

## **DRINKING WATER PRICING IN INDIA: THEORIES AND PRACTICES**

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### **ABSTRACT**

Water pricing has emerged as a pivotal concern in urban water management in India, driven by escalating water shortages, rapid urbanisation, and the rising demand for fair and sustainable water supply systems. In light of these issues, the Indian government has progressively acknowledged the necessity of revising drinking water pricing systems to enhance efficiency in water distribution, guarantee equal access for all, and attain full-cost recovery for water services. This study investigates the theoretical underpinnings of drinking water pricing, emphasising the various models and frameworks utilised worldwide and specifically in India while assessing their practical results within the Indian context. The paper references significant literature addressing the theoretical foundations of water pricing, including cost recovery, efficiency, and equality, and examines their implementation in India's urban regions characterised by diverse governance frameworks and socio-economic conditions. This article examines the practical issues associated with adopting drinking water pricing in Indian cities, including tariff structures, the effects of decentralised governance, and the influence of non-revenue water and also investigates the opportunities for water tariff reforms. This paper synthesises various international and domestic studies to understand the strengths and limitations of water pricing strategies in India while

**proposing recommendations for reforming these policies to improve service delivery and foster sustainability in water management.**

**KEYWORDS: Water Pricing, India, Cost Recovery, Water Management, Drinking Water Tariff.**

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## I. INTRODUCTION

Water is an important resource that is necessary for the continued existence of human civilizations as well as their further growth. However, the growing population, fast urbanization, and industrialization are all contributing to the depletion and deterioration of drinking water resources. The current water delivery system in India is antiquated, and the issue is worse owing to insufficient funding and inadequate maintenance. The existing tariff rates are inadequate to produce enough income to pay the financial costs of the utility. Tariffs established by governments below cost recovery levels do not incentivize utilities to offer services to significant population segments, often leaving low-income consumers underserved. Conventional pricing structures, such as flat rates, do not consider the comprehensive economic and environmental costs of water distribution, resulting in inefficiencies and overconsumption (Renzetti, 2002).

This study discussed the challenges in implementing effective water pricing in India and along with this what can be the opportunities for water tariff reforms in India. Water is not only essential for life but water is also an essential component in the process of economic growth. Population growth, urbanization, and industrialization have all contributed to a rise in the demand for water over the last several decades. This has led to a significant reduction in the amount of renewable water resources that are available annually per person. The under-pricing of water, on the other hand, may give the impression to the person who is purchasing that the actual worth of water is at the low-price level that the customers are paying. If water utilities and local communities want to accomplish an effective distribution of the limited water resources, the design of the water pricing structure is a significant problem that must be addressed.

## II. REVIEW OF LITERATURE

Rising urban populations, water shortages, and the need for fair and sustainable distribution models have all increased the significance of water pricing in India. The current literature underscores various essential theories and practices concerning water price and cost recovery,

particularly focusing on their implementation within the Indian context. (Renzetti, 2002) studied conventional pricing structures, such as flat rates, for neglecting to consider the comprehensive economic and environmental costs of water distribution, resulting in inefficiencies and overconsumption. Renzetti promotes volumetric and tiered pricing approaches to foster conservation and accurately represent genuine costs, while also addressing equality issues to guarantee affordability. His investigation of price elasticity in water demand underscores the capacity of pricing techniques to effectuate substantial decreases in water consumption, especially within the agricultural and industrial sectors.

This study provides a comprehensive framework for incorporating economic principles into water resource management, establishing it as an important reference for research on sustainable water policies (Aggarwal et al., 2013). Assert that water pricing in metropolitan regions is essential for demand management and the financial sustainability of water supply systems. They contend that the lack of cost-reflective pricing results in inefficiencies in water distribution, over-extraction, and considerable financial losses. This perspective is concluded by research that promotes complete cost recovery in water services, wherein the money from tariffs encompasses the total expenses of water distribution, including infrastructure upkeep and environmental safeguarding (Gupta, 2011; Birkenholtz, 2010). The practical application of this pricing model has been challenging since it frequently encounters resistance from consumers to subsidized rates (Gupta, 2011).

