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RESEARCH ARTICLE

WASTE WATER CIRCULARITY AND ITS RELATED INCENTIVES IN INDIA

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Abstract

In today's world, rapid population growth and urbanization have intensified pressure on natural resources, particularly water. Approximately half of the global population, around 4 billion people, experience water shortages for at least one month annually, with projections indicating that 1.8 billion may face "absolute water scarcity" by 2025. Wastewater exacerbates this strain, with untreated discharge posing severe health and environmental risks. In India, addressing wastewater circularity is imperative for sustaining a population of over 1.3 billion, supporting industries, curbing pollution, and conserving resources. Although policies exist at both national and state levels, only 11 states have operationalized wastewater reuse policy wise. Focusing on the basis for wastewater circularity, the need for incentives is paramount. The kinds of incentives, current scenario in India and way forward have been discussed in the paper.

Introduction:-

"Although two thirds of our planet is water, we face an acute water shortage. The water crisis is the most pervasive, most severe, and most invisible dimension of the ecological devastation of the earth."

-Vandana Shiva

In today's world of exponentially increasing population, urbanization and rapid waste generation, the strain on our natural resources, have increased multifold. Water is one of the most essential natural resources needed for sustaining life and operations. Minimum 50 percent of the global population, which is about 4 billion people, deal with water shortfalls atleast one month of the year. By 2025, 1.8 billion people are likely to face what the Food and Agriculture Organization (FAO) calls "absolute water scarcity" (UNEP, 2024).

While incessantly straining on the water resources, we also generate a considerable amount of wastewater. The dumping of untreated or inadequately treated wastewater in the environment causes pollution, which is calamitous for public health, biodiversity and the quality of natural water resources. According to Suez Group, 2.6 billion people live without access to enhanced sanitation services, 50% of the world's fresh water reserves are polluted and 80% of wastewater is discharged directly into the natural environment without prior treatment in developing countries. The wastewater generated needs to be safely disposed and treated to strengthen climate resilience while the recyle and reuse of it can cater to a sustainable circular economy.

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Similarly in India, wastewater treatment and its reuse are essential to help the country cater to over 1.3 billion population and address demands of growing industries, increasing urbanization, reduce water pollution and related health concerns, and prevent environmental degradation. Wastewater treatment needs requires a multi-faceted approach involving infrastructure development, policy reforms, technological innovation, public sensitization, and more. Treated wastewater, reclaimed water or recycled water, can be reused for various purposes, apart from being directly discharged into the environment. Reuse applications include irrigation of crops, landscaping, industrial processes, toilet flushing, and groundwater recharge. Reusing treated wastewater conserves freshwater resources, reduces demand on potable water supplies, and mitigates environmental pollution.

Every state in India has policies, guidelines or mandates on wastewater treatment, though the aspects may differ based on geography and need. There are National frameworks outlining the same. However, the recycle and reuse of wastewater has been operationalised in only 11 states of the country. In addition, a national-level framework on the safe reuse of treated water that provides guiding principles on preparing reuse policies was launched only as recently as November 2022.

Wastewater Reuse and Circular Economy

Wastewater treatment, reuse, recycling, and the circular economy are interrelated concepts that play crucial roles in sustainable water management and environmental conservation. Here's how they are related:

Wastewater Treatment:

Wastewater treatment involves removing contaminants from water. This process helps prevent water pollution and protects public health. Different treatment methods, such as manual, physical, chemical, biological and hybrid processes, are employed to treat wastewater to different levels of purity based on its intended reuse.

Reuse:

Treated wastewater, also known as reclaimed water or recycled water, can be reused for various purposes instead of being discharged into the environment. Reuse applications include irrigation of crops, landscaping, industrial processes, toilet flushing, and groundwater recharge. Reusing treated wastewater conserves freshwater resources, reduces demand on potable water supplies, and mitigates environmental pollution.

Recycling:

Recycling in the context of wastewater management refers to the recovery of valuable resources from wastewater or its by-products. For instance, the nutrients like phosphorus and nitrogen can be recovered from wastewater and used as fertilizers in agriculture. Similarly, energy can be generated from organic matter in wastewater through anaerobic digestion or other bio-energy processes. Recycling wastewater by-products promotes resource efficiency and reduces waste generation.

Circular Economy:

The circular economy is aimed at minimizing waste and maximizing resource efficiency by closing the loop of material flows. In the context of wastewater management, embracing a circular economy approach involves viewing wastewater not as a waste product to be disposed of but as a worthy resource that can be reused, recycled, recovered and restored. By integrating principles of the circular economy into wastewater management practices, such as resource recovery, sustainable design, and innovative technologies, it is possible to create more resilient and sustainable water systems.Treated wastewater being discharged into natural spheres like recharging groundwater, discharging into rivers, etc., while adhering to the quality standards set, are also ways of closing the loop.

There are a number of global frameworks and guidelines supervising upon the circular economy of water, out of which the Water in Circular Economy and Resilience framework is more holistic for reference to plan action. The WICER framework developed by the World Bank Group aims to promote sustainable water management practices by integrating principles of the circular economy and resilience-building strategies. It states that:

Resource Recovery:

It focuses on recovering valuable resources from wastewater and other water sources. This includes the recovery of nutrients, energy, and water itself through various treatment and recycling processes. By recovering resources from water, WICER aims to create economic value and reduce the environmental impact of water management practices.

Resilience Building:
It integrates resilience-building strategies into water management to enhance the ability of communities and ecosystems to withstand and recover from water-related challenges, such as floods, droughts, and water quality issues. This involves implementing measures such as nature-based solutions, infrastructure upgrades, and risk management strategies to improve water security and adapt to climate change impacts.

Sustainability:
It promotes sustainable water management practices that balance environmental, social, and economic considerations, including to ensure equitable access to water resources, minimize water pollution and degradation, and foster partnerships and collaboration among stakeholders to achieve common water management goals.

