INDIAN INSTITUTE FOR
HUMAN SETTLEMENTS

PLUGGING THE LEAKS, POWERING THE FUTURE

UNLOCKING WATER-ENERGY SAVINGS FOR INDIAN UTILITIES

DOI: https://doi.org/10.24943/PLPFUWESIU11.2025

Authors
K. V. Santhosh Ragavan, Mahima Vijendra, Manish Dubey, Nandagopal P., Sivaraj V.

This report should be cited as
Ragavan, K.V.S., Vijendra, M., Dubey, M., Nandagopal, P., & Sivaraj, V. (2025). Plugging the Leaks, Powering the Future: Unlocking Water-Energy Savings for Indian Utilities. Indian Institute for Human Settlements.

Acknowledgements
We would like to thank Aditya Chunekar, Amir Bazaz, Amit Tripathi, Prasad Vaidya, Sathish Kumar, Sudha Setty, and Sumedha Malaviya for their valuable insights. We would also like to thank Sasikumar Eswaramurthy for his support in facilitating data collection.

Design & Layout
Sathish Kumar
Supervised by Prachi Prabhu | Reviewed by Padma Venkataraman
IIHS Communications and Design

iihs

INDIAN INSTITUTE FOR
HUMAN SETTLEMENTS

PLUGGING THE LEAKS, POWERING THE FUTURE

UNLOCKING WATER-ENERGY SAVINGS FOR INDIAN UTILITIES

Introduction

Electricity use among India's water and wastewater utilities has surged over the past decade, driven by rising demand, ageing infrastructure, and inefficiencies in pumping and distribution. Yet behind this surge lies a powerful opportunity: by tightening operations, upgrading equipment, and cutting system losses, utilities can sharply reduce costs and reshape their energy footprint. Drawing on national data, State-level patterns, and examples from leading cities, this report pinpoints where efficiency gains are greatest – and how utilities can translate them into lower bills, stronger systems, and more reliable services for millions.

Indian water and wastewater utilities are massive electricity consumers- and their consumption surge shows little sign of slowing.

While utility operations span both rural and urban areas, and electricity consumption for rural services is set to rise with the national Jal Jeevan Mission (JJM)'s aim to extend functional household tap connections universally, urban consumption may be higher at the present time. Between 2011 and 2021, rural areas accounted for about 15-18% of total water supplied using electricity.

