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IMPACT OF SOCIOECONOMIC COST ON RECYCLING WASTEWATER IN URBAN INDIA

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ABSTRACT

Public health and sanitation are intertwined when it comes to sewage and sewage treatment. Around 70-80% of the entire amount of water used for household purposes is disposed of away as wastewater. Industrial and agricultural water demand necessitates the collection, purification, and reuse of wastewater as a viable alternative to freshwater. Industrial and agricultural water demand, future urban expansion areas, and ULBs all benefit from the use of treated wastewater as a source of money, as well as the ability to reduce greenhouse gas emissions. In irrigation and groundwater pumping, the use of fertiliser has the ability to generate energy, decrease GHC emissions, and be implemented as a CDM project. 17 billion cubic metres (BCM) of treated wastewater resources are available if wastewater created in 2030 is taken into account and 80% of it is treated. In terms of industrial need in 2025, this 17 BCM treated wastewater supply will meet about 75% of that requirement. A fourth of the country's drinking water needs will be met by this project. Key design issues that affect the feasibility of reuse programmes include tariff, quality & cost of treatment, cost of convenience, and residuals disposal costs Municipal wastewater treatment, agricultural and industrial sector potential, treatment costs and other economics for sewage treatment, reuse and recycling initiatives in different ULBs in India have been proven in the present research.

***KEYWORD**: Waste water treatment, technologies, reuse & recycle, treatment cost, tertiary treatment*

INTRODUCTION

When it comes to appropriate water supply and sewage disposal, urban India, in particular, has enormous issues. In many Indian cities and villages, water scarcity has become an ongoing issue. However, it is often not enough to fulfil the increasing demand for water from all economic sectors at one time. Per capita, water availability has decreased from 1,816 cubic metres in 2001 to 1,545 cubic metres in 2011 as a result of population growth. According to the most recent census, just 70% of urban homes in the United States have access to piped water service. The average daily water consumption for these homes falls well short of the required 135 litres. Between 2015 and 2050, India is predicted to generate 404 million additional urban residents. (2) Rapid urbanisation is expected to be accompanied by increased industrial production and an accompanying rise in energy consumption. Urban water shortages are being exacerbated by a rise in water demand from families, enterprises, and power plants. Due to the severe water constraint in industrial metros like Chennai, Bengaluru, and Delhi, the cost of freshwater production and industrial water prices have increased significantly. To lessen the impact of this approaching problem, freshwater alternatives are needed. Using recovered water or treated wastewater as a source of income is another option that is becoming more popular. 1. Ministry of Water Resources, Press Information Bureau (PIB), 2. World Urbanization Prospects 2014, 3. United Nations (UN), New York.

WATER SUPPLY & SANITATION INFRASTRUCTURE IN URBAN INDIA

An increasing population in India's metropolitan areas is putting a strain on the country's infrastructure and services such as water supply and sanitation. Poor hygiene practices as a consequence of insufficient sanitization cost the nation much. WSP (2011) estimates that in 2006, this loss amounted to around 6.4% of India's GDP. It's a win-win situation for the environment and the economy if municipal wastewater is collected, treated, and reused. It's also possible to recover nutrients and energy from wastewater in addition to making recycled wastewater a beneficial water supply. It is estimated that 70% to 80% of the water provided for home consumption is created as wastewater. Class-I cities and class-II towns (72 per cent of India's urban population) generate an average of 98 LPCD of wastewater per capita, whereas the National Capital Territory-Delhi generates more than 220 LPCD of wastewater per capita. Around 38000 MLD of wastewater is created, according to one estimate, from 723 Indian cities and towns with populations of 50,000 or more. Only 31% of the wastewater produced in these cities can be treated by the current wastewater treatment capacity. Class I and Class II cities in India produce at least 67 percent and more than 90 percent of India's wastewater that has not been treated, making it unsuitable for beneficial or safe reuse of wastewater. From 377 million in 2011 to 590 million in 2030, the urban population is predicted to expand by more than 50 percent and the volume of urban wastewater to approximately 60,000 MLD as a result of current population growth (1.7 percent per year and 3 percent per decade). There would be an increase of 400 percent in the amount of accessible treated wastewater if 80 percent of urban wastewater could be treated by 2030. In 2025, if this extra 17 BCM of treated wastewater resource is caught, processed properly, and recycled, this is comparable to over 75 percent of the estimated industrial water demand and almost a quarter of the entire projected drinking water demand in the nation.

