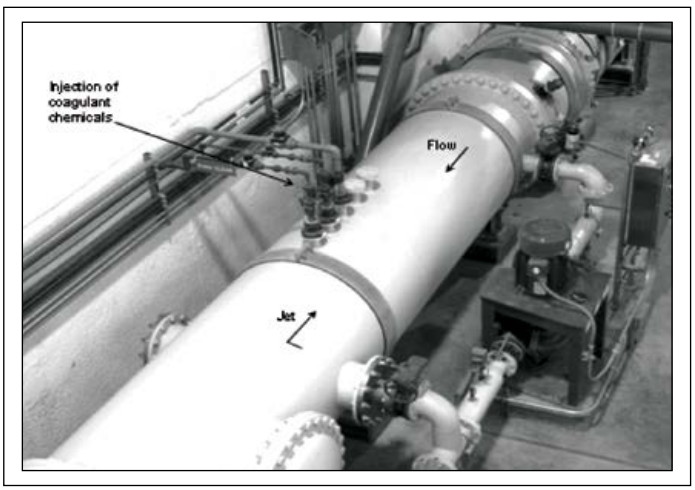


Fig. 8. The Jet one-line mixer (12)

The pH neutralization in the Na2Al2 pre-treatment can be from CO2 in upright cylinders as in Fig. 9 or "bullets" containers as done at Hosur public WTP in Tamil Nadu (13) in the 23 MLD water treatment plant where raw water from a river got polluted by upstream wastewater in 2004 and high Lime technology of raising the pH to 10.5 to precipitate the phosphorous and carbonation of the supernatant reduce the pH to 9.3 for ammonia stripping were implemented.

Fig.9. The high pH water in clariflocculators, CO2 cylinder bank and carbonation tank

The construction cost of projects like these has to be seen as a onetime infrastructure and does not need a justification especially when dealing with these water supply projects. It is the (O&M) cost that is the single major challenge of many cities in India and is a mismatch between functions and finances (14) and Puducherry is no exception. All the same, the cost of O&M of the project proposed here in Fig.8 is assessed at close to Rs 20 per Kilo liter (Kl) of product water at a recovery of about 85 %. Recovering it at least as a breakeven from the public is itself a huge challenge. But then, at nearby Chennai metropolis, it costs Rs 50 per Kl in seawater desalination but the levy to the domestic consumer is only Rs. 5 per Kl. This is a subsidy in the overall state budget. Such a mechanism has justification to be brought about at Puducherry. If not, what all has been tried and given up so far will only escalate. Also, what all have been written here will continue to be acceptable in principle but a "mirage" in reality for O&M costs, and the situation may become one of "water, water everywhere but not a drop to directly drink"

The Sewage as a onetime use

The town has sewage treatment plants (STPs) of 56 MLD and treated sewage reuse is 5.5 MLD for industries and 5 MLD for tertiary treatment and recreational boating in lakes and including other minor uses, 16.5 MLD is identified for reuse (15) and thus 40 MLD of fresh water turned sewage drains into the sea and depletion of ground water and seawater intrusion occurs and the utilization of treated sewage would minimize pressure on ground water resource.

The example of the coastal city in USA.

The Orange County in USA is a coastal city on the Pacific. It has also

experienced seawater intrusion and has only a limited rainfall in a desert like setting. It was way back in 1970's that they embarked on sewage indirect reuse after advanced treatment and blended with groundwater to inject into the coastal aquifer and extracted for city. Today in 2022, it boasts of a 450 MLD plant as a circular water economy as in Fig. 10 (16), (17). There are plans to expand this further.

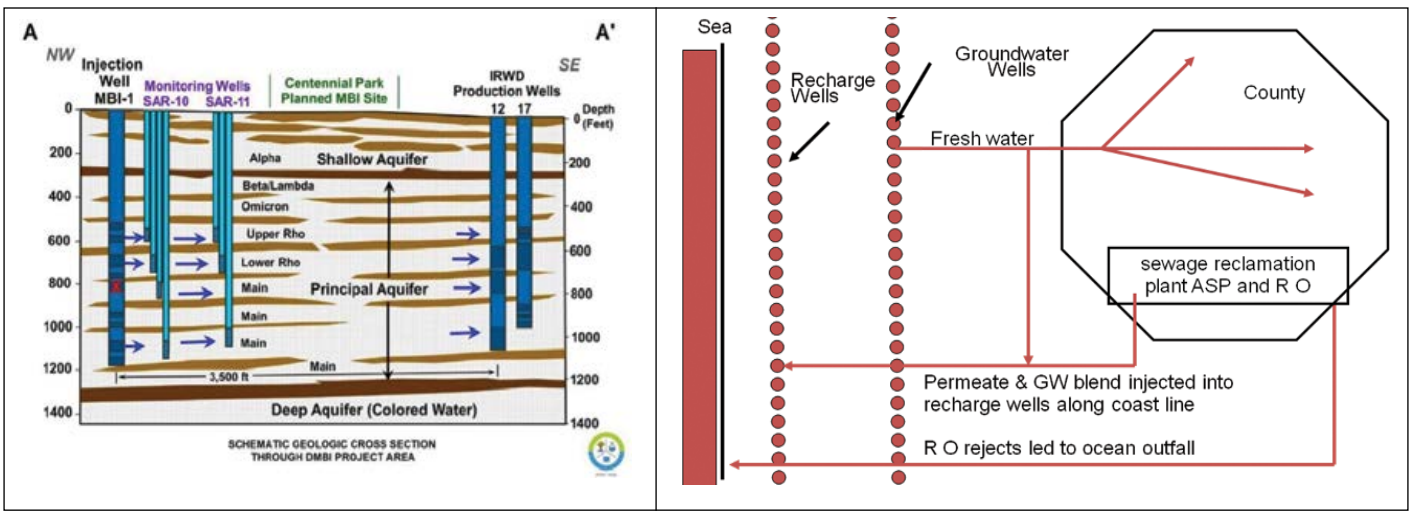


Fig.10. The sky view of Orange County sewage reuse and injection-extraction in the Aquifer

