THEMATIC BRIEF

Drop by Drop

Water and Wastewater Management in the CapaCITIES Project

National Institute of Urban Affairs

CapaCITIES

Water is recognized as the most critical natural resource. With climate change causing considerable irregularity in rainfall, which is the primary source of freshwater this resource is under severe stress. Additionally, freshwater supply in urban India has its own complexities: Indiscriminate and unregulated tapping of groundwater leading to their falling levels, leakage, wastage of supplied water, and pollution reduces the potential of tapping fresh water.

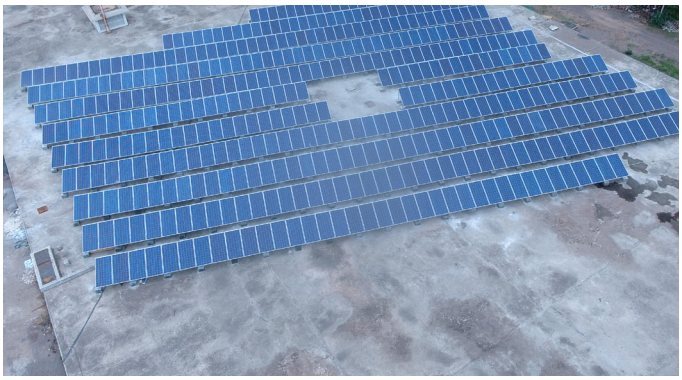
Almost 80% of water supply flows back into the ecosystem as wastewater, which becomes a critical source of water pollution in India. Water pollution poses threat to the environment and health. Currently, India has the capacity to treat approximately 37% of its wastewater, or 22,963 million litres per day (MLD), against a daily sewage generation of approximately 61,754 MLD of which approximately half is treated and the rest is discharged as untreated sewage. In this context, proper processing and management of wastewater would not only meet a city's water demand, but also keep a check on the pollution. The energy and financial cost for water supply and sewerage pumping is one of the bigest component for a Urban Local Body (ULB) and a proper managment plan can help cut costs while reducing greenhouse gas (GHG) emissions.

Water and Wastewater Management in the CapaCITIES Project

Water and Wastewater Management (WWM) is a thematic area identified as a priority for the 4 project cities of Coimbatore (Tamil Nadu), Rajkot (Gujarat), Siliguri (West Bengal) and Udaipur (Rajasthan) for the **Capacity Building for Low Carbon and Climate Resilient City Development (CapaCITIES) project.** The cities in cooperation with the consortium of implementing agencies supported by the Swiss Agency for Development and Cooperation (SDC) team developed the Climate Resilient City Action Plans (CRCAP), which is an overarching strategy to develop the city's resilience to climate change. Specifically planned Quickwin interventions were piloted and Bankable projects have also been detailed. These are strategic projects developed for the city prefaced with a study, to take up by the City themselves in their Municipal budgets.

The ClimateResilientCITIES Action Plan (CRCAP)

The consultative process and analysis of data gathered based on the **ClimateResilientCITIES** method led to the formulation of the CRCAPs in which the following were identified as challenges:



Quickwin Project: Solar PV installation at Aji Water Treatment Plant, Rajkot

Quickwin Project: Ground Water Recharge System, Rajkot

The ClimateResilientCITIES Process

The CapaCITIES project supported the city municipal corporations to identify baseline data from various departments in order to develop a profile for the city. These activities were conducted by a Core Team- officials from the local government, and a Stakeholder Group -individuals from different parastatal bodies in the city / NGOs / institutions / local stakeholders

The process involved creation of a GHG emission inventory of the municipal corporations and community level activities in the city using the HEAT+ tool.

Through the GHG inventory, possible mitigation measures were identified to reduce the cities emissions.

- Water supply, access, quality, and wastewater management were a common concern for all the project cities.
- Through appropriate management of wastewater greenhouse gasses (GHG) can be mitigated at source and be a source of revenue.
- Water management contributes to better management of climate change adaptation and increase resilience of communities.

From the city CRCAP some key sectoral interventions in WWM were identified to enhance resilience to climate change at the city level. Additionally, the total GHG mitigation potential from implementing these interventions were also identified.