One important area of study in urban water pricing is tariff structures. Diverse models have been suggested to enhance equity, efficiency, and conservation. The increasing block tariff (IBT) scheme is a frequently analysed tariff structure. This method raises water prices with increased consumption, promoting conservation and minimizing waste. Arbués et al., 2004 employed dynamic panel data models to examine the effect of IBTs on residential water demand, concluding that this pricing approach effectively encourages reduced consumption, especially in industrialized nations. Nonetheless, in India, the IBT approach has shown inconsistent outcomes. Boland & Whittington, 1997 Warn against the extensive implementation of IBTs, contending that it may intensify disparities in metropolitan regions, where affluent households gain from subsidies, while disadvantaged households endure a disproportionate impact of increasing rates. In India, the difficulty of cost recovery persists as a crucial issue. Bagchi, 2003 studied underscores the complexity of attaining cost recovery within a decentralized urban administration framework, wherein local authorities may be deficient in their ability to implement efficient

pricing mechanisms. The disproportionate allocation of water resources, insufficient infrastructure, and absence of technical proficiency at the municipal level frequently hinder the formulation and execution of efficient pricing strategies. (Mehta & Pathakr, 1998) Content that although cost recovery is essential for sustainability, it must be executed progressively and meticulously, prioritizing the protection of vulnerable groups. Non-revenue water (NRW) presents an additional challenge to the execution of cost recovery in Indian cities. (Mukherjee et al., 2015) assert that elevated levels of non-revenue water—water generated but unbilled—pose a substantial obstacle to the efficiency of urban water delivery systems, exemplified by Bangalore. Leakage, theft, and defective metering systems add to these losses, hindering utilities' ability to collect expenses and sustain infrastructure.

Mathur & Thakur, 2003 highlighted the necessity of advancing metering systems, diminishing non-revenue water (NRW), and augmenting operational efficiencies to guarantee the efficacy of water pricing reforms. The social and political aspects of water pricing have been extensively examined. (Dinar & Subramanian, 1998) Content that effective water price plans should be customized to local circumstances, considering socioeconomic inequalities and the political economy of water allocation. In India, water is both a resource and a highly politicized matter, frequently associated with access, inequality, and social justice. (Birkenholtz, 2010) Examines the situation in Jaipur, where the implementation of full-cost recovery policies faced opposition from low-income consumers concerned about being excluded from water access due to increased costs. (Singh et al., 2005) Assert that urban water pricing must achieve a balance between economic efficiency and social equality to prevent the exacerbation of already-existing imbalances. Although global experiences offer valuable perspectives on water price practices, the Indian setting poses distinct issues. (Katko, 1990) in his research examines cost recovery in water supply systems in underdeveloped nations, concluding that although full cost recovery is an aspiration, gradual advancements might result in significant enhancements in service delivery. This viewpoint corresponds with the suggestions of (Whittington, 2003) emphasized the necessity of establishing the appropriate tariff that takes into account both the expenses of the water supply and the socio-economic circumstances of metropolitan communities. International experiences indicate that India may gain from a slow and progressive implementation of water pricing changes, accompanied by targeted subsidies for at-risk populations, enhanced governance, and more public knowledge. In summary, the literature indicates that water pricing

in India has substantial obstacles regarding cost recovery, tariff structure, and governance. Nevertheless, it highlights multiple chances for reform, especially via the implementation of progressive tariff frameworks, the reduction of non-revenue water, and meticulous consideration of social and political conditions. Subsequent research ought to investigate the effectiveness of pilot projects and case studies from Indian towns, alongside the impact of technology breakthroughs on enhancing water supply management and minimizing losses.

### **III. OBJECTIVES OF THE STUDY**

- A. To study the key challenges during the implementation of effective water pricing in India.
- B. To discuss the opportunities for water tariff reforms in India.

### **IV. RESEARCH METHODOLOGY**

The study utilizes a comprehensive review technique to analyse the theoretical underpinnings and actual implementations of drinking water pricing in India. This technique emphasises synthesising existing information instead of creating original data, aiming to deliver a thorough grasp of both academic and policy-oriented viewpoints on water price. The study is to rigorously evaluate current frameworks, pinpoint discrepancies between theory and reality, and investigate avenues for improving the efficiency, equality, and sustainability of water pricing systems in India. The research starts with a comprehensive and methodical examination of pertinent literature to create a robust basis for the investigation. Scholarly publications, government reports, policy documents, and case studies were rigorously chosen for their pertinence to drinking water price in India.