The Signals Shaping up at Puducherry

1. The report by the Department of Science, Technology and Environment of Government of Puducherry in 2019 itself has cautioned that "ground water potential of Puducherry Region has been estimated as 140 million cubic meter. (Central Ground Water Board, 2016). Agriculture is the major ground water consumption sector (116 mm3) followed by Domestic (18.5 mm3) and Industrial Sector (5.4 mm3) at a ratio of 83 %; 13 %; and 4 %. The source of the water for the various activities including Domestic, Industrial and Commercial usage are met from the ground water as a result of which there is depletion in the underground water resources. 30% of over drawal of ground water is reported and thus Puducherry has been categorized as "Over Exploited Zone." (15).

2. Even at this 140 million cubic meters (15) and considering extraction for only the public water supply at 56 million liters daily, this can theoretically last for just about 6 years from 2019. There is a further report that this domestic requirement is 90 MLD (18).

3. Items 1 inter-alia 2 are an indicator towards the neighbouring state contesting this situation as their groundwater has also become salty and the prophecy of the former senior vice president of the Water Bank that "if the wars of this century were fought over oil, the wars of the next century will be fought over water - unless we change our approach to managing this precious and vital resource".(19)

4. The accelerated build up of the TDS in a water supply which is already not complying with the BIS and exposing the public to "gastro intentional irritation" is to be taken note of.

5. It is reported that there are 151 bore wells and 50 fresh bore wells are to be dug on the riverbeds in rural areas, following the recommendations of the Ground Water Authority and recharge shafts will be put in each bore well dug to ensure that they get recharged while the water is drawn for supplying and this way, the bore wells will get converted into recharge bore wells in the face of water needs of 90 MLD in the town area alone (18).This type of recharge needs caution as there are no standards in the world for such direct recharge from overland to safeguard from epidemics of water borne diseases that may occur.

Conclusions

1. The TDS and Silica discovered in 2016 are unresolved even in this 2022. The proposal in Fig. 8 may cost Rs 20 per Kilo liter (Kl) at doorstep. Alternative seawater desalination at this small scale will be 300 % costly. Right now people are paying Rs 7 for 20 liters of desalinated water purchased in their own containers from private kiosks and it amounts to Rs 350 per Kl that too to be bought at vendor's kiosk.

2. The desalination in Fig. 8 eliminates all privately patented chemicals as anti-scalants etc. The only chemicals needed are Sodium Aluminate and Carbon Dioxide both with BIS and available from a variety of manufacturers for competitive procurement here in India.

3. The agriculture needs of 116 million cum needs to be a blend of fresh water and treated sewage and in turn avoid seawater intrusion. (15).

4. A medium term need is to take up with acknowledged institutions which have implemented artificial injection of treated sewage in coastal aquifer and build up the hydrogeology of the local coastal rocks and reversible channels of seawater intrusion by artificial injection of renovated sewage like Orange County and embark on the cyclic water use as in Fig. 11

Fig. 11. The Cyclic Water for Puducherry. It is all about halting further seawater intrusion.