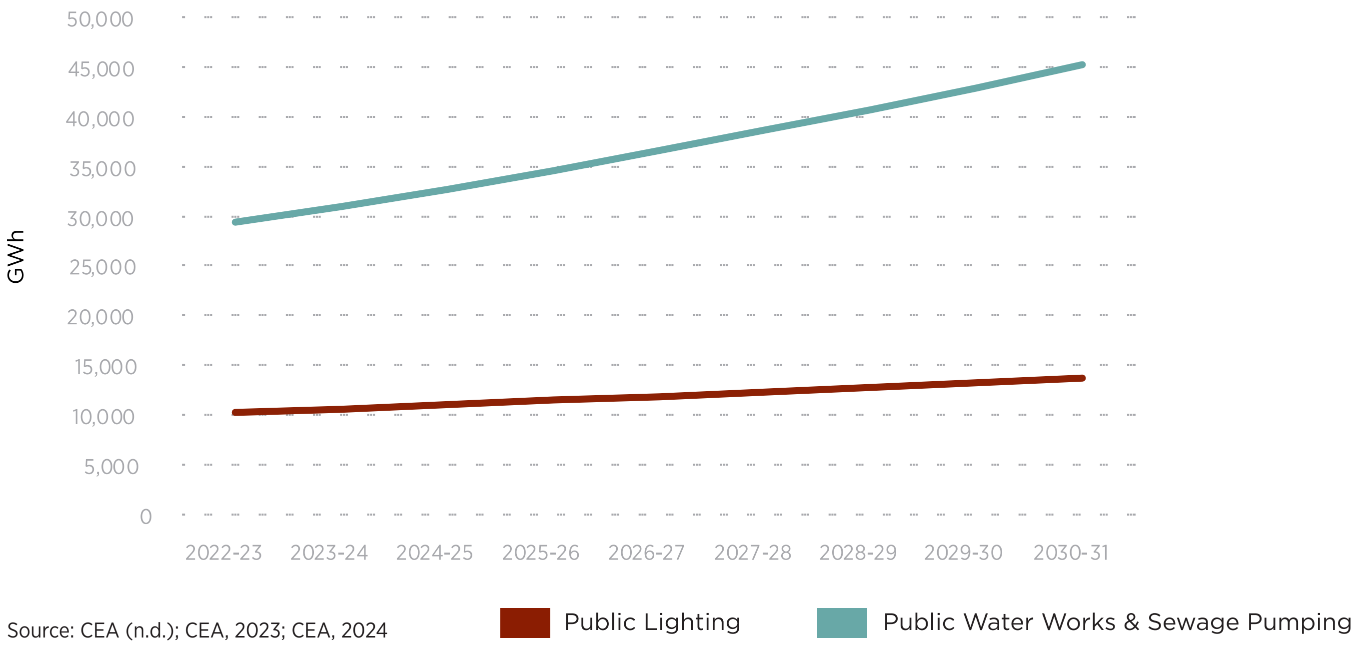
In urban areas, water and sewage pumping currently accounts for about 70% of the total electricity consumption among utilities (ICLEI-South Asia, 2009). Public lighting absorbs much of the remainder, with office buildings and related facilities—where multi-city assessments show a consumption share of about 6%—representing only a small fraction of the electricity consumed (ICLEI-South Asia, 2009)[1].

Indian utilities currently consume an estimated 39,000 million units (MU) of electricity annually—higher than or comparable to the yearly consumption in over 19 States—at a cost of about Rs 25,000 crore (CEA, 2024).

Over 2012-13 to 2022-23, electricity consumption among utilities increased 1.6 times, mirroring growth rates in the agriculture, commercial, and industrial sectors.

Annual consumption is projected to rise to about 59,000 MUs by 2030 (CEA, 2022), a compounded annual growth rate (CAGR) of about 5% that will outpace projected growth in several sectors, and potentially double the current 17-22% electricity demand-supply gap for utilities (CEA, 2020-2024).

All-India projected electricity consumption for public lighting, water works, and sewage pumping (GWh)