The literature was obtained from many sources, including Google Scholar, Web of Science, and JSTOR, guaranteeing the incorporation of peer-reviewed and reputable research. The assessment included policy studies and official publications from Indian governmental entities, including NITI Aayog, the Ministry of Jal Shakti, and the Central Water Commission, along with international organisations such as the World Bank, UNESCO, and the United Nations Development Programme. This varied collection of books offered a solid foundation for examining both theoretical frameworks and actual experiences with water price. The research primarily aimed to assess and contrast the theoretical concepts of water pricing with their practical implementation. The theoretical examination included many economic models, including marginal cost pricing,

block tariffs, and cost-recovery mechanisms, highlighting their aims and constraints. Theoretical ideas were compared with actual facts from Indian states and regions to evaluate the effectiveness and equity of various pricing strategies. The comparison also encompassed worldwide practices, allowing the discovery of optimal strategies that might be tailored to suit India's distinct difficulties.

The study approach emphasised a comprehensive examination of the policy and institutional frameworks regulating water price in India. The study aimed to elucidate the diversity and complexity of water pricing patterns by analysing policies enacted in urban, peri-urban, and rural contexts. Particular emphasis was placed on comprehending the influence of governance frameworks, institutional capability, and community engagement on water price results. The investigation identified significant deficiencies, including disjointed institutional duties and insufficient platforms for stakeholder participation, which frequently compromise the efficacy of pricing strategies. A crucial aspect of this technique was a thorough evaluation of the socioeconomic effects of water price. The research examined the effects of pricing policies on marginalised and economically disadvantaged groups, who frequently suffer from unequal access to drinking water services. This assessment was based on the larger discourse over whether water ought to be regarded as a fundamental human right or as a commodity. The study examined the viability and consequences of hybrid approaches that seek to reconcile these conflicting viewpoints, including progressive tariffs and targeted subsidies aimed at fostering both fairness and cost recovery.

The review-based technique utilised rigorous inclusion and exclusion criteria to guarantee the relevance and quality of the analysis. Studies that did not specifically focus on water price or were not contextually relevant to India were omitted. This targeted methodology enabled the research to concentrate on literature that directly supported its aims, so augmenting the depth and rigor of the analysis. Additionally, empirical evidence from research on water usage patterns, pricing structures, and cost recovery rates was incorporated into the review to furnish quantitative validation for the qualitative observations. The research included developing a comparative analytical framework to contrast the desired consequences of water price regimes with their actual effects. This methodology enabled a thorough assessment of inconsistencies between policy formulation and execution, especially regarding cost, resource sustainability, and institutional efficacy. The report proposed creative ideas and adaptable techniques to address India's water price

concerns by drawing parallels with worldwide experiences. The investigation focused on the impact of technical improvements, including smart meters and digital payment systems, to assess their potential for improving efficiency and transparency.

The research not only examined current practices but also investigated the practical problems associated with establishing water price laws in India. These obstacles encompass political resistance, popular dissent, and restricted technical and institutional competence within implementing institutions. The research offered a thorough evaluation of these obstacles, pinpointing their underlying causes and suggesting practical solutions for surmounting them. This research emphasised the necessity of synchronising pricing strategies with overarching development objectives, including poverty reduction and sustainable resource management, to guarantee their acceptance and efficacy. This research synthesises multiple viewpoints and evidence, enhancing the conversation on drinking water price in India and providing significant insights for policymakers, practitioners, and scholars. The technique provided a fair and thorough examination, tackling the intricacies of water price from several perspectives. The findings underscore current gaps and issues while also pinpointing potential for innovation and enhancement, establishing a foundation for more fair, efficient, and sustainable water pricing methods in India. This method seeks to reconcile theory and practice, offering a comprehensive knowledge of the complex nature of water pricing and its effects on Indian society.