Acknowledgements

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References

1. Data Received by the first author from the Public Works Department, Puducherry
2. District Groundwater Brochure, Puducherry Region, Central Groundwater Board, 2013 http://cgwb.gov.in/District_Profile/Puduchery/Puducherry.pdf
3. Government of India, Bureau of Indian Standards, IS 10500, Drinking Water-Specification/https://cpcb.nic.in/wqm/BIS_Drinking_Water_Specification.pdf
4. Study and Interpretation of Natural Water-USGS publications https://pubs.usgs.gov/wsp/wsp2254/pdf/wsp2254a.pdf
5. UN-Groundwater in World-https://www.un-igrac.org/sites/default/files/resources/files/Groundwater_around_world.pdf
6. Arina Kan et al, Appl Water Sci (2015) 5:65–72, Significance of silica in identifying the processes affecting groundwater chemistry in parts of Kali watershed, Central Ganga Plain, India,
7. Thilagavathi Rajendiran et. al. Influence of variations in rainfall pattern on the hydrogeochemistry of coastal groundwater—an outcome of periodic observation, Environmental Science and Pollution Research https://doi.org/10.1007/s11356-019-05962-w
8. Mohammad Muqtada et. al., Significance of Silica Analysis in Groundwater Studies of Domestic Shallow Wells in Parts of Jeli District Kelantan, Malaysia, Springer International Publishing, AG 2017, Water Resources in Arid Areas, The Way Forward, Springer Water, DOI 10.1007/978-3-319-51856-5_7
9. ch2m, Evaluation of Silica Removal Alternatives Mint Farm Regional Water Treatment Plant, Document number, 650582.03.35.13.03
10. S. Salvadore Cob, "Silica Removal to Prevent Scaling in Reverse Osmosis Membranes" Desalination, 344 (2014) 137-143 file:///C:/Users/Admin/Downloads/SalvadorCobSDesal2014344137%20(1).pdf
11. Gazelle Vaseghi, Charecterizsation of Reverse Osmosis and Nanofiltration Membranes, Effects of Operating Conditions and Specific Ion Rejection, Desalination and Water Treatment, 57 (2016), 23461-23472, https://www.researchgate.net/publication/286916424_Characterization_of_Reverse_Osmosis_and_Nanofiltration_Membranes_Effects_of_Operating_Conditions_and_Specific_Ion_Rejection
12. https://www.iwapublishing.com/news/coagulation-and-flocculation-water-and-wastewater-treatment
13. S. Saktheeswaran, Resurrection of Abandoned 23 MLD Sewage Infested Surface Water Treatment Plant at Hosur, NEERI, Feb-9-2011
14. Report Of The Sub-Committee On Financing Urban Infrastructure In The 12th Plan Ministry of Urban Development, Government of India, March, 2012, http://urbanindia.nic.in
15. Government of Puducherry, Action Plan for Utilization of Treated Sewage Water-https://dste.py.gov.in/Envispdy/assets/pdf/Action%20Plan/Treated_Waste_Water.pdf
16. Water Factory 21 Brochure, https://www.ocwd.com/media/2451/water-factory-21-brochure.pdf
17. Ground Water Replenishment System, https://www.ocwd.com/gwrs/
18. The New Indian Express, Tamilnadu, 23-November-2021, https://www.newindianexpress.com/states/tamil-nadu/2021/nov/23/french-agency-extends-funding-for-drinking-water-project-in-puducherry-by-two-years-2386898.html
19. http://www.serageldin.com/water.htm#:~:text=In%20August%201995%20he%20warned,this%20precious%20and%20vital%20resource".

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CASE STUDY - TO KEEP THE WATER SYSTEM IN PORTO, PORTUGAL RESILIENT IN THE FACE OF GROWING URBAN PRESSURES

By Sandra DiMatteo, Industry Marketing Director, Water Infrastructure, Bentley Systems

Project Name

H2PORTO Technological Platform for the Integrated Management of Porto's Urban Water Cycle

Location: Porto, Portugal

Overview: Águas do Porto created H2PORTO, a smart water platform with a digital twin, to keep the water system in Porto, Portugal resilient in the face of growing urban pressures.

Year in Infrastructure 2019 Awards Nominee; Going Digital: Advancements in Water, Wastewater, and Stormwater Networks

A Water System Facing Urban Pressures

As the city of Porto's water system aged it faced a variety of urban pressures, including infrastructure development, pollution, supply interruptions, pipe bursts, and sewer collapses. Water company Águas do Porto (AdP) knew they had to improve their access to system wide information, which would help them quickly identify problems and ensure that a more reliable system is in place. Additionally, system data had become housed in dozens of siloed applications. To improve access to their information and resolve problems, AdP decided to develop a sustainable smart water platform to manage the water cycle, forecast flood risks and water quality issues, and improve decision-making and system resilience.

Combining System Data into a Smart Water Platform

To develop the smart water platform known as H2PORTO, AdP retained a consortium of vendors that included Bentley Systems. Together, AdP and the consortium integrated all data sources, including geospatial information systems, real-time network sensors, household meters, SCADA, laboratory, billing, work orders, and logistics into a single platform. AdP helped create a digital twin of the water system that could automatically model water levels and flow based on real-world conditions and weather forecasts to predict flooding, service interruptions, or water quality problems.

Simulating Hydraulic Scenarios to Stay Prepared

AdP used Bentley's OpenFlows applications as the basis ofH2PORTO platform. OpenFlows FLOOD helped the team use spatially distributed numerical models to simulate all hydrological processes in the natural environment, including rivers and coasts. OpenFlows SewerGEMS provided engineering capabilities for managing wastewater systems, as well as the ability to model what-if scenarios. The two applications formed the basis of comprehensive flood modeling of the entire water system. OpenFlows WaterGEMS also provided numerous capabilities for water network analysis and decision-making.

Preventing Problems with Improved Information Access

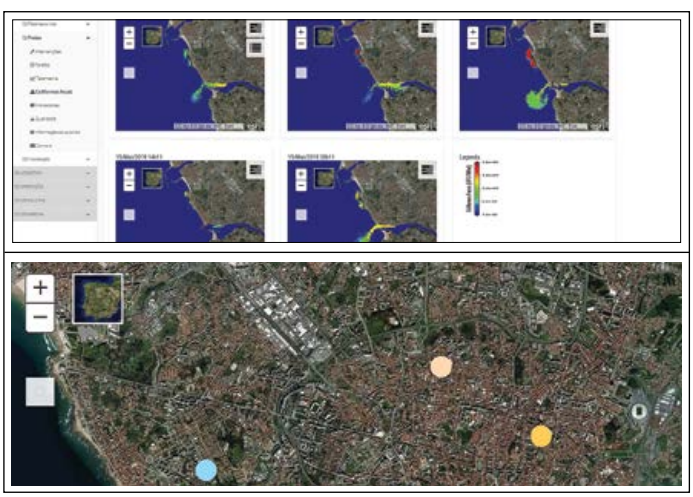
With H2PORTO fully operational, the city of Porto has made its water system more resilient and ensured a reliable source of water to residents and tourists. Supply interruptions fell by 22.9% and the number of sewer collapses decreased by 54%. Repairs for pipe bursts and sewer and service connections improved as well, by 8% and 44.5%, respectively. These improved repairs allow for a consistent water supply in the region. Also, the volume of nonrevenue water dropped by 3.6%. By providing access to water system conditions in near real time, AdP experienced operating gains of 25%. Automated water system modeling allows AdP to quickly respond to potential problems. By unifying the data produced by formerly siloed systems, AdP has improved the accuracy of the data produced from sensor readings to nearly 99%.With more accurate data, the organization has improved overall decision-making.