City	Key Resilience Interventions Proposed in WWM from the CRCAPs	Total Mitigation Potential (tCO_2e)
SILIGURI	• Installation of captive Solar PV plants at Jhankar, Shaktigarh, and Pareshnagar I water pumping stations and Intake point through RESCO mode • Reduction in proportion of non-revenue water from 78% to 20%	5,633
RAJKOT	• Solar 185kWp PV installation on pumping stations and water treatment plant • 28MLD tertiary treatment plant at Raiyadhar to recycle and reuse treated water. • Assessment of potential for augmenting local water resources • Replacement of existing old pipelines with new DI pipeline with hydraulic design • Legalise all illegal existing water connections and stop direct pumping • Energy efficiency in pumping, rooftop solar PV for drainage pumping stations • 100% sewerage network, improve treatment quality and adequacy of existing STP	20,845
UDAIPUR	• Proposed NRW reduction from 42% to 30%, solar PV installation on pumping stations and water treatment plant • Energy efficiency in pumping and SCADA implementation, solar PV for Hindustan Zinc Sewage Treatment plant	4,827
COIMBATORE	• Separate uses of water with IUWM principles, reduction in NRW and analysis of available water sources for better planning, example through aquifer mapping • Waste water treatment plant connections and network for dual supply	5,000

WWM challenges and priorities in the project cities

Data on water and sewage management extracted from the project cities CRCAPs indicate that all cities are falling behind the Service Level Benchmarks (SLBs); especially in water supply, water per capita (other than Udaipur), and sewerage networks. Reduction of non-revenue water (NRW) is a challenge across cities, with Siliguri having the highest NRW of 78% across the project cities. With the implementation of all the interventions outlined in the respective CRCAPs, the project cities stand to gain in the reduction of GHG emissions and therefore become more resilient against climate change.

Siliguri

The municipal water supply within Siliguri is sourced from the surface water intake located at the junction of the Teesta Mahananda link canal and River Mahananda at Fulbari. There is no waste water treatment facility in Siliguri or a dedicated sewerage network (currently at 2%). Waste water from households, along with the stormwater, flows in the road side drains. Limited collaboration between the state government and the city government due to differences is a challenge. Several urban services, such as water supply and wastewater are managed by the state government authorities, roll-out of projects in WWM require state level finances and actions, making coordination and progress a challenge.

Coimbatore

In Coimbatore there is a shortage of water in the city as municipal supply is only for 4 hours in 3 to 4 days on average. Residents generally store water in tanks for later use. It is estimated that close to 20% of households do not have safe sewerage disposal facility in the form of septic tank or sewerage network and collection efficiency of existing sewerage network is 25%. There is discharge of sewage to water bodies and storm water drains in several places. Further, the treatment capacity is inadequate and there is no reuse or recycling of sewage. Sewage charges are

Shared Learning Dialogues (SLDs) contributed to determining fragile urban systems in the city and the climate risks to these systems.

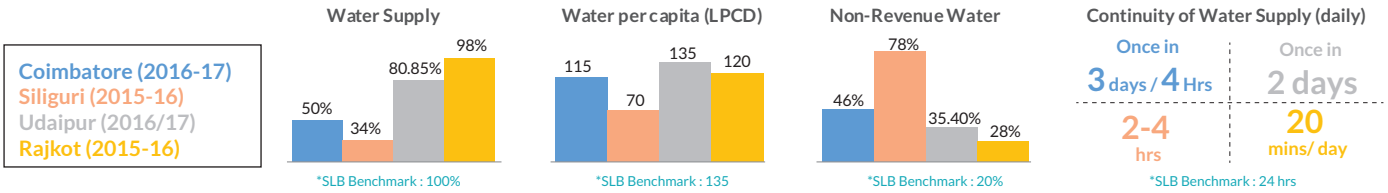
The vulnerability assessment helped to identify the areas and populations within the city impacted by these climate risks.

Finally, a second shared learning dialogue helped to identify resilience interventions for each fragile system and prioritize them to form a Climate Resilient City Action Plan (CRCAP).