THE GROWING URBAN SANITATION CHALLENGE

There are a number of issues for the provision of urban infrastructure and services such as water supply, urban sanitation, solid waste management and drainage in urban India as a result of this fast growth. Whilst home or communal sanitation is available to 87% of the country's urban population, there is still a problem with the collection, treatment and disposal of wastewater. On-site sanitation methods are used by 47% of all houses since sewage networks only reach 33% of them. Due to inadequate treatment capacity in metropolitan areas, poor coverage is further aggravated. According to the Central Pollution Control Board (CPCB), India produced around 38,000 MLD of wastewater in Class I cities and Class II towns (housing more than 70 percent of the urban population). Only 11,788 MLD of the total wastewater produced in these two types of metropolitan areas can be treated at the current wastewater treatment capacity, which accounts for around 31% of the total. About 72% of the current treatment facilities are not being used to their full capability (CPCB 2009a). Class I and II urban towns and cities produce more than 75% of their effluent on land or in aquatic bodies without any treatment. Large-scale environmental damage and public health risks are the result. 80 percent of the country's surface water is polluted by discharges of untreated or inadequately treated effluent into land or bodies of water (CPCB 2007).

TECHNOLOGY OPTIONS & TREATMENT LEVEL

There are a variety of methods for dealing with wastewater. The treatment of sewage water is done in phases in order to gradually increase the treated water's quality. BOD, TSS and nutrient concentrations are the most critical water quality metrics in the event of sewage contamination (nitrates and phosphates). Wastewater treatment methods may be classed according to the place in which they are given and the sort of treatment they provide. Treatment system location will determine the management system's type: onsite, decentralized or off-site. The latter requires substantial underground sewers to transport wastewater from the treatment facility to the treatment facility off-site. Each of these systems is unique in terms of geography, demographics, and finances. There is a growing pressure on service providers for capital and operational expenditures, and as a result, not enough income is realized in the lack of demand for this high quality water.

The typical treatment costs (including capital and O&M expenditures) associated with various degrees of wastewater treatment were calculated by CPCB (CPCB 2012) in their study. After accounting for more modern treatment methods including membrane ultra-filtration (UF) and reverse osmosis, the researchers found that wastewater treatment costs quickly rise. UF raises the yearly treatment cost from INR 34/kL (USD 0.649) to INR 52/kL (USD 0.97) when combined with a reverse osmosis module, and this cost rises to INR 73/kL (USD 1.37), when the water is also treated with a reverse osmosis module. Financial considerations, client characteristics, and their willingness to pay for treated water should all go into making a decision like this. In addition to the kind of therapy, another important categorization factor is the level of care delivered. In order to get rid of the trash, the first step is to use physical sedimentation or coarse screening to remove the particles from the water. The organic content in the wastewater is removed by some kind of biological treatment, which lowers the biochemical oxygen demand (BOD). It is the goal of both primary and secondary treatment to remove enough pollutants from effluent (also known as STW) before it can be safely released into nearby waterways. As part of the reuse/TTP project, the BOD and TDS levels may be further reduced to extremely low levels, as well as the dissolved pollutants and nutrients such as nitrates and phosphates, which may be present in the water. This is the most advanced degree of treatment. In comparison to traditional secondary treatment, advanced treatment (nutrient removal/reverse osmosis/advanced disinfection) is often more capital-intensive and comes with higher operating and maintenance expenses. Many peri-urban communities rely on the STW for agricultural purposes. However, STW must be tertiary treated in order to generate industrial-grade water for our specified purpose of industrial reuse. Following are the steps of industrial water treatment and their related grades:

Conditions like the amount of mineral concentration in the influent and the technology utilised to treat it at earlier stages determine which treatment stages and how they are employed. For some of the therapy phases, there are many technological options. This means that in order to obtain the necessary output, reuse projects must choose the most cost-effective technology-based on influent quality. Technology choices and demand patterns in a given location will influence treatment costs. SBR, ASP, sand filtration, microfiltration, and RO disinfection are significant phases in the tertiary treatment process for the production of industry-grade reclaimed water in this study.