## **V. DATA ANALYSIS AND INTERPRETATION**

### **A. Key Challenges in Water Pricing in India**

Water management in India encounters numerous significant issues, influenced by rapid urbanization, population expansion, and the increasing shortage of water resources. An essential concern is the ineffectiveness of water tariff frameworks. Numerous urban water utilities depend on flat-rate or subsidized tariffs that do not promote water conservation or accurately represent the true cost of water supply (Aggarwal et al., 2013). Although progressive approaches such as increasing block tariffs (IBTs) have been implemented in certain areas, their application has been irregular. This frequently leads to disparities, with affluent households disproportionately benefiting from subsidized rates, while low-income groups endure a greater financial burden (Boland & Whittington, 1997). A significant difficulty is the absence of cost recovery in urban water services. Inadequate water tariffs and

elevated non-revenue water (NRW) impede utilities from accruing adequate income to sustain and enhance water infrastructure (Gupta, 2011).

Numerous municipalities encounter difficulties in establishing efficient cost-recovery processes owing to insufficient technical skills and disjointed governance frameworks, resulting in budgetary shortfalls and subpar service delivery (Bagchi, 2003). A non-revenue water (NRW) encompassing loss from leaks, theft, and unbilled usage—intensifies this problem. Research demonstrates that NRW levels in Indian cities may attain 50%, considerably affecting the financial and operational efficacy of water utilities (Mukherjee et al., 2015). Urban water management in India is characterized by significant disparities in water access. Low-income populations frequently experience unpredictable or insufficient water supplies, whereas affluent areas benefit from more constant access (Birkenholtz, 2010). This imbalance is exacerbated by inadequately targeted subsidies and tariff frameworks that do not safeguard at-risk groups, resulting in an unequal allocation of resources (Dinar & Subramanian, 1998). Moreover, water administration in India is not working at its full capacity, involving numerous institutions functioning at both state and municipal tiers. This decentralization, although aimed at enhancing efficiency, frequently results in inconsistent policies and inadequate coordination among stakeholders (Bagchi, 2003).

Numerous municipalities also lack the financial resources and institutional competence required to execute successful water management changes (Aggarwal et al., 2013). The excessive dependence on subsidies for water supply has engendered inefficiencies and disincentivized conservation efforts. Subsidized tariffs frequently cause under-pricing, resulting in excessive consumption and wasting of water in urban regions (Mehta & Pathakr, 1998). Furthermore, these subsidies are sometimes misallocated, favouring affluent households rather than those in need. (Singh et al., 2005). Substandard infrastructure and insufficient maintenance exacerbate water management challenges. Obsolete water supply systems are responsible for leaks and inefficiencies, diminishing service reliability and exacerbating high NRW levels (Mukherjee et al., 2015). Infrastructure investments have lagged increasing urban demand, rendering water utilities inadequately prepared for future difficulties.

Demand management is another domain in which Indian cities are deficient. Notwithstanding the pressing necessity for water conservation, public awareness initiatives and efficient metering systems are still inadequate. Inadequate water rates do not accurately



represent the resource's scarcity, hence hindering initiatives to encourage responsible consumption (Arbúes, Barberan, & Villanua, 2004). Opposition to reforms, including cost-recovery tariffs or privatization, presents a considerable obstacle. Concerns regarding affordability and fair access have prompted popular dissent and political resistance, undermining numerous reform measures. This underscores the necessity for enhanced communication and stakeholder involvement in the formulation and execution of water policies (Birkenholtz, 2010). Climate change introduces an additional degree of intricacy to water management in India. Inconsistent precipitation, decreasing groundwater levels, and increasing water demand in urban regions intensify water shortages, rendering sustainable management more essential (Aggarwal et al., 2013).

## **B. Opportunities for Water Tariff Reforms**

Many studies about drinking water supply management show that the O&M and capital cost cannot be fully recovered through the existing tariff structure and in addition to the above, those studies also available, which show that people are consuming a substantial part of their income for drinking water on alternate strategies such as borewell, submersible pump, handpumps, RO water and purchase water from private vendors etc.

It can be concluded from previous studies that people are spending money for better water services but they are not paying government agencies. The reasons for the same may be inefficient services, bad quality of water, inconsistent water supply etc. Hence, it can be said that people are ready to pay for water services but the condition is to provide better quality water services. There are several research and case studies available that illustrate the opportunities for tariff structure reforms in India. A group of researchers conducted a study in Chennai, Hyderabad and Bangalore and found that maintenance cost for water services is Rs. 13, Rs. 17 and Rs. 16 respectively. But the average cost charged in India for water services ranges between Rs. Approximately 1.5 - 2.00 per cubic meter is very low from the O&M cost. So, there are so many opportunities for tariff reform in India (Ragupatti & Foster, 2000). A study conducted in Dehradun showed that the average cost for alternate strategies (borewells, submersible, private vendor etc.) is Rs. 2.11 per cubic meter whereas the cost of the tariff of municipal water supply services is just Rs. 2.00 per cubic meter.