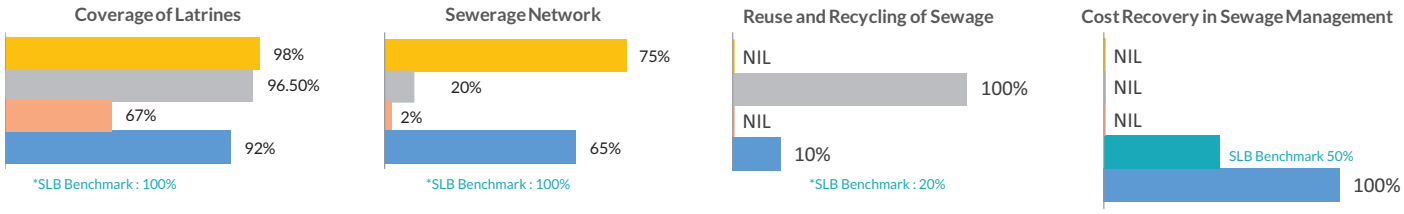
Through the CapaCITIES project, the city level authorities worked to identify city specific solutions in the CRCAP.

Quickwins Bankables, with technical studies enhanced city climate resili

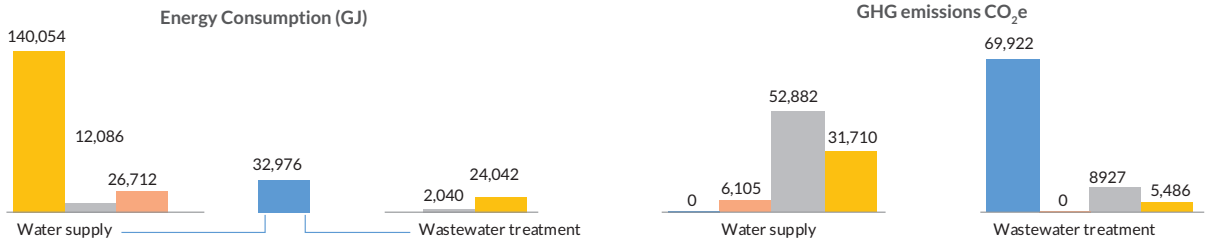
Water data in the CapaCITIES project cities identified in the project CRCAPs



Sewage data in the CapaCITIES project cities identified in the project CRCAPs



Energy consumption from water and waste water sector and the GHG emissions mitigated from identified interventions in the CRCAPs



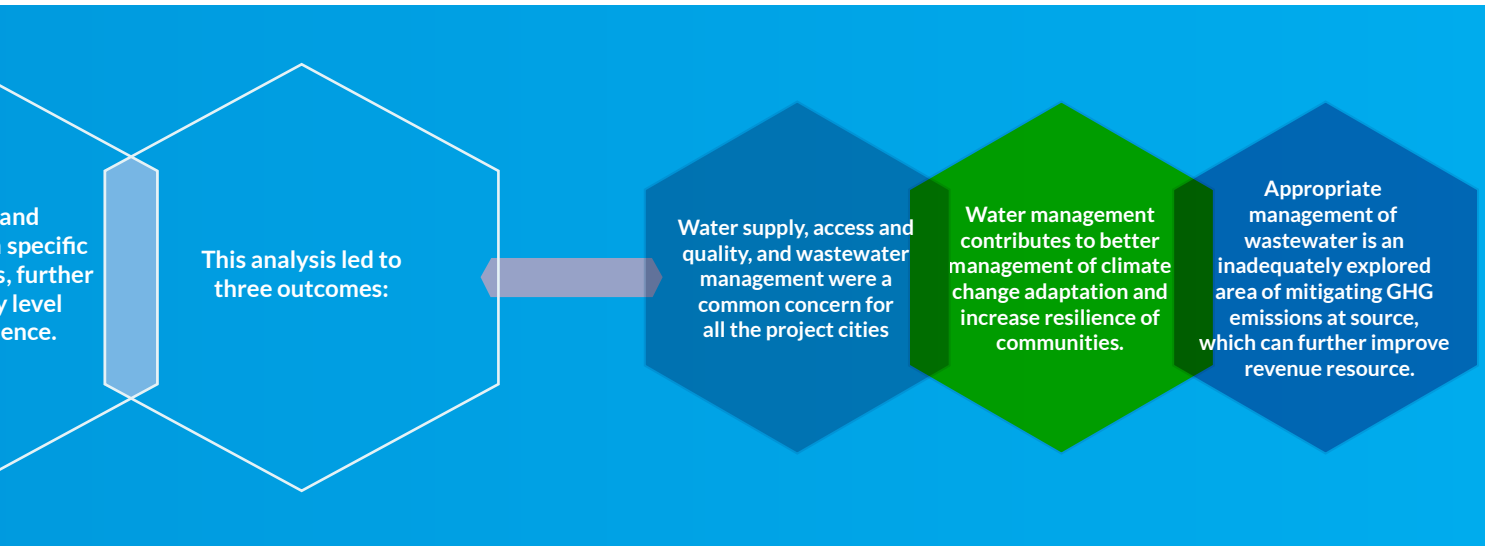
non-existent and linked to general property taxes. Therefore, significant capital for improvement, operation and maintenance is not available with the city.