Capacity Building and Knowledge Sharing: It supports capacity building initiatives and knowledge sharing platforms to enable governments, organizations, and communities to implement the framework effectively. This involves providing technical assistance, training programs, and access to best practices and innovative solutions in water management.

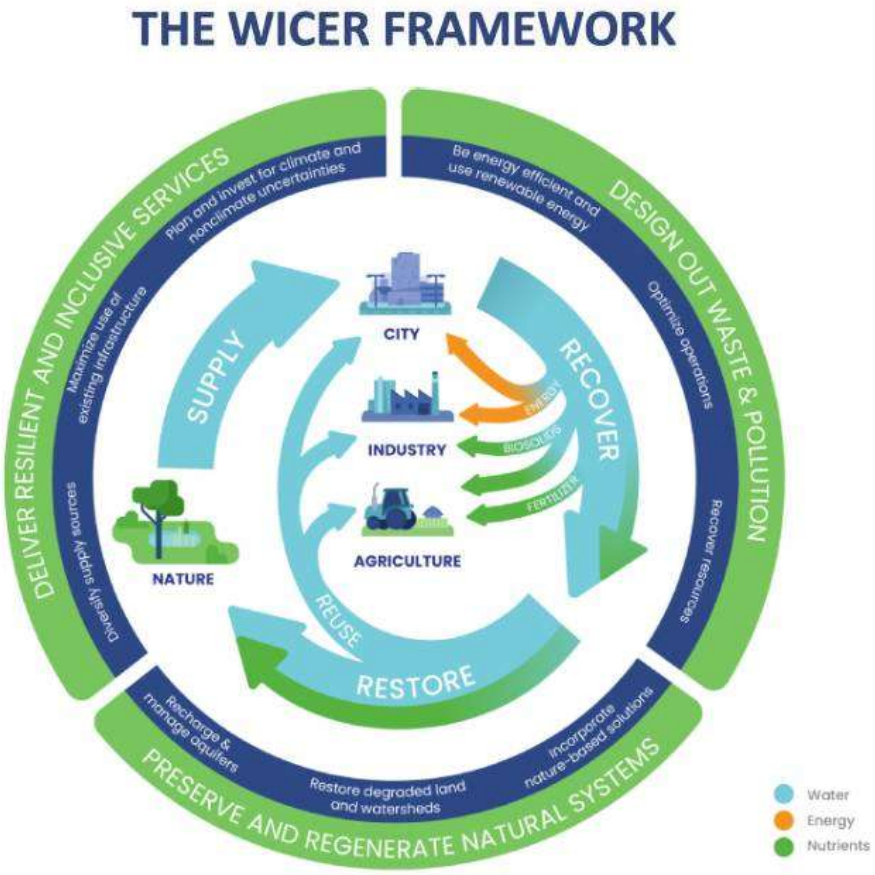

Fig 1:- The Water in Circular Economy and Resilience (WICER) Framework by World Bank (World Bank, 2021).

Benefits of Circular Economy:
Adopting integrated approaches that combine wastewater treatment, reuse, recycling, and circular economy principles offers several benefits:

1. Conservation of freshwater resources
2. Reduction of pollution and environmental degradation
3. Enhancement of water and food security
4. Promotion of sustainable economic growth and job creation
5. Mitigation of climate change impacts
6. Improvement of public health and well-being
7. Meeting water demands along with existing water systems

In summary, wastewater treatment, reuse, recycling, and the circular economy are essential components of sustainable water management strategies. By maximizing the value of wastewater as a resource and minimizing its environmental footprint, societies can achieve greater resilience, prosperity, and environmental sustainability.

There is an estimate that 96,378 MLD (or 35,178 million cubic meters per annum) of treated wastewater will be available for reuse by 2050. This offers significant prospects for utilizing treated wastewater for non-potable applications across diverse sectors

Roadmap on Compliances of Wastewater Treatment, Recycle and Reuse in India

As outlined in the seventh schedule of the Constitution of India (Article 246), 'Water' falls under the jurisdiction of the States as a State subject. It is the duty of the States/Union Territories (UTs) to uphold the cleanliness and foster the development of rivers within their respective territories. The National level policies, guidelines and mandates to aid wastewater treatment and protect water bodies from the direct flow of untreated sludge have been formulated and implemented in India since its inception with the Water (Prevention & Control of Pollution) Act of 1974. It serves as comprehensive legislation regulating agencies responsible for monitoring water pollution. This Act delineates the responsibilities of pollution control boards at both the central and state levels. Under the Water Act of 1974, it is prohibited to discharge sewage or pollutants into water bodies, including lakes. State pollution control boards are mandated to intervene and halt such activities.

The Environment (Protection) Act of 1986 applies to all establishments, agencies, or individuals releasing pollutants into the environment. The term "pollutant" encompasses both treated and untreated sewage. Municipalities must adhere to discharge standards for effluents discharged from sewage treatment plants and are subject to paying water cess under the Water Cess Act of 1977. The National Environment Policy (NEP) of 2006 builds upon preceding policies that tackled environmental challenges and underscored the imperative of sustainable development. Its objectives include preserving and safeguarding vital ecological systems and resources. National Urban Sanitation Policy (NUSP) 2008 aimed to convert all urban areas into community-led, thoroughly sanitized, healthy, and livable cities and towns. Its objective was to ensure and maintain optimal public health and environmental benefits for all residents.

The Handbook on Service Level Benchmarking (2010) by the Ministry of Housing and Urban Affairs (MoHUA) recommends a 20% sewage recycling and reuse benchmark for urban areas. The Manual on Sewerage and Sewage Treatment (CPHEEO) of 2013, issued by the Central Public Health and Environmental Engineering Organization under the Ministry of Housing and Urban Affairs (previously known as the Ministry of Urban Development), provides technical standards for optimal practices in on-site sanitation and wastewater management. It offers guidance on planning, design, and construction for different technical solutions, along with recommendations for operation and maintenance. Additionally, the manual outlines measures to prevent water pollution across diverse soil and groundwater conditions. The Model Building Bylaws of 2016 require wastewater recycling and reuse for "all buildings discharging a minimum of 10,000 litres or more per day. The recycled water must be utilized for horticultural purposes."The National Faecal Sludge and Septage Management Policy of 2017 aims to accomplish 100% access to safe sanitation, integrated urban sanitation, and the safe disposal of faecal waste. It also mandates stringent environmental discharge standards while advocating for an appropriate, cost-effective, step-by-step approach to meeting these standards.