Source: CEA (n.d.); CEA, 2023; CEA, 2024

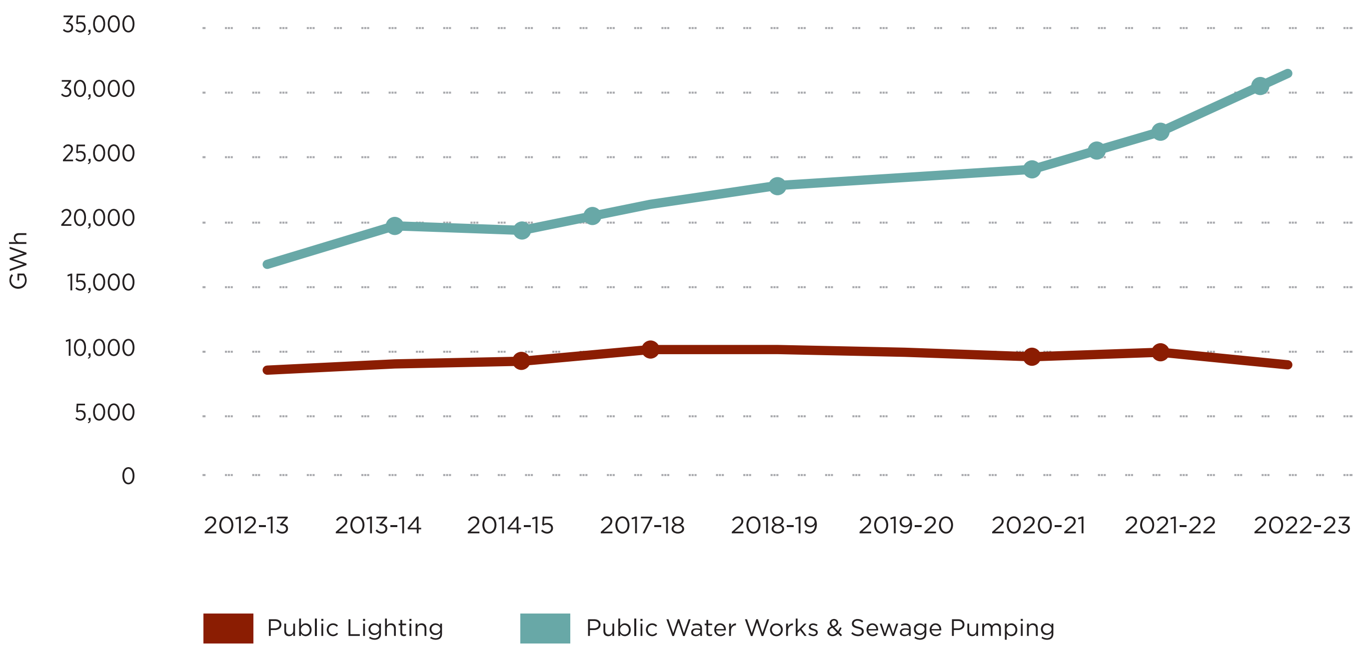
1 Systematic time series data on buildings electricity consumption across rural and urban areas is not available. According to a 2009 study of 54 cities, buildings accounted for just about 6% of total Municipal electricity consumption. This brief defines utility electricity consumption as the sum of electricity consumption for public lighting and public water works, with 'utility' collectively referring to both rural and urban local government bodies and parastatals consuming electricity for public lighting and public water works (ICLEI-South Asia, 2009).

Electricity consumption for water and sewage pumping is expected to rise as service networks expand in the years ahead.

Between 2012-13 to 2022-23, electricity consumption for pumping grew at a CAGR of over 7%, in sharp contrast to the 0.5% CAGR for public lighting where a nation-wide efficiency effort has curbed consumption (CEA, n.d.; CEA, 2020-2024; EESL Editorial Team, 2024). Projections for 2030 suggest that pumping operations are expected to maintain a high growth trajectory, with a CAGR of 6% (CEA, 2022).

Reflecting the growing dominance of pumping activity, the ratio of electricity used for pumping to that for public lighting consumption grew from 2-to-1 to 4-to-1 between 2012-13 to 2022-23 (CEA, n.d.; CEA 2024).

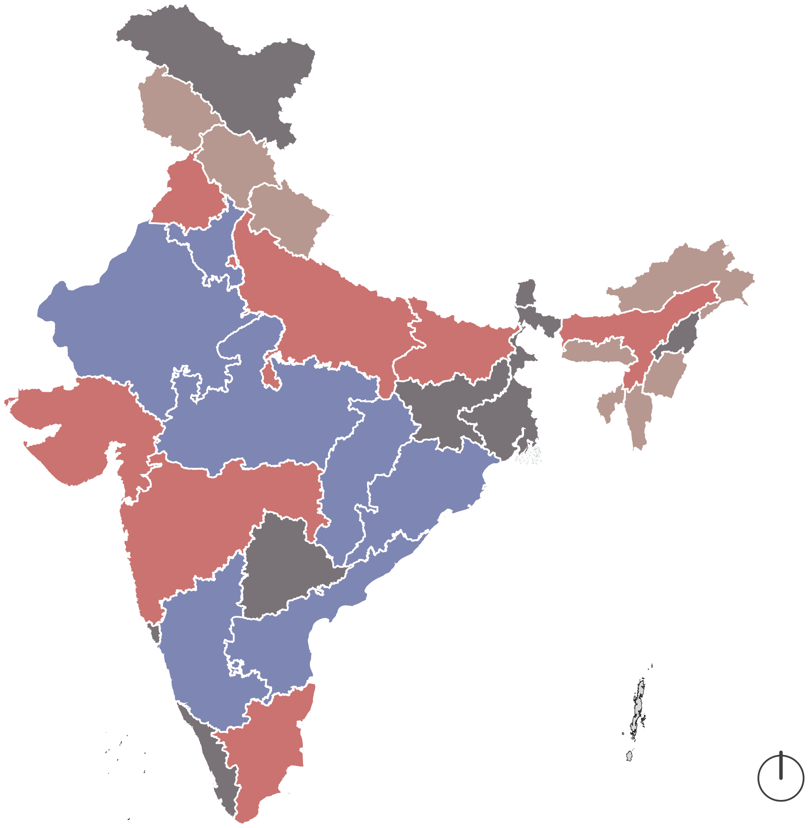
All-India trend in electricity sales for public lighting, water works, and sewage pumping (GWh)