Project Playbook: OpenFlows FLOOD, OpenFlows WaterGEMS, OpenFlows SewerGEMS

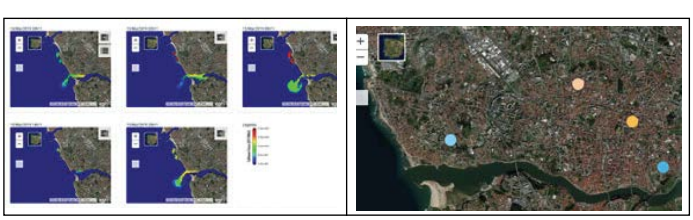
Outcome/Facts:

- The city of Porto's aging water system faced increasing urban pressures including infrastructure development, tourism, pollution, supply interruptions, pipe bursts, and sewer collapses.
- Since implementation, the city of Porto has seen significant improvements to its water supply, with supply interruptions falling by 22.9% and the number of sewer collapses decreasing by 54%.
- Their smart water system ensures a reliable source of water to residents and tourists.

Quote: "H2PORTO is an important catalyst for the digital transformation supporting changes in people, process, and technology and most importantly, helps us with operational mobility and the provision of information in real time on any device." - Pedro Vieira, IT and Innovation Director, Águas do Porto.



The city of Porto's aging water system faced increasing urban pressures including infrastructure development, tourism, pollution, supply interruptions, pipe bursts, and sewer collapses. *Image courtesy of Águas do Porto, EM.*



Their smart water system ensures a reliable source of water to residents and tourists. *Image courtesy of Águas do Porto, EM.*

Since implementation, the city of Porto has seen significant improvements to its water supply, with supply interruptions falling by 22.9% and the number of sewer collapses decreasing by 54%. *Image courtesy of Águas do Porto, EM.*

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CLEARBLACK™ - A SMART SEWAGE TREATMENT & RECYCLING SYSTEM

By Rohan P Vyas, Product Manager - STP Huliot India

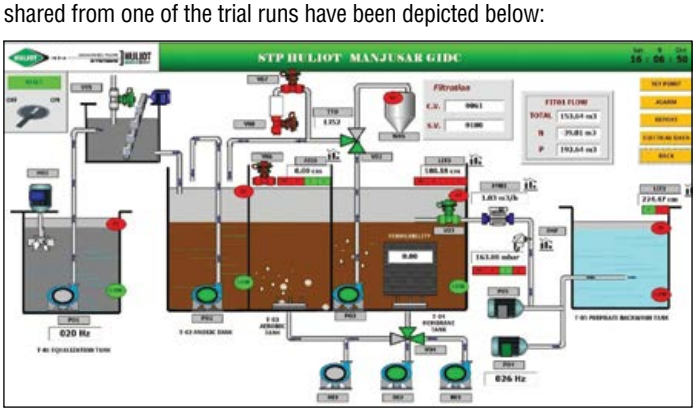
ABOUT CLEARBLACK™

ClearBlack™ is a modular wastewater treatment plant designed and developed by the Huliot Advanced Flow Systems for treatment as well as reclamation and reuse of treated sewage for non-potable purposes.

The system presents the Sewage Recycling and Reuse as the best symbiotic solution complementing the optimization of freshwater resources in the time of ongoing water stress and saving them by getting polluted simultaneously by its untreated discharge into the river bodies.

The development of the system draws its inspiration from Israel's Wastewater Management Policy where about 500 Million cubic meter of sewage is produced in Israel every year and 93% of it is treated and reclaimed for reuse reducing the freshwater demand for agriculture by 25-30%.

The system is designed REAL SMART to operate on its own automatically with Israeli Technology including a Real Time Monitoring System displaying the plant performance on a Smartphone Screen. A Screenshot has been shared from one of the trial runs have been depicted below:



TECHNOLOGY

The system uses the most advanced and efficient technology of MBR combining activated sludge process treatment with submerged membrane filtration. The membranes with a pore size of 0.04 micron separating all the solids in the process, giving away the solids free clear water. This system is the most compact one among all other systems eliminating the secondary treatment of clarification and tertiary treatment of Pressure Sand Filtration and Activated Carbon Filtration.

The system is tolerant to organic and hydraulic fluctuations producing steady high quality with minimal technician attendance and automated cleaning arrangements.