The Atal Mission for Rejuvenation and Urban Transformation (AMRUT) is geared towards furnishing essential services such as water supply, sewerage, and urban transport to households. Its overall aim is to elevate the quality of life for all residents, focusing on uplifting the socio-economically disadvantaged segments of society.The Swachh Bharat Mission I, 2014, along with Swachh Bharat Mission II, 2020, also integrates wastewater management and the reuse of treated water to achieve its sanitation objectives. Emphasizing the efficient treatment of sewage, the initiative advocates for the establishment of sewage treatment plants and decentralized systems across India. Additionally, it promotes the reuse of treated wastewater for non-potable purposes. By encouraging the adoption of water-efficient technologies and raising public awareness, the mission strives to mitigate water scarcity and environmental pollution while fostering sustainable development. Through a number of such efforts, Swachh Bharat Mission endeavors to ensure cleaner communities and healthier ecosystems for the nation's populace.

In November 2022, The National Framework on Safe Reuse of Treated Water was released. The Framework encompasses the non-potable reuse of wastewater from urban and rural areas. It advocates for an integrated and

comprehensive approach to managing the water cycle, promoting connections to established and forthcoming policies on sanitation, fecal sludge management, and the recycling of industrial wastewater. These efforts are situated within a broader framework of river basin planning and initiatives to mitigate the effects of climate change. It serves three distinct purposes for SRTW (Sewage and Reclaimed Water Treatment) from the national to the local level by:

1. Mandating the reuse of treated wastewater for various non-potable purposes. Establishing principles to integrate into the planning and design of SRTW projects, while encouraging the adoption of national standards for different uses.
2. Providing a mechanism to support SRTW initiatives through incentives such as access to funding programs, as well as disincentives and facilitating uptake across the country at the central level.
3. Offering a model policy framework for states to consider and customize in the development and improvement of their own policy, regulatory, and implementation measures.

The Framework also suggests Business models for implementation of SRTW. They include Minimum guarantee and fixed price model, Reuse buy-back model, Reuse PPP model - investment by end user. This Framework however doesn't state any comprehensive pricing mechanism or incentive for reuse.

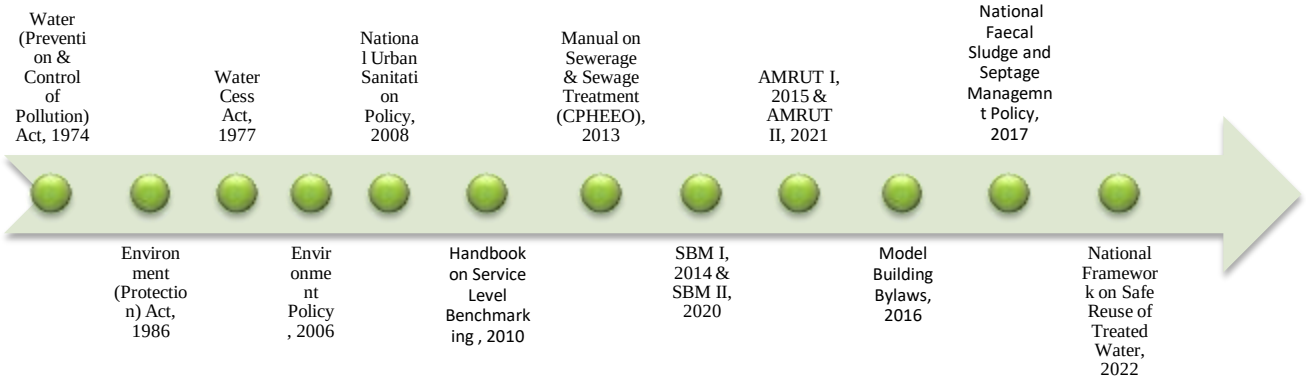

Fig 2:- Roadmap of Indian Wastewater Policies and Compliances (Source: Figure created by author based on stated findings).

Incentives: The Need for it and its Kinds

The severity of the water crisis in India is increasing with each passing day. The reuse of treated wastewater can act as a crucial resource to meet the rising demands across different sectors while reducing the pressure on freshwater resources (Kim et al., 2018). Incentives to safely dispose and treat wastewater and act upon its reuse and recycle, while acting upon strengthening climate resilience are essential to encourage governments, industries, local municipalities, and other stakeholders are necessary to invest in sustainable water management practices.Wastewater treatment and its reuse require extensive on-ground baseline data collection, historical data analysis, intensive research, policy/guidelines creation and implementation, colossal infrastructure investment and resource investment for behavioural change. The work is tedious and strainful, requiring dynamic improvements as need be, and hence incentives to various stakeholders to make it possible are essential for motivation.

There are several kinds of incentives that can be implemented to promote wastewater treatment and reuse, some of the commonly used ones in leading practices are:

Financial Incentives:

1. Subsidies and Grants: Governments can provide financial assistance, subsidies, or grants to industries and municipalities to offset the initial capital costs of wastewater treatment infrastructure upgrades or the implementation of water reuse projects.
2. Tax Incentives: Tax incentives, such as tax credits or deductions, can be offered to businesses that invest in wastewater treatment and reuse technologies or demonstrate significant water conservation efforts.
3. Low-Interest Loans: Access to low-interest loans or financing programs can facilitate investment in water reuse projects by reducing the financial burden on stakeholders and encouraging private sector participation.
4. Sustainable bonds: Sustainability Bonds are financial instruments used to support projects that cater to environmental and socio-economic development. They can be issued by international bodies like World Bank

(Blue Bonds, Green Bonds, etc.), by National or state governments (Municipal Corporation Bonds, Impact bonds in India), and designated Banks.