Source: CEA (n.d.); CEA, 2023; CEA, 2024

State-level analysis reveals substantial untapped energy efficiency potential in 18 States, which collectively account for about 70% of the total electricity used for water and sewage pumping.

Classification of States according to specific energy consumption



Typology # 1
States and UTs with high specific energy

Typology # 2
States and UTs with low specific energy

Typology # 3
Hilly terrain States

Typology # 4
States and UTs with data gaps[2]

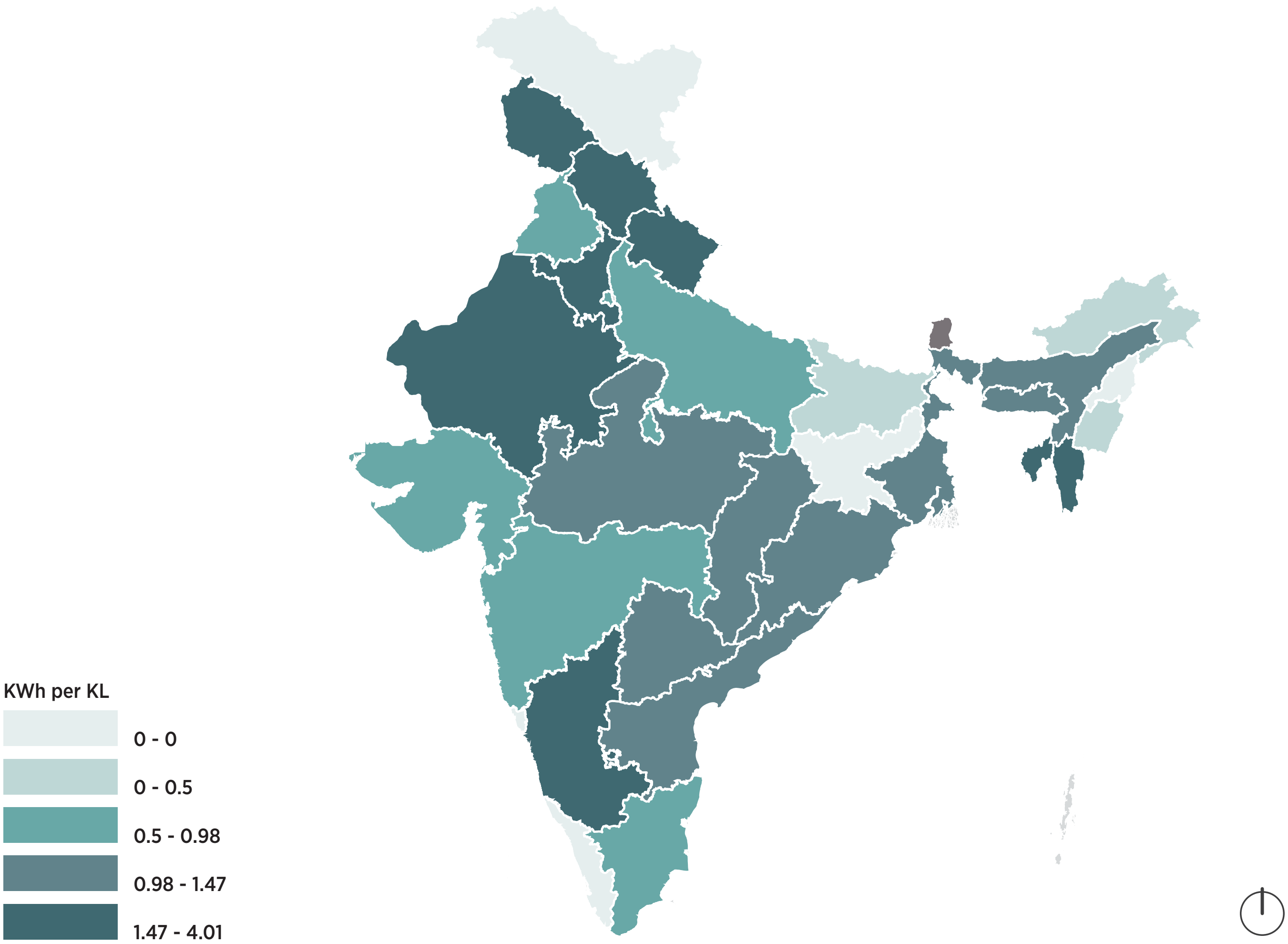
Source: CEA (n.d.); National Commision on Population, 2019. Map by Lokesh BS, IIHS-GSL