The treatment process strictly adheres the revised norms of treated sewage discharge as per notification of National Green Tribunal of India (NGT) dated 30th April 2019. The system produces an excellent output water quality consistently with following parameters:

Sr. No.	Parameters	Values
1.	pH	6.5-8.5
2.	Oil and Grease	< 5 mg/l
3.	BOD	< 5 mg/l
4.	COD	< 30 mg/l
5.	TSS	< 2 mg/l
6.	Ammoniacal Nitrogen	< 5 mg/l
7.	Total Nitrogen	< 10 mg/l
8.	Fecal Coliform	< 100 MPN/100 ml

A picture of the treated water quality from trial run of 100 KLD in India has been depicted below:

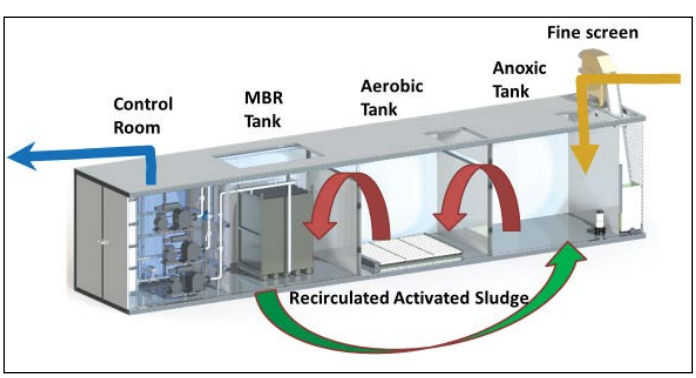
WORKING PRINCIPLE & TREATMENT SCHEME

ClearBlack™ works on the principle of biological treatment of sewage based on the well-known activated sludge process and combines a remarkable ultrafiltration membrane system to consistently produce a colour free, odour free and disinfected treated water safe to handle and reuse.

The treatment scheme for the system is described below:

1. The raw sewage first requires pre-treatment for separation of large solids and Oil & Grease.
2. The pre-treated raw sewage undergoes homogenization in a collection tank and is pumped to the Clearblack™ System. The pre-treated sewage is further screened through an automatic rotary drum screen to separate all the particles larger than 2 mm.
3. The screened sewage enters the Anoxic tank for decomposition of nitrogen compounds which contribute to its pollution. The tank is provided with a mixing arrangement for incoming sewage flow and RAS (Return Activated Sludge) flow.
4. It further undergoes Aerobic treatment in aeration tank for decomposition of compounds of carbon i.e. BOD and COD, which again contribute to its pollution. The tank is installed with a fine bubble diffuser system supplied with air from the blowers.
5. Lastly it enters the MBR tank installed with the membrane system producing exceptionally clean and filtered water. The system is equipped with an automatic cleaning arrangement for membranes. The RAS is recirculated back to the anoxic tank.

A Conceptual Sketch for the treatment scheme inside the Clearblack™ System is depicted below:



APPLICATIONS OF CLEARBLACK™ OUTPUT WATER

ClearBlack™ alters the water management approach from 'use and throw' to a 'use, treat, and reuse' approach for saving the most vital resource on earth by making the treated water available for the following major uses:

i) Flushing

Flushing is usually the biggest water hog and accounts for 35-40 % of water demand. ClearBlack™ will treat the flushed wastewater and recycle it back for flushing again.

ii) Vehicle & Floor Washings

A significant amount of water is consumed in keeping the external floorings clean & hygienic as well as vehicle washings etc. at intervals. ClearBlack™ treats the water wasted in such activities and recycle it for reuse again saving all the water while helping in staying clean and hygienic.

iii) Industrial Processes

The treated water from ClearBlack™ can significantly supplement the freshwater demand in industrial processes and utilities such as Cooling Tower Make-up, Boiler Blowdown Make-up, and Preparation of chemical solutions for ETPs etc.

iv) Gardening

ClearBlack™ is perfectly fit to use for maintaining the greenery for any kind of area including public parks, sports fields, and tracks etc.

v) Ground Water Recharge

ClearBlack™ is absolute solution to recharge ground water to maintain humidity levels in soil.

SLUDGE MANAGEMENT

The sludge management in ClearBlack™ System is made simpler comparative to the existing complex systems in following ways:

- The sludge generated in the system is minimal - almost 1/3rd of the conventional systems.
- The sludge wasting can be carried out in long intervals of 30-60 days.
- There is an option of an additional fully automatic multidisc press for sludge dewatering.
- The dewatering press is provided with the self - cleansing mechanism and requires no manual intervention.
- The power consumption of the dewatering press is incredibly low, between 0.2-0.5 kW only with noise levels less than 65 dB.
- The dried sludge can be disposed/processed/reused in lawns as per the local authority norms.

SALIENT FEATURES OF CLEARBLACK™ SYSTEM

ClearBlack™ is a simple, smart, and reliable solution for sewage treatment, recycling and reuse with following features:

i. 100 % Sewage Recovery
ii. On-Site Treatment, Recycle and Reuse of Available Wastewater for several Non-Potable Purposes
iii. Optimization of Freshwater Resources to Save It for Future Generations
iv. Completely Automated Process Operation with IoT & Smartphone Connectivity
v. No Tertiary Treatment Required
vi. Compact & Modular Design

i. Lower Space Requirement
ii. Lower Power Requirement
iii. Lower Chemical Consumption
iv. Easy Sludge Management

ADVANTAGES & BENEFITS OF CLEARBLACK™ SYSTEM

i. Return on STP Investment is less than 5 Years.
ii. Odour free, Colour free& Disinfected Output Water Safe to Handle & Reuse.
iii. Occupies 50-60% Less Space than Conventional Systems.
iv. Lower Operation Costs due to Lower Power Consumption.
v. The Existing STPs can also be upgraded withClearBlack™ System.
vi. Significant Savings achieved on Energy and Life Cycle Costs.
vii. Can be installed in Remote Areas Having No Sewerage Networks upto Centralized STPs.
viii. Off-Site Operations and Real Time Monitoring for less accessible and remote areas with Online Access.
ix. Process Operation does not require 24 x 7 Skilled Operators.