ECONOMIC & FINANCIAL BENEFITS OF WASTEWATER RECYCLING & REUSE

When it comes to meeting industrial and agricultural water demands, treated wastewater plays a critical role. A number of nations have implemented some degree of wastewater recycling and reuse. Wastewater recycling may be used for a variety of purposes, including irrigation in agriculture, for municipal needs, and in industry. Industries and agriculture are two major consumers of recycled wastewater, as will be addressed in the following paragraphs.

1. Wastewater Recycling to Meet Agricultural Water Demand

Treatment and channelling of India's urban wastewater (estimated at 38,000 MLD in Class I and II cities) to fulfil agricultural irrigation needs would provide 14 BCM of irrigation water, enough to irrigate 1 to 3 million hectares of land (ha). Although the overall irrigation water demand in 2025 is expected to be 910 BCM, the amount of wastewater generated in 2009 (14 BCM) is substantial when examined in proportion to the national efforts to expand the area under irrigation in prior FYP years. During the 10th FYP era, 4.59 million hectares of major and medium irrigation potential were established, while 0.71 million hectares of surface water-fed minor irrigation potential were developed (MoWR 2011). Nearly three times the surface water-based minor irrigation potential, the WWI potential (2 million hectares) represents 44% of the major and medium potential outlined in the 10th plan.

2. Potential for New Urban Growth Areas

In certain new urban areas, such as Jaipur, Rajasthan, wastewater recycling and reuse is a vital part of urban water and sanitation programmes. As Nearly all rural and urban water delivery systems in Rajasthan rely on the extraction of groundwater as their primary source of supply. Groundwater supplies in the state are deteriorating at an alarming rate to keep up with rising demand. 172 of the state's 243 blocks are classified as "overexploited" (2011 assessment). As a result, Jaipur has launched a project to process and reuse the city's wastewater for industrial and non-domestic purposes, such as flushing toilets (through a dual piping system in all new urban growth areas under development). The projects are being developed and thorough project reports are being prepared for the plan.

3. Sale of Recycled Water – a Source of Revenue for ULB

Depending on the demand and availability of alternative water supplies, ULBs running well-managed STPs may be able to sell treated effluent to industrial clients. For the delivery of recycled wastewater, they may charge industrial clients according to the treatment given and the quality of wastewater. In Chennai, treated wastewater is sold to industries for INR 8-11 KL-1 (USD 0.13 - 0.1823), and the cash produced by this sale is sufficient to pay the O&M expenditures of the treatment facilities. It's purely anecdotal throughout much of the nation, although certain utilities do provide cleaned wastewater to various industrial uses. A number of ULBs have tried a variety of approaches to reusing and reselling cleaned wastewater.

4. Potential of Nutrients

It is possible to extract important nutrients (NPK) from wastewater and reuse it for irrigation or other purposes, or to recycle it. In India, the use of treated wastewater for irrigation may decrease the requirement for synthetic fertilisers by up to 40%. A rich supply of nutrients for plants may be found in wastewater, which planners at all levels of government need to recognize as an economic asset. The Central Pollution Control Board (CPCB 2009a) assessed a nutrient load of 347.56 tonnes per day in about 6,400 MLD of wastewater produced daily from these cities in India's coastal cities during its study (the treatment capacity against this is about only 3,050 MLD, which is about 47 per cent of the total wastewater generation). The nutritional potential of wastewater has been determined to vary from 0.054 to 0.073 tones by much additional research. Other components that may affect the acceptability of reusing treated or untreated wastewater in agriculture should be taken into account when appraising the nutrients contained in wastewater. Soil and river salinity may be affected by the excessive salinity of the wastewater that is being treated, which is of particular importance. Wastewater and crop salinity thresholds will have a significant influence on agricultural production.