Item	Typology # 1	Typology # 2	Typology # 3	Typology # 4
Number of States	8	9	8	11
Share of population (2025 projected)	31%	52%	3%	13%
Share in electricity consumption growth among utilities between 2012-13 and 2022-23	51%	26%	17%	6%
Share in current annual electricity consumption among utilities (2022-23)	48%	36%	13%	4%
Share in projected growth in electricity consumption among utilities by 2030	63%	29%	4%	4%
Share in projected (2030) annual electricity consumption among utilities	54%	35%	6%	5%

2 Along with smaller States and union territories, this category includes Jharkhand, West Bengal, Sikkim and Nagaland. Telangana data has been merged with Andhra Pradesh to correct for gaps between different datasets.

States with high growth or high specific energy[3] consumption account for nearly 40% of the total population but consume 70% of the total electricity.

Specific energy consumption for water works and sewage pumping (2021)



Source: CEA (n.d.).; National Commision on Population, 2019. Map by Lokesh BS, IIHS-GSL

The national average electricity consumption per million litres of water and sewage has risen 34% between 2012 and 2021, and currently stands at about 1,130 units (CEA, n.d.).

Across States, consumption per ml pumped varies dramatically—ranging between 1,110 and 2,520 units in Typology # 1 States, between 420 and 990 units in Typology # 2 States, and between 440 and 4,010 units in Typology # 3 States—suggesting inconsistent operational efficiency and asset performance.