DISTINCT ADVANTAGES IN PANDEMIC SITUATIONS LIKE COVID-19

i. The sophisticated automation with Israeli Technology allows the system to operate on its own without the requirement of personnel for strict supervision.
ii. The operations monitoring can be carried out online on the Smartphone without the need to daily visit the site.
iii. The Ultrafiltration Membrane System is helpful in restricting most of the bacteria and many viruses in the treated water.

Case study for an Industrial Sewage Treatment

i. We have run our ClearBlack™ STP in an Industry for sewage treatment. Industry has many products like bearings and etc.
ii. In the industry, the parameters were very high like > 900 mg/l COD, > 60 mg/l Oil & Grease and > 150 mg/l Ammonical Nitrogen. The existing plant was of Moving Bed Bio Reactor (MBBR) plant technology for Sewage Treatment. Outlet parameters were not in accordance with CCA of Gujarat Pollution Control Board (GPCB).
iii. Though ClearBlack™ STP was designed for inlet parameters of < 600 mg/l COD, < 10 mg/l Oil & Grease and < 50 mg/l Ammonical Nitrogen, we have installed our ClearBlack™ - STP, and plant was running successfully since April 2021 to December 2021.
iv. Outlet parameters of treated sewage after treatment in ClearBlack™ STP were < 50 mg/l COD, < 12 mg/l Oil & Grease and < 11 mg/l Ammonical Nitrogen.

About the Author

Rohan P Vyas is a B.E. Chemical Engineer and has done M. Tech in Chemical Engineering with specialization in Environmental Process Design. He is also has a PGD in Environment, Health & Safety and is NEBOSH IGC certified.

He has around 8 years of experience in wastewater treatment field including design to execution for Effluent Treatment Plant and Sewage Treatment Plant, treatability studies and detailed engineering. He has thorough knowledge in RO & MEE - Zero Liquid Discharge (ZLD) systems and has developed complete Internet of Things (IoT) based STP system with timer based logic which requires very less manpower.

To know more about the contributor of this article, you can write to us. Your feedback is welcome and should be sent at:
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Entry Free

WHY IS PURITY OF OXYGEN IS SO IMPORTANT IN OZONE GENEARTION?

I have always been advocating that we should not be wasting time in re-inventing the wheel. We need to leave the specialists to do the work they are good at. The oxygen supply to the ozone generator is very important. It has to have the required purity, the required pressure and the required dew point. All the three will affect the performance and the reliability of the system, It for this reason I am always against an Ozone manufacturer manufacturing oxygen system. Of course, if we are able to make a reliable oxygen system that confirms strict specification of the ozone feed gas, it should be ok. Often the oxygen system in not given the requisite importance and resulting in frequent failures of system and the process

PURITY: This has reference to the percentage of oxygen in the gas. Oxygen plants generally produce oxygen at around 93% purity. Liquid Oxygen has about 99% and above purity. This means that if we feed a 93% oxygen, it means that the oxygen gas contains 93% oxygen, and the rest inert gases like Argon etc. To remove the more than 78% Nitrogen from the Air will require special media that is very expensive. The media should also be selected so that it consistently adsorbs the nitrogen required to produce over 93% oxygen gas. Ozone generators are calibrated to produce ozone at different concentrations depending on the volume and purity of the feed gas will affect ozone production, subsequently the process. Most of the time this factor is ignored. Cost of oxygen plants can be manipulated based on the quantity of molecular sieves used and the pre treatment of air

The molecular sieve media is hygroscopic. That means it can absorb moisture if it is exposed and deteriorate in quality, effecting the purity of the oxygen. Small oxygen concentrations that are used take air from the plant room and hence water /moisture in the room, relative humidity can all interfere in the performance. To prevent accumulation of water vapor in the plant room, it is always suggested to have free recirculating air by way of an exhaust fan The systems are to be installed in a dry place .In larger oxygen plants this issue is resolved since compressed dry air is used

Ozone System using small oxygen Concentrators

PRESSURE: Many ozone generators require high pressure (2-3 Bar) oxygen as feed gas. By stipulation of high pressure they are ruling out high dew point (PDP). This is because the higher the air is compressed the more water is removed and the performance of the molecular sieves are far better at higher pressures. Small Oxygen concentrators provide oxygen at very low concentrations (the medical oxygen generators). Small Oxygen concentrators at high pressure are manufactured by very few companies like Sequel, Airsep. They are classified for industrial use and are expensive, Customers often do not want to use them since they are aversed with the high cost-plus service availability if required. Normally these units are very dependable

DEW POINT (Pressure Dew point) Dew point suggests the quantity of moisture in the air. It is specifically important if air is used as feed gas. Using feed gas as air will generate up to 5% ozone concentration (since air has only 19-21% oxygen compared to 93% and above in oxygen). However, in the manufacturing of an oxygen system the PDP of the air feed to the oxygen plant is important since excess moisture will affect the performance of the Molecular sieves. Hence air preparation becomes very important and design of the air preparation will have a bearing up to the ozone production

Therefore, it is important that prospective users of ozone realize the importance of the oxygen system that is supplied with the ozone generator. In my 30 years of experience in ozone, 70% of the issues with ozone systems are due to the oxygen system. Oxygen plants meant for an ozone system have unique specifications and are quite different from oxygen system supplied to other industries like steel plants etc.