5. Reduction in Fertilizer Use

Agricultural fertilizer subsidies in India are important to the success of the country's agriculture industry, which relies significantly on government subsidies. In general, the soils of India are deficient in K and P. In order to satisfy its fertilizer demands, the nation must rely on imports of potash (100%) and phosphate (90%). About 80 percent of India's need for fertiliser is met by urea (a source of N), which is manufactured in the country. At almost INR 700 billion in 2012-2013, the federal government's fertiliser subsidy burden was predicted to quadruple by the 12th FYP's conclusion in 2016-2017. However, the intrinsic nutritional content of treated wastewater irrigation into agricultural fields has the potential to cut dependency on fertiliser by roughly 40%. The planned projections for the 2017/18 fertiliser subsidies have not altered. (It's around 700 billion Indian rupees). The yearly fertiliser subsidy might be reduced by INR 1.3 billion based on existing wastewater output, irrigation potential projected for wastewater in India, and the accompanying potential to decrease fertiliser use in wastewater watered regions.

6. Increase in Overall Farm Income

Farmers who use treated or untreated wastewater in their farming have an advantage over those who use freshwater because their yields are greater, their fertiliser needs are lower, and the quality of their food is better, leading to higher pricing for their produce, according to numerous studies. Some cities in India have seen a 30 percent rise in farmers' income when they just utilise freshwater, compared to when they use both freshwater and recycled water. With an average landholding size of about 1 hectare in India, and the potential to support 2 million farmers and increase their annual farm earnings by INR 17,000 ha/year, or about 30 percent over the baseline levels, channelling the entire amount of treated wastewater towards agriculture has a significant impact. (Only freshwater is used).

MARKET POTENTIAL FOR REUSE

Industrialization and increasing urbanization are two of the most important current developments in India. Energy and water use increase as the industrial footprint rises. By 2050, it is predicted that water consumption for both the energy and industrial sectors is expected to increase by 3.7 times and 2.2 times, respectively. What follows is a look at the expected increase in industrial water usage.

When human use is taken into consideration, the yearly utilisable freshwater supply will fall from 491 billion cubic metres in 2020 to 135 billion cubic metres in 2050 if current trends continue. The most dependable supply of water for these industries will be the reuse of reclaimed water. Depending on the quality of the processed water, wastewater recycling may benefit both utilities and industrial clients in meeting a portion of their industrial water demands. Customers in the industrial sector can now afford to pay for the treatment of their wastewater. A joint evaluation by the Ministry of Environment and Forests and the Central Pollution Control Board (CPCB) identified 88 industrial clusters distributed across 21 Indian states. An estimated 36% of India's total wastewater (from all Class I and Class II towns) might be recycled for industrial use inside these 88 industrial clusters. A quarter of the present industrial water demand may be met by recovered wastewater from Class I and Class II cities (17 BCM including demand for energy). Even with such a high demand for water, there will be little to no market for recovered water. Some critical design factors that affect the feasibility of reuse projects must be addressed if recovered water is to meet this demand. There are a variety of factors, such as proximity to industrial areas with access to treated water, the cost of alternative water sources, water tariffs, and transportation distance, all of which increase the upfront and ongoing costs of reuse projects and have an effect on the industry's water tariff. In the next part, we'll address some of this feasibility.

CONCLUSION

Based on the foregoing observations, it was imperative to encourage the reuse of treated wastewater. To do this, the federal and state governments should collectively establish a national wastewater reuse policy with defined policy goals and legislative, regulatory, and financial mechanisms to attain those goals. Water quality standards for various classes of industrial water, defined jointly by the Environment and Water Resources Ministries, will aid in standardizing the design of re-use systems throughout the country. The legitimacy of reclaimed water as a dependable alternative requires national standards for water safety planning and risk management. A city-level urban wastewater reuse strategy must be developed initially, followed by individual project feasibility studies that are more in-depth. Detailed industrial water demand assessments are also part of the project's argument. This demand assessment would also serve to establish the amount of therapy and other design issues involved in the project's implementation. The ULB SPCB and the state's industrial development organization should work together. Additionally, utilities/ULB should be compelled to provide a financial strategy for dealing with ongoing operations and maintenance costs. There might be state-level seminars to educate utility management about water reuse possibilities, new requirements, legislative incentives, implementation issues and best practices in procurement. Infrastructure development in India's water industry has always been supported entirely by government. To fulfil industrial water demands in light of growing water shortages in many Indian cities, it is imperative that the government devote money and efforts to the development of wastewater reuse. Reusing wastewater may be a difficult road ahead for utilities and the government, but the long-term rewards are enormous.

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