Keywords: Effluent Treatment Plant, Zero Liquid Discharge, Bulk Drug Plant

WASTEWATER AS RESOURCE – SEWAGE TREATMENT & REUSE

There is an ardent need to think deeply and adopt new perspectives towards wastewater to counter water scarcity and other problems and work towards enduring solutions

By Subhash Sethi, Chairman, SPML Infra Limited

42 MLD Sewage Tretament Plant, Kanpur

42 MLD STP, Kanpur

Overview

Freshwater supply is diminishing with each passing day leading to scarcity in several countries across the globe. India is one of these countries that is facing the problem of water scarcity. This problem is real and is becoming extreme as fast–paced urbanization is resulting in an increased demand for clean drinking water and the water supply is increasingly becoming polluted. India is home to 17.7% of the world's population but has only 4% of the world's water supply. As many as 140 million Indians have no access to clean drinking water. The demand for clean water will continue to rise in the coming years. The unsustainable urbanization in the country is causing so much pollution that an increasing amount of water is becoming unsuitable to drink or use for industry and agriculture.

In 1951, the per capita water availability in India was 5,177 cubic meters (m^3) that reduced to 2309 m^3 in 1991, 1902 m^3 in 2001 and 1588 m^3 in 2010. In the next few decades, the demand for water is expected to grow by over 20%, fuelled primarily by the population and industrial growth and it is projected that per capita water availability is likely to be reduced to 1401 m^3 by 2025 and it will further decline to 1191 m^3 by the year 2050. As the availability is declining significantly, the demand is rising and widening the gap between demand and supply. This gap is estimated to reach as high as about 50% by 2030. As the water scarcity is becoming real, India needs a novel approach to freshwater and wastewater management as plugging this huge gap would need an additional investment of about INR 19.5 lac crore in water sector alone.

It is estimated that about 80% of the total water supplied for domestic use gets generated as wastewater. The discharge of untreated sewage in water bodies, both surface and ground, is a major source of water pollution in India. Out of about 62000 million litres per day of sewage generated, treatment capacity for only about 23000 million litres per day exists. Thus, there is a large gap between generation and treatment of wastewater in India. Even the existing treatment plants' capacity is not effectively utilized due to operation and maintenance problems. It is estimated that the wastewater from urban India may cross 120,000 million litres per day by the year 2050 and by that time rural India will also generate not less than 50,000 million litres daily. There is an urgent need for better infrastructure and management with regard to wastewater management.

From the public health perspective, it is estimated that the impact of water–

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Gas Holder at 42 MLD STP, Kanpur

borne diseases in the country affects 37.7 million persons annually, including the death of 1.5 million children from diarrhoea alone. There are more deaths from diseases caused by drinking contaminated water than from HIV/AIDS, malaria & TB combined every year.

Challenges in the wastewater management

If there are good opportunities in the Indian wastewater treatment market, so are the challenges. The biggest of all is the slow pace in implementing policy reforms. Old technologies, traditional methods, and ageing infrastructure present challenges with existing facilities. In the absence of proper management of discharge and reuse of treated water, in most cases, the treated water is released to the sewer line thus making the whole effort inept. The replacement or retrofitting of assets poses another challenge in wastewater treatment plants.

Innovations in wastewater management

Demographic trends and increasing urbanization are the two key factors for the increase in wastewater. Treating this wastewater poses a significant environmental challenge for municipal authorities and industries. The use of innovative techniques like physical, chemical, biological and ultrafiltration treatments are environment–friendly and focus on making wastewater a resource.

The innovations in wastewater treatment have to satisfy a number of criteria:

- To integrate planning with other local services, such as solid waste, organics composting programs, energy and public services so that community benefits are derived from wastewater treatment
- To lower the costs of wastewater treatment through recovery and reuse
- To minimize environmental pollution
- To embrace flexibility, new innovations and technologies that can be employed as they become available for better efficiency

New Technologies for Wastewater Treatment

The technological advancements have led to developing more sophisticated instruments for the treatment and wastewater characterization is likely to improve further. With new equipment and devices, the measurement values in micrograms or even nano–grams per litre can be measured and contaminants present only in traces can also be accurately detected. Some of the new technologies being used for wastewater treatment globally to reclaim the resources are Nanotechnology, Automated Variable Filtration (AVF) technology, New Urban Sanitation technology, Microbial Fuel Cells separation technology among others. The innovations and new technologies and ideas revolve around the simple wisdom – reuse of wastewater that will result in less extraction of water and thus saving the fast depleting natural resources from extinction. It's a good proposition to address the ever–increasing water demands and exploring new ideas for wastewater treatment and optimum reuse.

Future Prospects

Certain practices, if implemented efficiently, can definitely make a difference. In developing countries, pushing for greater efficiency in rain–fed agriculture is a cost–effective way to conserve water, produce more food, and reduce poverty. A research report suggests that agriculture accounts for 74% of global water use, while the industry is responsible for 18% and domestic use is only 8%. Suitable policy measures need to be formulated to encourage the reuse of treated wastewater for irrigation and industrial purposes. Measures may include incentives to Urban Local Bodies (ULBs) to construct treatment facilities using relevant technology, constituting a central and state–level water sector regulator to regulate tariff and quality standards of treated water for reuse. Construction, operation and maintenance of treatment facilities should be given to specialized companies, who will work under the respective ULBs. Municipalities could treat wastewater as per CPCB obligations to supply it to farmers and industries and can even make it a revenue source for themselves.