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TENDERS

Ownership:
Education & Research Institutes
Tender Value: N.A.
Location: Delhi - India
Closing Date: 15-4-2022
Ref No: 48447129
Annual operation and comprehensive maintenance contract for Effluent Treatment Plant (ETP) having capacity of 2.8 lacs litres per day/280 KLD at nitrd, new delhi for year 2022-25.

Ownership:
Private Sector
Tender Value: N.A.
Location: Kerala - India
Closing Date: 18-5-2022
Ref No: 48433489
Construction of 1.5 MLD Sewage Treatment Plant and associated sewerage network at ottappaalam municipality.

Ownership:
Central Government/Public Sector
Tender Value: N.A.
Location: Gujarat - India
Closing Date: 6-5-2022
Ref No: 48435830
Empanelment notice are invited from the vendors/reputed firms (including existing empanelled vendors under division for below mentioned categories for the empanelment for various jobs category of vendor/firm for supply of (a) Furniture and fixtures- furniture & fittings (wooden & iron) safes. fire/ water proof storage equipment, policy racks, sofa set, chairs etc, purchase of water cooler, water Purifier, fridge. air coolers, photo copier machine, RO Systems, air conditioners, weighing machine, purchase/ maintenance of all types of curtains, telecommunication equipments such as EPABX, fax intercom, CCTV camera suppliers, fire alarm system suppliers etc, purchase of note counting machine, fake note detectors, making of flex board, foam sheet board, employees' name plates, information display board etc, purchase of electrical items like all kinds of fans, emergency light, wall clock, calculators etc. Maintenance contract services - AMC/CAMC for water coolers, air coolers, air conditioner, water Purifiers/RO System/aqua guard, UPS batteries, bundle note counting and note detector machine, fire equipments, lift, electrical repairing and maintenance work, EPABX system, postal franking machine, CCTV cameras, fire alarm system etc.

Ownership:
Corporations/Associations/Others
Tender Value: N.A.
Location: Madhya Pradesh - India
Closing Date: 18-4-2022
Ref No: 48452753
Construction of 100 m3 capacity dewats - decentralized waste Water Treatment system including 05 year of operation and maintenance at sidhha ghat, gwarighat,

Ownership:
Central Government/Public Sector
Tender Value: 101,250,000.00
Location: Madhya Pradesh - India
Closing Date: 16-4-2022
Ref No: 47555355
Provision of central sewage system including STP at cmm

Ownership:
Private Sector
Tender Value: N.A.
Location: Kerala - India
Closing Date: 18-5-2022
Ref No: 48430632
Construction of 1.5 MLD Sewage Treatment Plant and associated sewerage network at municipality.

Ownership:
Corporations/Associations/Others
Tender Value: 14,889,000.00
Location: Gujarat - India
Closing Date: 12-4-2022
Ref No: 48427196
Construction of storm water drainage with water Harvesting at lal bahadur shastri co-operative housing society to patel colony street no. 10 via gokul dham society to kastbhanjan canal in ward no. 3 under 15th finance commission grant.

Ownership:
Central Government/Public Sector
Tender Value: 1,255,455.00
Location: Gujarat - India
Closing Date: 12-4-2022
Ref No: 48428140
Chlorination of drinking water at (for 05 years)

Ownership:
Corporations/Associations/Others
Tender Value: 5,200,000.00
Location: Gujarat - India
Closing Date: 12-4-2022
Ref No: 48454196
Construction of storm water drainage with water Harvesting ganpatnagar to sonalnagar in ward no. 6 under sjmmsvy infrastructure facility grant - 2021-22.

Ownership:
State Government
Tender Value: 704,125,543.00
Location: Gujarat - India
Closing Date: 12-4-2022
Ref No: 48456512
Providing, supplying, lowering, laying and jointing di/pvc pipeline as rising/gravity main, designing constructing WTP, constructing rcc esr/ u/g sumps, pump house, quarters, compound wall, village level sump's, esrs & pump room including connecting line at various village & pumping machineries and electrification at various h/w or sub h/w under limkheda regional water supply scheme with five year o & m turn key project.

Ownership:
Central Government/Public Sector
Tender Value: N.A.
Location: Orissa (Odisha) - India
Closing Date: 11-4-2022
Ref No: 48118352
Design, engineering, manUFacture, supply, construction, erection, testing & commissioning works for the epc package for thermal power project stage- iii (2 x 660 mw), on the basis of single point responsibility, completely covering the following activities and services in respect of steam generator, steam turbine generator, water cooled condenser (wcc), electrostatic precipitator, de-nox ready Plant, flue Gas desulphurization, biomass firing, Water Treatment Plant, liquid Effluent Treatment Plant, clo2 system, condensate polishing Plant(cpu), cw system with ndct, make-up water system, equipment cooling water system, compressed air (instrument & service air) system, air conditioning & ventilation system, fire detection & protection system, coal and biomass handling system inside Plant, external coal conveying system through cross-country conveyor, ash handling system, fuel oil handling system, railway siding for coal rake and ash rake, all electrical systems, complete control & instrumentation, complete civil, structural and architectural works and rooftop solar pv Plants at buildings, workshop & lab equipment covered under the specifications.

Ownership:
Education & Research Institutes
Tender Value: 23,700,000.00
Location: Madhya Pradesh - India
Closing Date: 11-4-2022
Ref No: 48428535
Rain water Harvesting Including De siliting Deepening Work.