Rajkot

In Rajkot the combined annual GHG emissions from municipal buildings and facilities from wastewater treatment and water supply is ~37,197 tCO_2e i.e. nearly two thirds of the total GHG emissions from all sectors (~55,080 tCO_2e). This is due to water being directed from the distant Narmada Canal 700 Km away. This is a direct result of the local dams: Aji II and Nyari II being abandoned due to the high levels of pollution due to raw waste water flowing into them from the city. In addition, the availability of potable ground water in Rajkot is limited due to the soft-rock nature of the substrate. Thus, only during the monsoons water is available for extraction from the upstream catchment areas of River Aji. A full stormwater system is not structurally implemented in the city, therefore rain water cannot be led to the *vokdas* (natural drains), that can help recharge the aquifers. Instead, during the monsoons; the blocked *vokdas* overflow; flooding the city, inhibiting daily life The *vokdas* are encroached with solid waste and illegal buildings; or are damaged. Due to these issues there is lack of water during the dry season due to parched groundwater levels. As of 2015-16, the untreated sewage is discharged into the Aji River through the *vokdas* resulting in the pollution of the river and the Aji dam further downstream.

Udaipur

Udaipur has a network of man-made lakes, which was built to collect water during the monsoons for the drier months. The city depends on the surface water from the lakes. However, with climate change; such as increase in temperature and variable rainfall, has noticeably affected life in the city with a rise in flooding incidents. The water tested through the supply network indicates that water supplied through the old line is not suitable for drinking as most of them are broken, causing



pollution & wastage. Undulating topography leads to many low-pressure points; compounding the water supply challenges. Due to lack of metering of water connections and non-functional meters; the cost recovery in water supply services in Udaipur is only 15%, which is very low further impacting the operations and maintenance of infrastructure. Sewerage network is not available citywide worsening emissions impacting the city's life and economy substantially. Under AMRUT, 20.3% of the town is estimated to be covered by underground sewerage network. Three more STPs are expected to be constructed by the UMC increasing the sewerage coverage to 62.5%.

Pilot (Quickwin) Projects

Quickwin Project: Acoustic Water Leak Detection, Siliguri

Siliguri Acoustic Water Leak Detection (AWLD): Siliguri has the highest rate of NRW from the four project cities i.e. 78% therefore the city authorities prioritised detection and plugging water leakages. There were no scientific mechanism for detecting leaks at the water distribution mains. When a puddle of water appeared, the authorities detected the leak by digging the spot through a trial and error method. Through the CapaCITIES project, the Siliguri Municipal Authority was provided with two acoustic water leak detection machines, which can pinpoint a leak up to an area of $1m^2$ thus, reducing effort, man power and cost. Training and capacity building exercises were provided to the Siliguri Municipal Corporation Through the AWLD machines costs were reduced including the cost of reconstructing the additionally excavated road stretch. Furthermore, from 2012 to 2016, a total of 5.4 million units of electricity was wasted in pumping water, i.e. unaccounted for water (UFW) which equate to 4.44 million tonnes of CO_2e emissions. The AWLD quickwin reduced wastage of UFW, electricity and mitigated GHG emissions and can easily be replicated.

Rajkot Ground Water Recharge System: Rajkot's rocky sub terrain resists recharge of its aquifers. Therefore, the Rajkot Municipal Corporation (RMC) prioritised ground water recharge for the city, primarily to reduce its dependence on the Narmada Canal. Through the CapaCITIES project, a study of the basins and sub-basins in the city led to the identification of 5 flood-prone locations where water stagnates and ground water recharge is conducted by boring through the rock substrate. Becoming more water sufficient locally would allow GHG to be mitigated by saving on electricity used to pump water to the city from 700 kms away.