Regulatory Incentives:

1. Compliance Assistance: Regulatory agencies can provide technical assistance and guidance to help businesses and municipalities comply with wastewater discharge regulations and standards. This can include assistance in selecting appropriate treatment technologies and optimizing treatment processes.
2. Flexible Permitting: Regulatory agencies can adopt flexible permitting approaches that incentivize water reuse and resource recovery. This may involve streamlining permitting processes for water reuse projects or providing regulatory incentives for facilities that exceed minimum treatment requirements.

Market-Based Mechanisms:

1. Water Trading Systems: Implementing water trading systems or water markets can incentivize water reuse by allowing stakeholders to buy, sell, or trade water rights or allocations. This creates a financial incentive for industries to invest in water reuse technologies and practices to reduce their water consumption and operating costs. This can cater to forming wastewater financial sustainability.
2. Economic Valuation of Ecosystem Services: Recognizing the economic value of ecosystem services provided by treated wastewater, such as nutrient recycling, habitat creation, and groundwater recharge, can incentivize investment wastewater treatment and reuse projects.

Public Recognition and Certification:

1. Recognition Programs: Governments, industry associations, or certification bodies can establish recognition programs or certifications for businesses and municipalities that demonstrate excellence in wastewater treatment and reuse practices. Public recognition can enhance the reputation of organizations and incentivize others to follow suit.
2. Green Building Certifications: Green building certification programs, such as LEED (Leadership in Energy and Environmental Design), can incentivize developers to incorporate water reuse systems into building designs by awarding credits or points for sustainable water management practices.

Collaborative Initiatives:

1. Public-Private Partnerships: Governments can liason with private sector to develop public-private partnerships (PPPs) for financing, building, and operating wastewater treatment and reuse infrastructure. PPPs can leverage private sector resources and expertise to accelerate project implementation and achieve cost savings.
2. Industry-Wide Initiatives: Industry associations and coalitions can facilitate collective action and knowledge sharing among businesses in a particular sector to promote best practices in wastewater treatment and reuse. Industry-wide initiatives can create economies of scale and collective benefits that incentivize participation.

Environmental Incentives:

1. Water Quality Improvement of Natural Resources: Wastewater treatment removes pollutants and contaminants from water, improving its quality before it is released into the environment. This prevents the pollution of natural water bodies like rivers, lakes, and oceans, which are crucial for aquatic ecosystems and human use.
2. Preservation of Soil Quality: When untreated wastewater is used for irrigation or seeps into the soil, it can contaminate the soil and affect its fertility. Wastewater treatment helps remove excess nutrients like nitrogen and phosphorus, which can cause eutrophication in water bodies. Hence, wastewater treatment ensures that harmful substances are removed before water is reused for agriculture, preserving soil quality and preventing contamination.
3. Conservation of Biodiversity: By maintaining the health of aquatic ecosystems and reducing pollution, wastewater treatment supports biodiversity conservation. Healthy ecosystems provide habitats for diverse species and contribute to ecosystem services like water purification, flood control, and carbon sequestration. Untreated wastewater can contain harmful substances like heavy metals, pathogens, and organic pollutants; this can be toxic to aquatic organisms. By treating wastewater before discharge, we protect fish, plants, and other aquatic life from the negative impacts of pollution.