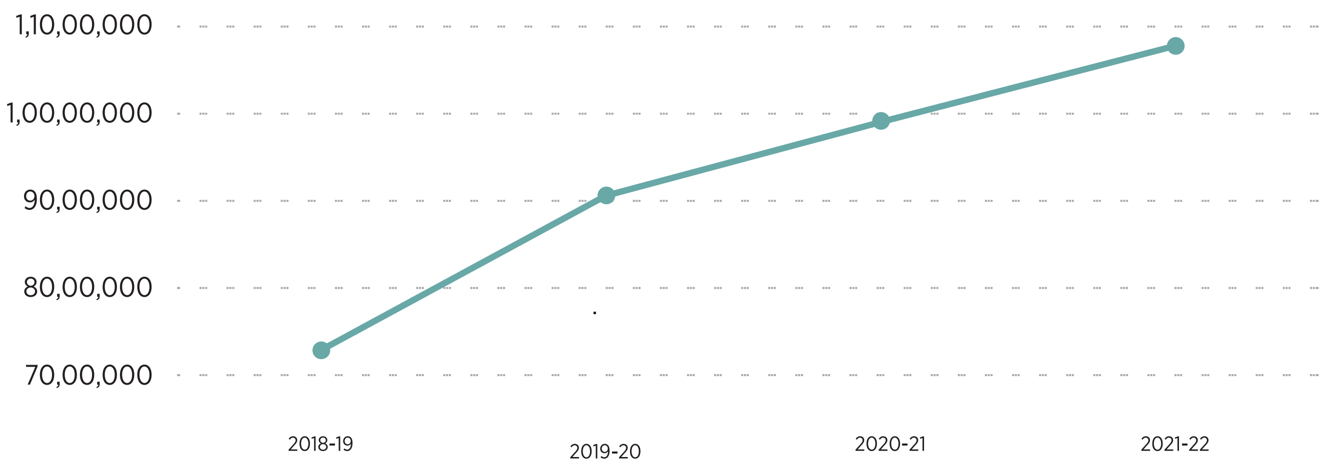
3 Specific energy is estimated as the amount of electricity consumed (KWh) to supply 1 kilolitre (kl) of water. Water volumes supplied across rural and urban areas are estimated based prevailing per capita daily consumption norms, Census population counts (2011) and projections (2021), and National Sample Survey piped water access estimates (2021).

Utilities have significant room to streamline pumping operations and electricity usage- key to both cost containment and sustainability.

Contracted electricity demand[4]—the basis for a portion of utilities' billing—rose about 1.3 times between 2018-19 and 2021-22, even as the actual volume of water and sewage pumped increased only 8% over the period (CEA, 2020-2024); National Commission on Population, 2019; NSS, 2021).

Among States within the same typology, the present variation in contracted demand per mld water and sewage pumped is significant—ranging between 100 and 400 in Typology # 1 States, between 90 and 200 in Typology # 2 States, and between 30 and 800 in Typology # 3 States—and indicates oversizing, and inefficiency in capacity planning.

Public water works connected load (KW)



Source: CEA, 2020 – 2023

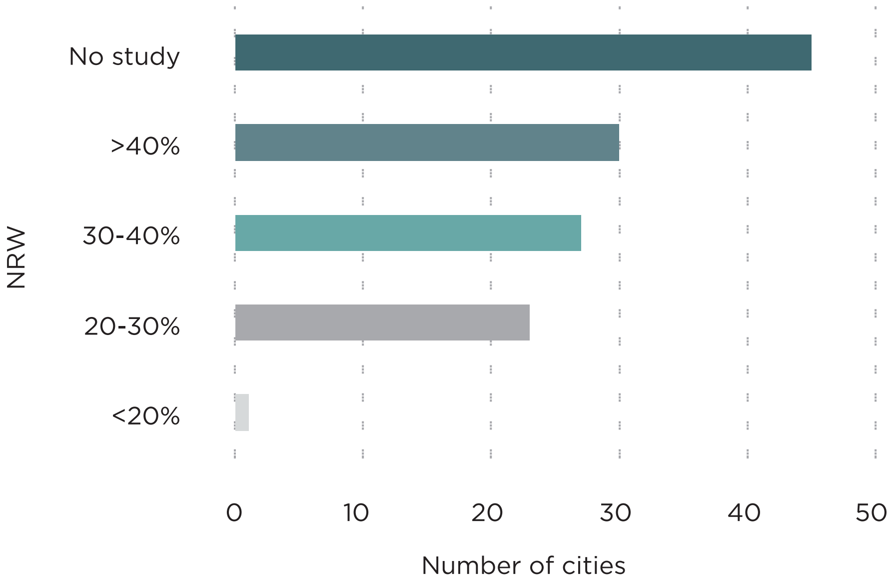
*Note: Tamil Nadu has only reported for 2022, and therefore excluded from India totals.