Rajkot Renewable Energy Deployment at RMC's Aji Water Treatment Plant: The CapaCITIES project supported the installation of 145kWp grid connected Solar PV system, co-funded by RMC. This resulted in the generation of 580 units of electricity per day i.e. 211,700 units electricity per year. This is equivalent to 18% of the total power consumption of the plant with a potential to reduce 174 tons of CO_2e GHG emissions. This electricity generated through the solar PVs is used to pump water and mitigate GHG emissions. RMC has already proposed a 250kWp grid connected solar PV at Raiyadhar wastewater treatment.

Technical Studies to Support the Project Cities

The technical assistance of the project included detailed studies. In this thematic area, Indian and Swiss expertise were called upon to conduct studies on water and wastewater. This led to a comprehensive study on the 'Strategic Urban Sewerage Planning in Coimbatore'. Inputs to enhance the efficiency of the existing sewage treatment plants (STPs), optimize the operations, number and size of new STP plants were provided. Designs for the STP at Singanallur Tank are now being prepared. The assessment also revealed that the minor sewage treatment plants planned for treating untreated flows into each of the lakes are not required, thus saving installation and other costs. Additionally, technical study on 'Assessing potential for augmentation of local water resources through ground water/aquifer recharge, rain water harvesting, and waste water reuse in Rajkot' was conducted and the potential for ground water recharge was established in more than 15 locations.

Financially Viable (Bankable) Projects

The above studies feed the development of bankable projects that are meant to be taken up by the city themselves in the longer term

- In Coimbatore, IIFCL Projects Limited and South Pole Group developed a financial model for the implementation of the STP at the Singanallur Lake. The assessment of catchment area of the lake through a survey of the household waste water connections and lake water quality was undertaken to determine relevant technology for treating the water before it enters the lakes to reduce pollution. Further, the Strategic Action Plan for Waste Water Management and Treatment has been developed by assessing the existing and proposed sewerage infrastructure to practically reduce emissions.
- In Rajkot, assessing the potential for the augmentation of local water resources through ground water/aquifer recharge through the development of a catchment area and aquifer recharge plan, and identifying mechanisms for reuse of treated wastewater has been developed to be taken forward by the city. Additionally, the assessment of the Gas Digester Chamber in Raiya STP plant has been proposed where the anaerobic gas digesters at the Raiya Sewage Treatment Plant (51 MLD) has been dysfunctional for last 6 years, causing climate and health impacts. The project proposes a plan for rehabilitation of the gas digesters.
- An action plan and design for an anaerobic digestion based faecal sludge treatment plant for Udaipur has been prepared. This will provide the Udaipur Municipal Corporation (UMC) with a robust scientific assessment considering local conditions and appropriate engineering solutions for faecal sludge management. The “Scientific Assessment and Analysis for Effective Waste Water Management in Udaipur” and Guidance on Tender Preparation has been completed. These guidelines and recommendations to enhance the waste water treatment in the new STPs (40 MLD) have been prepared with an aim to meet the new improved treated waste water quality standards. This would ensure safe reuse and/or disposal of treated waste water.

Learnings and Challenges

- Water scarcity exists as water and wastewater is not adequately managed to serve its highest potential. The way forward for the City Authorities is to mitigate GHG emissions by considering wastewater as a resource rather than a liability and building the reuse and recycling of water into a holistic, integrated value chain at the city level.
- Access to funds for project implementation is a challenge. Access to funds for an integrated water and wastewater management plan is the need of the hour. For this capacity building of city staff is required for a financially viable plan.
- For the cities of Rajkot, Siliguri, Coimbatore and Udaipur, through the CapaCITIES project various bankable i.e. financially viable projects that have been supported with technical studies and pilot projects have already been outlined. This information through the CapaCITIES project is catered for each city and addresses city specific concerns keeping the City Authority in mind as clients; and is available for use. Additionally, going forward, to include the interventions outlined in the Climate Resilient City Action Plans into municipal budgets. The cities could easily access and put these plans into action.
- Updating old systems is a resource intensive and financially expensive process but is essential in the case of many cities. Project related success stories such as the acoustic water leak detection method as used by the Siliguri Municipal Authority can be used city wide, for example to conduct pan city water audits which can help pinpoint areas of non-revenue water and upgrade old pipes and existing systems.

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