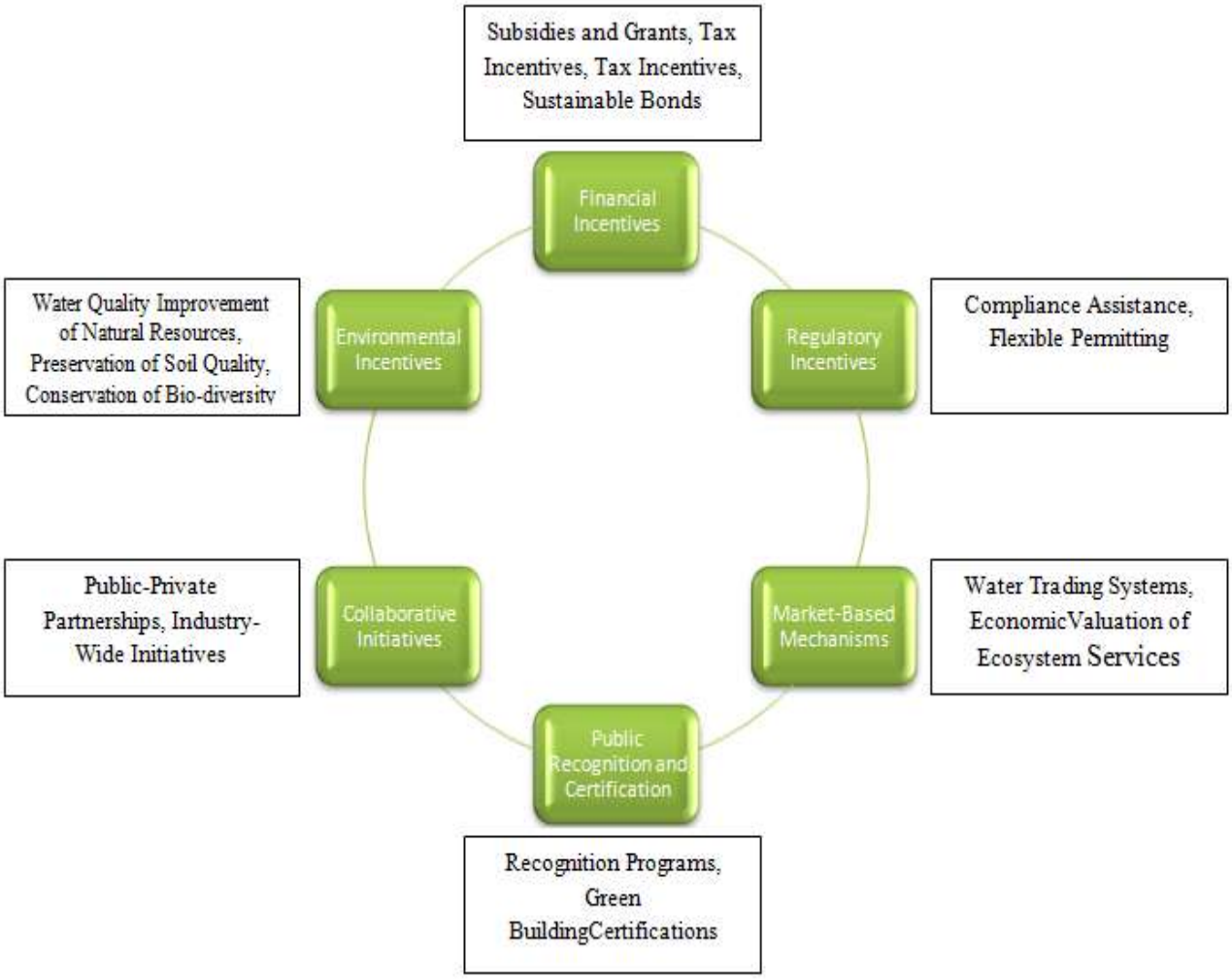

Fig 3:- Snapshot of the kinds of Incentives(Source: Figure created by author based on stated findings).

By implementing a combination of financial, regulatory, market-based, and collaborative incentives, the governments, businesses, and communities can foster a culture of sustainable water management and incentivize investment in wastewater treatment and reuse infrastructure. These incentives can help address water scarcity, reduce pollution, and enhance water security while promoting economic growth and environmental sustainability.

Water Reuse Incentives in India

The incentives in India have been issued by International Bodies, Government of India, State Governments and Banks for various wastewater projects, aiding a range of beneficiaries like Individuals, communities, governments, private sector industries, and other organisations. Discussing on the kinds of incentives, the avenues are many, but the takers have been sparse in certain kinds like financial ones of sustainability bonds/loans.

To understand the urgency of promoting Treated Water circularity and its related incentivisation for better motivation, it is necessary to first know about the market value of Treated Waste Water in India. According to the Ministry of Housing and Urban Affairs, Government of India, in 2021 the standard market rate for treated wastewater was INR 20 per kilolitre. Based on this information, it was estimated that the market value of the treated wastewater available in 2021 (11,622 MCM) exceeds INR 630 million. This potential value could be realized through the implementation of a system facilitating the sale of treated wastewater to various sectors for reuse at its full market price. Additionally, projections suggest that the market value is likely to increase substantially in the coming years, reaching over INR 830 million in 2025 and INR 1.9 billion in 2050, assuming the current market rate remains constant (Bassi, 2023).

The incentives scopes in the national and state level are stated below:

National Level Incentives

On the National front, conservation of natural resources, preservation of health and sustenance of bio-diversity can be the major environmental incentives from wastewater treatment.Water restoration by ensuring that polluted water doesn't flow into water bodies is also a part for water circularity and indirect reusage. Apart from conservation, financial sustainability through water circularity can prove to be a major incentive for the Nation. Unfortunately in India, there is no policy or Act which mandates the reuse of wastewater and ensures water circularity. While there are supportive policies in place like the National Framework on Safe Reuse of Treated Water, clear guidelines with detailed provisions have yet to be released.

In 2015, approximately half of India's population, estimated at around 568 million individuals, faced the challenge of safe defecation as they were defecating in fields, forests, water bodies, or other public areas due to inadequate access to toilets. This practice amounted to tonnes of faeces introduced daily into the environment. According to UNICEF, this situation contributed to nearly 100,000 diarrhoeal deaths of children under five years in India. In 2017, a whopping 70% of India's wastewater is released untreated, polluting surface and ground water sources, and posing a great risk to public health (Sushmita Mandal, 2017). Inadequate sanitation could impede national development by causing workers to fall ill, shortening their lifespans, reducing productivity and income, and preventing them from providing education and stable futures for their children. Moreover, insufficient water, sanitation, and hygiene (WASH) services in India's healthcare facilities contributed to the high neonatal mortality rate.

Over the years, there have been major changes in the wastewater collection and management to aid in the betterment of health and environment. A major step includes relentless efforts through Swachh Bharat Mission, by which on October 2, 2019, Prime Minister Narendra Modi announced India's achievement of becoming open defecation free (ODF). The number of operational sewage treatment plants doubled between 2014 and 2020 (Statista, 2024). As of 2024, all states in the country have policies/regulations for water treatment and conservation, while 11 states have regulations in place for waste-water reuse.

According to Central Pollution Control Board, in FY 2016-2017,the number of polluted river stretches identified was 351. A coordinated arrangement of both centralized and decentralized wastewater treatment systems were needed in urban and rural areas across India. After several interventions of the government through policies, guidelines and mandates as stated earlier, the river pollution reduced drastically. In FY 2019-2021, the number of polluted river stretches identified was 311, which shows an improvement in the water quality of 40 river stretches in just 4 years.

However, we still have a long way to go in order to ensure 100% wastewater treatment and to consider the treated wastewater as a resource to reduce stress on the freshwater resources. According to the latest CPCB Annual Report of 2020-2021, India produced 72.4 billion liters of wastewater per day. During this period, there were 1,093 operational sewage treatment plants capable of processing 26.9 billion liters of wastewater daily. However, approximately 400 plants were either non-operational or undergoing construction. Consequently, only 37% of sewage underwent treatment, amplifying the risks associated with communicable diseases and the contamination of food and drinking water. According to NITI-NFSSM-Alliance-Report of 2021, approximately over 700 cities/towns were in various stages of Faecal Sludge Implementation. Hence this has been a huge gap to fill in wastewater treatment and a major push in this case can be lucrative incentives for different stakeholders, from asset creation till usage and reusage.

The Incentive needed for creation and implementation of the sustainability projects, especially which aid in climate resilience and circularity can be availed throughInternational bodies like World Bank, commercial banks, and PPP (Public Private Partnership) models. Some common ones include sustainability loans, bonds and hybrid financing models.