CEA data on connected load is available only from 2018 onwards.

4 Connected load has been assumed to be the same as contracted demand.

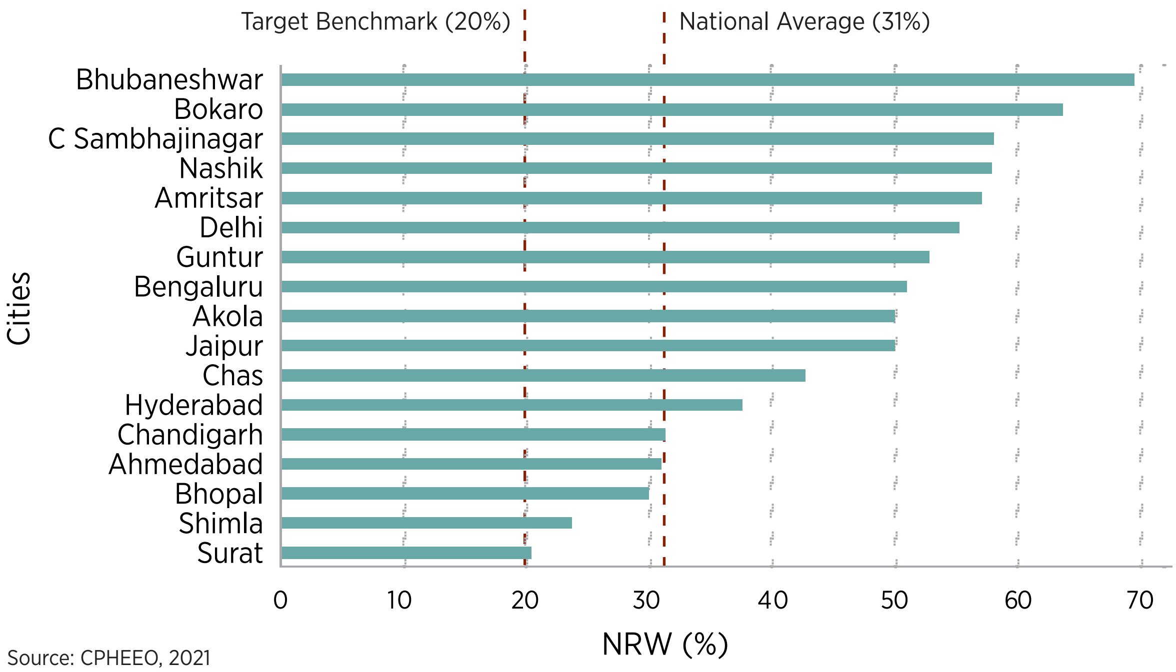
Non-revenue water (NRW) in urban India is conservatively estimated at about 30%, higher than the national target of 20%. This means at least 10% of the water pumped—and the electricity consumption and costs associated with it—are 'wasted'.

Number of cities vs. Non-Revenue Water (NRW)



Source: NIUA, 2023

City-wise NRW



Source: CPHEEO, 2021

Rightsizing demand, modernising pumps, and cutting water losses could reverse years of rising electricity use and save up to Rs 5,500 crore annually for Indian utilities.

Intervention Track	Annual Potential Energy Savings (MU)	Annual Potential Cost Savings (INR crore)
Resizing contract demand	-	500
Upgrade of inefficient pumps, pumping practices	5,600	3,200
NRW reduction to 20%	3,000	1,800
Total	**8,600**	**5,500**

Source: IIHS Analysis; CEA, 2023

Note: Estimated benefits are likely conservative. Actual benefits could be greater given that existing efficiencies are not yet fully captured in available data.

The most substantial gains are expected in Karnataka, Tamil Nadu, Maharashtra, Rajasthan, Gujarat, Madhya Pradesh and Uttarakhand, where annual electricity consumption and related costs could be cut by as much as 28% (about 5,700 MUs) and 31% (about Rs 3,600 crore) respectively, compared to current levels of about 20,400 MUs and Rs 11,700 crore.