Another study of Vadodara, Gujrat reveals that impoverished households spend twice as much as affluent households. Poorer and middle-class households spend their money on alternate options for water supply such as borewells, private suppliers etc. They are compelled

to spend their money due to an unreliable supply of water (Lè Ne Zeh, 2000). The results of studies in four Indian cities presented in the filed note of UNDP, World Bank, according to which households of Baroda can pay three to four times more than the prevailing water rates of MC, Baroda. In Dehradun, people were paying Rs. 10 per KL in the form of alternate cost whereas the rate of municipal water was Rs 2.00 per KL. In Punjab state, people are willing to pay more if they get improved water services (UNDP-World Bank Water and Sanitation Program South Asia, 1999). Thus, it can be concluded that there are many opportunities in India for tariff structure reforms. Indirectly, people are paying more than the municipal tariff in the form of coping costs such as tube wells, submersibles, private vendors etc.

## VI. PROBABLE SOLUTIONS FOR BETTER WATER MANAGEMENT

India's drinking water management necessitates comprehensive policies emphasizing sustainable resource utilization, equitable access, and effective service provision.

Mitigating systemic inefficiencies and anticipating future issues are crucial for guaranteeing water security.

- A. Reforming Tariff Structures:** Establishing progressive water pricing mechanisms is crucial to promote conservation and accurately represent the true cost of water supply. Rather than employing flat rates or universal subsidies, tariffs might be designed to impose elevated charges for excessive consumption, thus fostering efficiency. Subsidies ought to be directed at low-income demographics to guarantee affordability and prevent resource misallocation.
- B. Attaining Cost Recovery:** To guarantee the financial viability of water utilities, pricing plans must focus on cost recovery, ensuring that tariff income encompasses operational, maintenance, and infrastructure expenses. Incremental modifications to tariffs, along with financial support for at-risk groups, can render this change socially acceptable. Cost recovery enhances service delivery and diminishes reliance on government subsidies.
- C. Mitigating Non-Revenue Water (NRW):** Reducing water losses by improving the management of non-revenue water is essential. This includes rectifying leaks, theft, and defective metering systems. Investments in sophisticated metering systems and pipeline upkeep can markedly enhance efficiency. Systematic audits and oversight of water distribution networks can assist utilities in swiftly identifying and rectifying losses.
- D. Investment in Contemporary Infrastructure:** India must prioritize the enhancement and expansion of its water infrastructure to satisfy increasing urban and rural demands. This

includes the construction of efficient water treatment facilities, enhancement of distribution networks, and establishment of sufficient storage systems. Investments in robust infrastructure can also alleviate the impacts of climate change and guarantee a continuous water supply.

- E. Enhancing Governance:** Optimizing governance frameworks and equipping local entities with sufficient financial and technical resources is crucial for efficient water management. Enhanced institutional frameworks can mitigate fragmentation and increase accountability. Explicit policy directives and collaboration among central, state, and municipal authorities are essential for guaranteeing uniform service provision.
- F. Advocating for Demand Management:** Public awareness initiatives aimed at promoting water conservation techniques can substantially diminish wastage. These can be augmented by implementing rules that require the installation of water-conserving devices, such as low-flow faucets and dual-flush toilets, in residential and industrial settings. Integration of awareness and teaching of safe water usage into community outreach initiatives and educational curricula is essential.
- G. Promoting Community Engagement:** Engaging communities in water management cultivates a sense of ownership and responsibility. Community-driven initiatives, such as rainwater gathering and local water governance committees, can enhance overarching policy approaches. Active engagement guarantees that policies are more comprehensive and attuned to local needs.
- H. Utilizing Technology:** Technology can significantly improve water management. Intelligent metering, instantaneous monitoring, and data analysis can enhance water utilization and refine distribution. Geographic Information Systems (GIS) facilitate the mapping of water networks, the identification of vulnerabilities, and the planning of infrastructure development. Technology-driven solutions promote efficiency while improving transparency and accountability in service delivery.
- I. Enhancing Water Quality:** Guaranteeing the availability of potable water necessitates rigorous monitoring and testing. Advanced water treatment methods, including membrane filtration and ultraviolet disinfection, must be implemented to mitigate pollution concerns. Decentralized treatment facilities in peri-urban and rural locales can improve access to potable water, especially in places with inadequate infrastructure.
- J. Utilizing Rainwater Harvesting:** Advocating for large-scale rainwater gathering can enhance water supplies and alleviate the strain on groundwater extraction. Urban and rural homes,