One such model is of the Sovereign Green Bonds (SGrB). The budget division of the Ministry of Finance forwards projects sanctioned by Green Finance Working Committee (GFWC) for bond issuance via the Reserve Bank of India (RBI). These bonds, labeled as sovereign green bonds, are authorized by the central bank to fund environmentally friendly endeavors. There are 9 eligible categories under SGrB which include Sustainable Water and Waste Management, Pollution Prevention and Control, and Climate Change Adaptation. Ghaziabad Nagar

Nigam, a civic body in Uttar Pradesh, is the first Indian local government to have issued a green bond (USD eq 20 million in 2021). Indore Municipal Corporation issued USD 87 million in green bonds in 2023 (World Bank Blogs, 2023).Ghaziabad Nagar Nigam got 150 crore INR worth Green Bond issued at 8.1% rate of interest for 10 years, to construct a 40 MLD Tertiary Sewage Treatment Plant. This is to fund a part of the 293.93 crore INR project to supply treated water to 1765 Sahibabad Industries and conserve groundwater. The project shall cost over 12 crore INR in total annual interest. But once the plant I fully operational, it shall produce 18 lakh INR of daily revenue, with treated wastewater priced at 45.9 INR per Kiloliter as per MoU with Sahibabad Industries Association. Hence, once the plant is functional in full capacity, the cost interest shall be recovered in just 67 operational days and the project cost of 293 crores in 1628 operational days or in less than 5 years, taking downtime, holidays and lower sewage flow into consideration. Therefore, this project shall be revenue generating project in a matter of half a decade, thus ensuring financial sustainability along with water circularity and climate resilience.

Year of Study	2018	2022
Year of Water Quality Data for Study	2016 & 17	2019 & 21
Number of River monitoring locations sanctioned under NWMP during the study	1533 (NWMP network of 3000)	2026 (NWMP network of 4294)
Data sets available for BOD parameter	521 rivers - 1488 locations (793 > 3mg/L)	603 rivers - 1920 locations (817 > 3mg/L)
Priority Class	Number of polluted river stretches	
I (> 30 mg/L)	45	46
II (20-30 mg/L)	16	16
III (10-20 mg/L)	43	39
IV (6-10 mg/L)	72	65
V (3-6 mg/L)	175	145
Number of Polluted River Stretches identified	**351**	**311**
Number of Rivers identified as polluted	**323**	**279**
Number of States/UTs in which polluted rivers identified	**31**	**30***

* No polluted rivers identified in Sikkim

Fig 4:- Comparative Assessment of Polluted river stretches in India (Source: Central Pollution Control Board, 2022).

PPP based Hybrid Annuity Model (HAM) is another practiced method of green financing. In this, generally the government pays 40% of the project cost and the remaining 60 percent is paid over 15 years as annuities to the private alliance along with other working capital costs. The Sarai 14 MLD Sewage Treatment Plant in Haridwar stands as the inaugural sewerage project finalized through the Hybrid Annuity (HAM), with an expenditure of Rs. 41.40 crores. Impressively, the plant was completed ahead of its projected schedule. The advantages of HAM include(CEPT University, 2018):

1. Government agencies obligated to only gather 40% of the initial funding upfront, while the remaining 60% is sourced by the private entity
2. Government assumes responsibility for obtaining all environmental and land clearances, minimizing project commencement delays and thus reducing private sector risks associated with construction delays

3. Provision of assured annuity payments offers reassurance to potential lenders and financing institutions, facilitating debt provision to private contractors.
4. The model incorporates inflation-adjusted project costs over time, particularly for projects with implementation periods exceeding one year, as well as for O&M expenses. This serves to mitigate inflation risks.
5. Performance-based annuity payments also create appropriate incentives for private sector providers.

State Level Incentives

The state-level incentives have provisions in terms of state policies, bank-based aids, and local municipality-based loans or bonds. Currently, only 11 states in the country have policies or guidelines specifically for Wastewater Reuse, and out of them, only 5 states have provisions for incentives. Around 61% of the Municipal Bonds Issuances in India have been for WaSH (Water, Sanitation and Hygiene) Projects, from 1997 to 2023-2024. Most of the WaSH Projects fall under the Eligible "Green Project" taxonomy by SEBI (Drishti Dwivedi, 2024).

The Municipal Bond market has been incentivized by Government of India over the years, resulting in the maximum issuances post 2015. Under the AMRUT Scheme since 2015-2016, Government promoted incentivisation to issue Municipal Bonds. 227 crore INR has been released as incentive to AMRUT linked ULBs for bonds issuance. Online Bu0ilding Permission System (OBPS) has been made operational in 2,465 towns including 457 AMRUT cities to facilitate online issuance of construction permits (Press Information Bureau, 2022). Under the Smart Cities Programme since 2019, there have been workshops conducted on Sustainable Financing & Municipal Bonds for 25 ULB's. Since 2023, Government is providing Incentivisation to issue Green Municipal Bonds, 10 crore INR has been incentivized out of 100 crore INR raised (Drishti Dwivedi, 2024).