TENDERS

Ownership:
State Government
Tender Value: 5,726,000.00
Location: Chhattisgarh - India
Closing Date: 11-4-2022
Ref No: 48438156
Providing, laying, jointing, interconnection, testing and commissioning of upvc dia of pipe 90,110, 140 mm, dia upvc pipe for distribution system 50 mm dia gi pipe class medium , valve specials and all fittings including all allied civil works supplying & installation of energy efficient five star bee rating isi marked required capacity of single phase, 50 hz, 415v, deep well submersible pump steel body, suitable for 150 mm dia tube well with contral panel starter, verification of yield of tubewell, single phase electic connection from cspdcl, Chlorinator room 3.0x4.0x3.0 mtr, & installation of electroChlorinator, providing functional household tap connection(f.h.t.c) in individual households and government institutions, with trial run of completed scheme for operation & maintainence for 06 (six) months of single village scheme electric based piped water supply under jal jeevan mission (jjm) at village girwar (khas,) block gaurella district gaurela-pendra-marwahi (c.g)

Ownership:
Central Government/Public Sector
Tender Value: N.A.
Location: Bihar - India
Closing Date: 11-4-2022
Ref No: 48452011
Providing of security guards, gardener & cleaning services, printing works, furniture supply & repair, stationery, laboratory goods, sports goods, ac window & split, cctv camera, lamination board / banner / flex board etc. supply, r. repair and construction work related to cc water supply and electricity, computer and photocopier machines and related materials and maintenance, materials related to awning, tents, rugs etc., civil and electrical work contracts, supply and maintenance of water Purification materials, repair and construction work related to grill iron, school canteen service, paint and paint related materials and labour services.

Ownership:
State Government
Tender Value: N.A.
Location: West Bengal - India
Closing Date: 8-4-2022
Ref No: 48320969
Operation, maintenance and guarding of mobile Water Treatment unit in the district of bankura under mechanical division, p.h.e.dte.

Ownership:
State Government
Tender Value: 16,072,101.00
Location: Jharkhand - India
Closing Date: 8-4-2022
Ref No: 48448543
Construction & commissioning of fecal sludge Treatment Plant of capacity 6m3/day at majhiaon town by operation and maintenance including desludging operations for 5 years.

Ownership:
Corporations/Associations/Others
Tender Value: 24,760,956.00
Location: Jharkhand - India
Closing Date: 7-4-2022
Ref No: 48433442
Construction and Commissioning of Fecal Sludge Treatment Plant of Capacity of 6m3/day at Majhiaon Town (jharkhand) Follower By Operation and Maintenance Including Desludging Operations for 5 Years.

Ownership:
State Government
Tender Value: 13,979,543.00
Location: Mizoram - India
Closing Date: 7-4-2022
Ref No: 48448286
Jjm scheme.
construction of semi permanent pump house, laying of distribution system, installation of pump motor in / c electrical accessories of panel board, making of sluice valve chamber and extension of domestic connection.
construction of innovative water supply scheme,
,. construction of sedimentation tank, UFff cum ssf weir, providing pipeline & domestic connection and other allied work. construction of semi permanent pump house, installation of pump motor, extension of pipe line and extension of house hold functional tap connection to the consumer in/c other allied work at various places.

Ownership:
Central Government/Public Sector
Tender Value: N.A.
Location: Multi State - India
Closing Date: 5-4-2022
Ref No: 48455184
Consultancy services for preparation of dpr for Provision of Sewage Treatment Plant at naugam under ge 969 ews

Ownership:
State Government
Tender Value: 594,500.00
Location: Haryana - India
Closing Date: 4-4-2022
Ref No: 48454960
Comprehensive annual maintenance of water coolers with inbuilt water Purifiers, plcsupva,.

Ownership:
Central Government/Public Sector
Tender Value: N.A.
Location: Himachal Pradesh - India
Closing Date: 31-3-2022
Ref No: 48427652
Registration of firms for purchase and service work, supply of materials - furniture for school and classroom, flooring work, stationery, sports materials, medal, trophy, painting materials and construction materials, electrical materials, aquaguard system, CCTV camera and related material, musical instrument, P.A. system, teaching aid material, cleaning materials, books for library, tent canopy and sound system, painting material, computer related materials, equipment and material for science laboratory, question paper/magazine in printing work, student dairy, certificate, printing material, for service work - security (security guard, cleaning work and extension services etc), computer, photostat machine, C.C.T.V. camera, A.M.C. of aquaguard, painting work in building and other repair work, transportation (inside and outside of state), tent related materials from firms/agencies for kendriya vidyalaya ghumarvi for the year 2022-23.

Ownership:
State Government
Tender Value: 5,806,000.00
Location: Chhattisgarh - India
Closing Date: 31-3-2022
Ref No: 48428688
Providing, laying, jointing, interconnection, testing and commissioning of 63 mm dia to75 mm upvc 0 mtr , pn-6 pipe 1300 mtr length & 90 mm dia to 110 mm dia upvc class 06 to 10 kg/sqcm with suitable joints length 3733 mtr ms pipe 0 mtr all fitting, valve specials, yield test 3,tw 2, pp2, rcc ohtoht 30/12 nos,steel structure oht 2 nos, Functional House Tap Connections 70, pump house 2, electroChlorinator 0, Chlorinator room 0, bw 0 job, electricity 2 job, sing board complete with trial run six month and operation & maintanance for 06 months under svs of piped water supply scheme under jal jeevan mission for village ladua block shankargarh district.

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