The experience of cities such as Bengaluru and Surat—leaders in efficient water and wastewater management—and the success of India's energy-efficient public lighting programme highlights clear priorities.

Curb water losses through systematic leak detection, metering, and performance-linked accountability.

Lower electricity use via optimised pumping schedules, modern high-efficiency equipment, and integrating water-energy planning.

Scale proven innovations, such as IoT-enabled smart meters, advanced treatment and reuse systems, and automation, from pilots to city-wide programmes.

Foster collaboration among utilities, State agencies, and private partners to align investment, capacity development, and results-based finance around shared performance outcomes.

Conclusion

The path ahead is clear and actionable. With targeted reforms—rightsizing electricity demand, modernising pumps, and curbing water losses—Indian utilities can roll back years of consumption growth, restore energy use to more sustainable levels, and save thousands of crores annually. Achieving and sustaining these gains will depend on partnerships that drive innovation, unlock financing, and scale proven technologies, turning efficiency into a shared agenda for stronger utilities.

References

EESL Editorial Team. (2024, December). Sustainability milestones and key achievements in India's energy efficiency sector. *National energy conservation day 2024: securing a sustainable energy future for India*. EESL. https://eeslindia.org/wp-content/uploads/2025/01/EESL_December_Newsletter_301224%20copy.pdf

Central Electricity Authority. (n.d.). *Central Electricity Authority Dashboard*. Ministry of Power, GOI. https://cea.nic.in/dashboard/?lang=en

Central Electricity Authority. (2020). *All India electricity statistics*. Ministry of Power, GOI.

Central Electricity Authority. (2021). *All India electricity statistics*. Ministry of Power, GOI.

Central Electricity Authority. (2022). *All India electricity statistics*. Ministry of Power, GOI.

Central Electricity Authority. (2022). *Report on twentieth electric power survey of India (volume-I)*. Ministry of Power, GOI.

Central Electricity Authority. (2023). *All India electricity statistics*. Ministry of Power, GOI.

Central Electricity Authority. (2023). *Electricity Tariff & Duty & Average rates of electricity supply in India.* Ministry of Power, GOI.

Central Electricity Authority. (2024). *All India electricity statistics*. Ministry of Power, GOI.

Central Public Health and Environmental Engineering Organisation. (2021). *Guidelines for planning, design, and implementation of 24x7 water supply systems*. Ministry of Housing and Urban Affairs, GOI.

ICLEI-South Asia. (2009). Energy and carbon emissions profile for 54 South Asian cities. ICLEI.

Ministry of Statistics and Programme Implementation. (2023). Multiple indicator survey in India: NSS report no. 589 (78/5.1/1). Government of India.

National Commission on Population. (2019). *Population projections for India 2011—2036*. Ministry of Health and Family Welfare, GOI.

National Institute of Urban Affairs. (2021). *Climate smart cities assessment framework 2.0: Cities readiness report*. Ministry of Housing and Urban Affairs, GOI.

iihs®

INDIAN INSTITUTE FOR
HUMAN SETTLEMENTS

iihs.co.in

IIHS, SADASHIVANAGAR, BENGALURU
197/36, 2nd Main Road, Sadashivanagar,
Bengaluru 560080, Karnataka, India
T: +91 80 6760 6666

IIHS, CHENNAI
24/51, Floor 7A, Chaitanya Exotica,
Venkatanarayana Road, T Nagar,
Chennai 600017, Tamil Nadu, India
T: +91 +91 44 6630 5500

IIHS, DELHI
Prius Platinum, 3rd Floor, B Wing,
Saket District Centre,
New Delhi 110017, India

IIHS, MUMBAI
Flat No. 2, Purnima Building,
Patel Compound, 20-C Nepean Sea Road,
Mumbai 400006, Maharashtra, India
T: +91 22 6525 3874

Scan the QR Code to
download the report