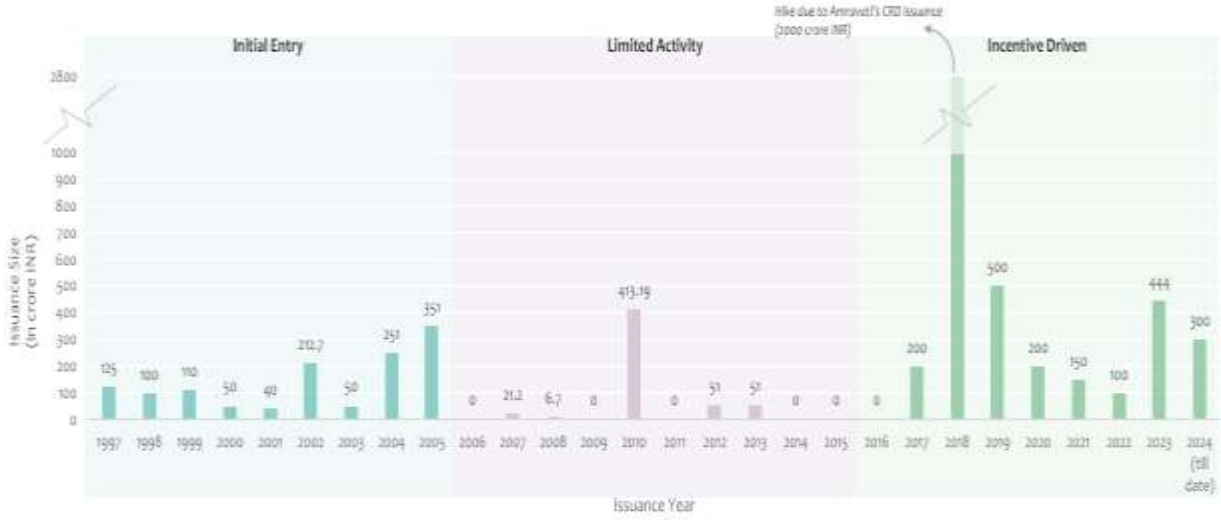

Fig 5:- Municipal Bond Issuances in India (Sourced from Drishti Dwivedi, 2024).

The Vadodara Municipal Corporation (VMC) has set a regional example by introducing its Rs. 100 crores (equivalent to USD 12 million) Certified Green Municipal Bond, which is not only the first of its kind in India, but also the entire Asia region. This initiative has been geared towards promoting sustainable urban development in line with the Paris Agreement and focuses on improving liquid wastewater management infrastructure.

The policies and regulations of the five states in the country which have outlined incentives for reuse of wastewater are as follows:

Jharkhand

The Jharkhand Waste Water policy, 2017, states four kinds of tax incentives which are:

Individual Households:

All Individual Households of Resident Welfare Associations (RWAs) will receive a 10% reduction in property tax if all individual households within their jurisdiction treat their wastewater in a decentralized manner and reuse it within their colonies, subject to local regulations.

New Apartments:
Newly constructed apartments that implement compulsory wastewater treatment and reuse within their premises will receive a rebate of 10% of the construction permit fee or 2,00,000 INR, whichever is lower.

New Infrastructure Buildings:
New establishments such as malls, hotels, industries, clubs, colleges and universities, hospitals, and sports stadiums must mandatory treat and reuse treated water. In return, they will be eligible for a rebate of 10% of the construction permit fee or 2,00,000 INR, whichever is less.

Wastewater Tax:
A separate tax category named 'Wastewater Tax' shall be established within the property tax system to cover the operation and maintenance costs of the sewage infrastructure.

Karnataka
Government Order No: FEE 188 ENV 2003, Bangalore dated 14-08-2003, mandates the use of tertiary treated water for non-potable purposes, including gardening; washing, servicing and cleaning of vehicles; and civil construction activities; and roads and bridges in Bangalore city.

The sectoral incentives by Karnataka Government related to wastewater include:

Reimbursement of expenses incurred for Water Audit include:General Category: For All Zones 75% subject to maximum of 1,00,000 INR each forwater audit (one time); and for Special Category: For All Zones 75% subject to max. of1,00,000 INR each for water audit(one time).

Wastewater Recycling: As per the Karnataka Urban Waste Water Reuse Policy, not less than 20 per cent secondary treated water (STW) is targeted, as a combined average across sectors, of total urban wastewater generated for identified Karnataka Urban Centres by 2020, aligning with the national Service Level Benchmark and with the AMRUT program.

Madhya Pradesh
According to the Govt. of Madhya Pradesh State Level Policy (2017) for Waste Water Recycle & Reuse and Fecal SludgeManagement (FSM), the state shall adhere by the AMRUT Guidelines Para 12 on Urban Reforms, which states that 10% incentive shall beprovided to the State / ULBs on the basis of self – assessment done by the States.

It also states that each ULB should devise a system tailored to its specific needs. The ULB or water supply authority could implement a fee collection system from households and utilize the funds to compensate the contractor for each truckload of septage delivered to the treatment facility. This approach would incentivise the contractor to responsibly manage the septage instead of resorting to indiscriminate dumping, as is presently the case. Such a system has the potential to generate revenue and serve as a financial motivator for the ULBs.

The policy also emphasizes the importance of implementing a system to incentivize citizens through various means, such as enhancing their public image for commendable efforts and offering discounts on charges for septage collection and disposal. Incentivisation for Research and Development of human resources and security of their jobs are also mentioned.

Rajasthan
As defined under Micro, Small and Medium Enterprises Development Act, 2006, Water Conservation and Green Measures Subsidy entails reimbursement for the following:

Fifty percent of the expenses incurred on a water audit conducted by any Government-empanelled or Government-approved agency, capped at a maximum of 2,00,000 INR.

Fifty percent of the payment made to suppliers for plant procurement, excluding civil work, for the establishment of zero liquid discharge-based effluent treatment plants.

Fifty percent of the payment made to suppliers for plant procurement, excluding civil work, for the implementation of Green Building Measures in buildings with a minimum floor space of 2000 square meters.

Fifty percent of the payment made to suppliers for plant procurement, excluding civil work, for the establishment of a "Reuse and Recycling of Industrial Waste Plant," capped at a maximum of 50,00,000 INR, and provided as one-time assistance.

The maximum total subsidy, is limited to 50,00,000 INR and is offered as one-time assistance only.

Maharashtra
The Maharashtra State Water Policy, 2019, by the Water Resources Department states that the Recycle and reuse of water after treatment of sewage wastewater is to be done by the specified standards, and should be incentivised through a properly planned tariff system."

Emerging Incentives and Way Forward
There are several emerging sustainability models which can be tapped upon like the Blue Bonds by World Bank, and leveraging the National Green Credit Programme launched in October 2023 in India. Similarly, the existing models can be tapped upon for incentivisation as well.