organizations, and industries must be incentivized to implement rainwater harvesting systems. Policies that require rainwater collection for new projects can facilitate the institutionalization of the practice.

- K. Executing Groundwater Recharge Strategies:** The over-exploitation of groundwater is a significant problem in India. Implementing recharge wells, check dams, and percolation tanks can facilitate aquifer replenishment. These initiatives must be accompanied by more stringent rules on groundwater extraction and utilization to guarantee long-term sustainability.
- L. Enhancing Climate Resilience:** Implementing integrated water resource management (IWRM) solution helps mitigate the effects of climate change. This includes the establishment of urban wetlands, the restoration of water bodies, and the augmentation of green cover to mitigate urban flooding and enhance water retention. Robust infrastructure planning and optimal resource utilization are essential for adjusting to evolving climate circumstances.
- M. Establishing Public-Private Partnerships (PPPs):** Public-private partnerships can introduce experience, creativity, and investment to enhance water infrastructure and service provision. Although private involvement might improve operational efficiency, governmental supervision is essential to protect public interests, especially regarding affordability and equity.
- N. Augmenting Policy and Regulation:** A robust legal and policy framework is crucial for efficient water management. Consistent enforcement of clear regulations governing water extraction, delivery, and pricing is essential across regions. National policies must also consider local-specific situations, permitting flexibility in execution according to regional requirements and challenges.

## VII. CONCLUSION

Water pricing is fundamental to efficient water resource management, especially in metropolitan India, where issues like fast population development, urbanization, and water shortages are prevalent. The main goals of the water tariffs now in place in India are not being met. They are not making enough money to guarantee that utilities can recoup their expenses. Households are not receiving the proper economic signals from them, which include the need to treat water as a valuable commodity due to its scarcity. Service delivery is unfair because many families are compelled to buy water through private vendors. Most impoverished families, many of whom are not linked to the piped distribution system, are not receiving any assistance from the government. Currently, no city in India is enjoying 24x7 water supplies. People should provide 24x7 continuous

water service as continuous water supply is beneficial in many ways like better quality of water, people want to pay for better services etc. But to achieve this, capital investment & maintenance, revenue collection, cost recovery, etc. are necessary. But because of low pricing designs, costs cannot be recovered and insufficient funds result in poor service delivery. The majority of current subsidies go to middle-class and upper-class families that are connected to the piped distribution system.

Although economic theories offer strong frameworks for developing pricing systems, their application in India has been obstructed by socio-political, institutional, and infrastructural limitations. The current pricing structures, mostly flat-rate or significantly subsidized tariffs, do not recoup costs, encourage effective water utilization, or guarantee equity among various socioeconomic classes. The analysis underscores the necessity for a paradigm shift in India's water price strategy. Progressive pricing approaches, including increasing block tariffs (IBTs) and uniform price with rebate (UPR) frameworks, have shown promise in harmonizing economic efficiency with social equality. Their success depends on enhancing governance, decreasing non-revenue water (NRW), and rectifying systemic inefficiencies in urban water supply systems. Global experiences, especially from nations with comparable socio-economic conditions, highlight the significance of gradual reforms over sudden shifts to complete cost recovery.

These experiences indicate that attaining financial sustainability in water utilities is a progressive endeavour necessitating robust political will, institutional capability, and public endorsement. The complex urban terrain of India requires context-specific solutions that consider differences in water availability, socioeconomic profiles, and administrative capacities. In summary, water pricing reforms in India should transform basic cost recovery frameworks to encompass wider objectives of justice, efficiency, and sustainability. The path forward involves the integration of strong policy frameworks with specific interventions that reconcile economic demands with the needs of excluded groups.

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