Developments in wastewater treatment and reuse practices from developed countries could be made available through the creation of an information network, which can serve as a forum for the exchange of information, ideas and knowledge about the latest research, techniques and technological advancements in the realm of wastewater treatment and management practices. Such a network must be broad in scope, addressing various aspects of wastewater management, including appropriate and affordable wastewater collection, treatment and disposal technologies and best practices as well as the planning and regulation issues that are fundamental to wastewater management. With the business environment improving, one can expect several new initiatives aimed at wastewater and sanitation sector. Different industrial segments also offer the varied potential for the wastewater treatment markets.

The Project- Kanpur Sewerage System

With about four decades of experience, SPML Infra has gained a strong foothold in the area of design and construction of wastewater treatment plants. SPML has adopted modern treatment techniques and provide solutions for proper treatment and disposal of municipal and industrial wastewater. This is done to ensure that the generated wastewater does not harm our delicate ecosystem and is recycled for further usage.

Kanpur, the heavily industrialized city of Uttar Pradesh, has several tanneries and other polluting industries. These pose the biggest challenge of the gigantic task of Clean Ganga Mission. The main drain of the city discharges the highest amount of untreated sewage (@138 MLD) into the river and passes through heavily populated and congested areas. The strategy document of the National Mission for Clean Ganga identifies the Kanpur–Varanasi leg as the "most critical stretch" having engineering complexities. As part of the clean Ganga mission, Kanpur Sewerage System is strategically planned and executed to treat the sewage and effluent of the current population of more than 3 million people and numerous industries with inbuilt capacity to handle the future demands for next 30 years.

The municipal area of Kanpur city is divided into 110 wards, out of which 4 wards namely Chakeri (10), Sanigawan (19), Delhi Sujanpur (53) and Shyam Nagar Sujatpur (77) are situated in the city sewerage district – IV. The total area of these wards is 63.85 square kilometre. Ward wise projection of population has been derived from the census population of the year 2001. Base year and design year have been adopted as 2010 and 2040 respectively. This area is open and fast–expanding due to the availability of land for future development. The population of the inner old area of Kanpur city for the base year 2010 is 1.055 lacs and for the design year 2040, is 8.36 lacs. There is no sewerage system in this area. Considering the rapid growth in population as well as sewage production, this sewerage district requires 42 MLD Sewage Treatment Plant to take care of sewage load till the year 2025 before expanding the treatment facility.

The Sewage Treatment Plant of 42 MLD is designed and constructed based on the activated sludge process, including power generation from biogas. Biogas generated in 2 sludge digesters is stored in 2 gas holders with a capacity of each Gas Holder of 675 m^3 and further utilized in 3 biogas engines of 380 KVA capacities for power generation which will fulfil the partial power requirement of the plant. The sewage generated from the Kanpur city population that was usually released to rivers will get treated properly that will significantly help in Clean Ganga Mission.

Challenges faced during implementation

- Land issues by local villagers
- Digging & laying of pipelines in highly populated areas and narrow by–lanes
- Trenchless Technology was used for a critical stretch of the sewage network
- Interconnection of new sewage networks with existing & operational sewage networks was a key challenge in certain sections
- Various clearances were obtained from several government agencies
- Workforce and Skilled Labor not easily available for such large sewerage project
- Safe working environment was ensured with zero accidents
- Design of plants was optimized resulting in saving of land & overall costs
- Political influence by local leaders while executing the project

Process followed for deployment/implementation

- The treatment plant is designed to treat the sewage meeting the specified standard, making it suitable to discharge into disposal point.
- The project is designed and constructed keeping in view the growing population and future demands for the next 30 years.
- City is divided into 110 wards.
- The digested sludge from the digester shall be dewatered on the sludge drying beds and waste dry sludge will be disposed of.
- Overflows from the thickener and digesters and filtrate of sludge drying bed shall be collected back in the raw sewage pump house for further treatment.
- The project is executed with a specialised system for higher safety precautions.

Innovative aspects

- The generated gas will be fed to the biogas engine, which will generate power to meet the partial power requirement of the plant.
- The STP is SCADA based on operation and control from a master control room for better operation and management with lesser human intervention.
- The treated sewage will be reused for gardening, construction and industrial purposes by the municipal corporation.

Benefits of the project

- Contributed towards Clean Ganga Mission
- Environmental pollution will be under control
- Planned disposal of treated wastewater has reduced stagnation of water in stormwater drains
- Septic tank system is completely eliminated, which in turn reduced soil & subsoil water pollution
- Breeding of mosquitos & other insects has reduced drastically
- Outbreak of epidemics and viral diseases reduced effectively
- Better sanitation and cleanliness on the streets and roads, better health and overall clean environment
- Successful laying of sewerage network of 130 km spread in Sewage District IV, which involved digging and laying of pipeline in highly populated areas, interconnections with existing sewage networks and ensuring its complete testing and operations within an agreed time frame.
- Successful installation, commissioning and operations of two units of 14 MLD Intermediate Pumping Stations at Chakeri & Sanigwan, one unit of 42 MLD Main Pumping Station and one unit of 42 MLD Sewage Treatment Plant within agreed time frame.

About the Author

Mr. Subhash Sethi is the Chairman of SPML Infra Limited, a leading Engineering and Infrastructure Development organization in India with over 600 completed projects in the domains of Water, Power, Sanitation, Environment, and Civil Infrastructure. Under his leadership, SPML Infra went on to establish itself as the leader in water domain and developed sustainable infrastructure to help water utilities to deliver safe and clean drinking water to over 50 million people in India.

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