On the Policy front, only 11 states in the country have exclusively created a policy for wastewater reuse, there is the need for other states to formulate their own by analyzing their local situations and needs. There should be a system of pricing of treated wastewater and strategies to map it for reuse and restoration. In those policies, incentives need to be well outlined and implementation strategy briefed.

Conclusion:-

For Treated Wastewater reuse, directed subsidies and incentives for both operators and end-users can serve as catalysts. For example, incentivizing residents' welfare associations or housing colonies for establishing decentralized wastewater treatment facilities within gated colonies could encourage on-site treatment and reuse. A valuable insight drawn from the experiences of other nations is the significance of ensuring the financial sustainability of water reuse projects, a lesson that can inspire various states in India. Global practices indicate that a diverse array of funds is essential to guarantee financial viability. This may include investments from the private sector, public equity, loans from multilateral institutions, bilateral engagements, and similar avenues.

Nevertheless, establishing an effective pricing mechanism for treated wastewater (TWW) is imperative. This mechanism should be based on the market potential of TWW and should take into account the diverse categories of end-users and their capacity to pay. By doing so, the aim is to alleviate or recover the costs associated with wastewater treatment, thereby aiding in the commercial viability of reuse projects for the implementing authorities. Policy formation and implementation in these lines are the need of the hour. While the National Framework on Safe Reuse of Treated Water offers guidelines, the implementation of a comprehensive pricing mechanism represents a step forward in this direction.

References:-

1. Global water shortages are looming - here's what can be done about them. (n.d.). UNEP. Retrieved from:https://www.unep.org/news-and-stories/story/global-water-shortages-are-looming-here-what-can-be-done-about-them#:~:text=At%20least%2050%20per%20cent,calls%20%E2%80%9Cabsolute%20water%20scarcity.%E2%80%9D
2. Anna Delgado, Diego J. Rodriguez, Carlo A. Amadei and Midori Makino: World Bank Group. (2021). Water In Circular Economy and Resilience (WICER)
3. Sharma, D., & Singh, S. (2016). Instituting environmental sustainability and climate resilience into the governance process: Exploring the potential of new urban development schemes in India. International Area Studies Review. https://doi.org/10.1177/2233865916632942
4. Kim, Narae, Swastik Das, KangkanikaNeog, and Rudresh Sugam. 2018. The Perfect Storm – Pathways to Managing India's Water Sector Sustainably. New Delhi: CEEW.
5. Namani Gange, Government of India. 2022. National Framework on safe reuse of Treated Water

6. Water (Prevention & Control of Pollution) Act, 1974, Government of India
7. Environment (Protection) Act, 1986, Government of India
8. Water Cess Act, 1977, Government of India
9. Environment Policy, 2006, Government of India
10. National Urban Sanitation Policy, 2008, Government of India
11. Manual on Sewerage & Sewage Treatment (CPHEEO), 2013, Government of India
12. Swachh Bharat Mission, Government of India
13. Handbook on Service Level Benchmarking, 2010, Ministry of Housing and Urban Affairs, Government of India
14. Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Government of India
15. National Framework on Safe Reuse of Treated Water , Government of India
16. Kim, Narae, Swastik Das, KangkanikaNeog, and Rudresh Sugam. 2018. The Perfect Storm – Pathways to Managing India's Water Sector Sustainably. New Delhi: CEEW
17. Bassi, N., Gupta, S., & Chaturvedi, K. (2023, March). Reuse of Treated Wastewater in India: Market Potential and Recommendations for Strengthening Governance.
18. Mandal, S. (2017). Wastewater: One of the Greatest Untapped Opportunities for Sustainable Development in India. International Water Association. https://iwa-network.org/wastewater-one-of-the-greatest-untapped-opportunities-for-sustainable-development-in-india/
19. Water Quality Management (I) Division. (2022). River Stretches for Restoration of Water Quality - 2022. Central Pollution Control Board India. Retrieved from: https://cpcb.nic.in/openpdffile.php?id=UmVwb3J0RmlsZXMvMTQ5NF8xNjcxNzc3ODg2X21lZGlhcGhvdG8xODc0Ni5wZGY=
20. Statista. (2024). Development of Number of Operational Sewage Treatment Plants and Annual Sewage Generation in India. Statista. Retrieved from: https://www.statista.com/chart/32296/development-of-number-of-operational-sewage-treatment-plants-and-annual-sewage-generation-in-india/
21. Geeta Shreeprabha. (2024). Sovereign Green Bonds: Fuelling India's Sustainability Revolution.
22. World Bank Blogs. (2023). India Incorporates Green Bonds into Its Climate Finance Strategy. World Bank Blogs. Retrieved from https://blogs.worldbank.org/en/climatechange/india-incorporates-green-bonds-its-climate-finance-strategy#:~:text=Ghaziabad%20Nagar%20Nigam%2C%20a%20civic,in%20green%20bonds%20in%202023.
23. CEPT University. (2018). Hybrid Annuity Model for Sanitation. Retrieved from https://www.pas.org.in/Portal/document/UrbanSanitation/uploads/Hybrid%20Annuity%20Model%20for%20Sanitation%20April%2023%202018.pdf
24. Drishti Dwivedi. (2024). Review Of Green Bonds For Urban WaSH Infrastructure Investments. CEPT University. CWAS. Retrieved from https://cwas.org.in/resources/file_manager/Review%20of%20Green%20Bonds.pdf
25. Press Information Bureau. (2022). Status of AMRUT. Retrieved from https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1881751#:~:text=%E2%82%B9227%20crore%20has%20been,online%20issuance%20of%20construction%20permits
26. Jharkhand Waste Water policy, 2017, Government of Jharkhand
27. Madhya Pradesh State Level Policy (2017) for Waste Water Recycle & Reuse and Fecal Sludge Management (FSM), Government of Madhya Pradesh
28. Rajasthan Micro, Small and Medium Enterprises (Facilitation of Establishment and Operation) Act, 2019, Government of Rajasthan
29. Maharashtra State Water Policy, 2019, Water Resources Department, Government of Maharashtra.