SenRa

CASE STUDY

Smart Water Metering
AMI Ultrasonic Water Meters

Utilities

An Indian city leverages LoRaWAN® using Smart AMI Ultrasonic Water Meters to send water data over long distances, wirelessly enabling in creating an efficient solution for water management and related water maintenance activities.

THE CHALLENGE

Currently, India ranks 133rd out of 180 nations for its water availability and 120th out of 122 nations for its water quality. Some of the key factors to this crisis are related to increased water consumption and wastage in urban areas, industrial growth, political and regulatory disputes, water cycle imbalances, increased irrigation due to agricultural demands, and lack of technology. In addition to mentioned factors above, the overall population, which is expected to increase to 1.6 billion by year 2050, is also contributing to the water crisis in India. According to Central Water Commission (CWC) report, water levels in 91 major reservoirs in the country are at just 25% of capacity, 30% lower than last year and 25% less than the average storage in a decade. It is estimated that India's water sector requires an investment worth US $13 billion to tackle these difficult problems. Hence the need to put technology in the fore front of this problem is the need of the hour.

Water has become one of India's leading topics of discussion amongst government, cities, and urban decision makers in the recent years. Water scarcity, water pollution, and water consumption have fast become some of the most challenging issues to address for cities in India today. We work with global partners to help India solve some of these exact challenges.

WHY LoRaWAN®?

In India today, most of the meter management and meter reading are still being accomplished in an old fashion manual process which requires resources to physically visit the meter sites and take the readings manually. This process is considerably high in the case of water metering vs electricity distribution companies, as they in their quest to cut transmission and distribution costs have shifted to smart metering solutions long ago. One of the main challenges for water distribution companies is the non-revenue losses. These companies are realizing the only way to control and increase their revenue base is to bring in smart meters which can provide real-time feedback of water consumption and promote water conservation methods.

The most efficient manner in order to achieve the above is to deploy Advanced Metering Infrastructure (AMI) instead of the old-fashioned Automated Meter Reading (AMR) methodology.

LoRaWAN® enabled smart AMI water meters provide end-to-end automated mechanisms including wireless communication, secure data transfer, and real-time analytics. These mechanisms provided the end customer, in this case typically the utilities companies, distribution companies, and city administrators, a clear view in their day-to-day processes. This information will provide insights for managing the entire distribution eco-system in a much more efficient manner enabling the city administration to predict behavior of the consumption, loss, and most importantly influence behavioral changes of the consumers creating a better awareness of water saving strategies.
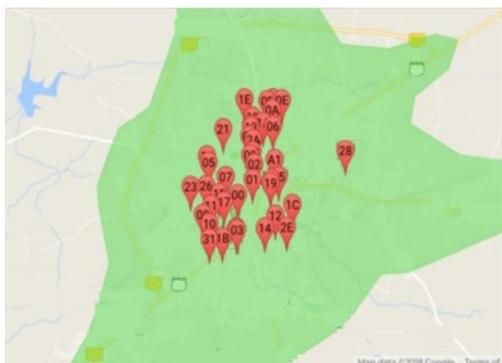
LoRaWAN

LoRa Alliance™ Member

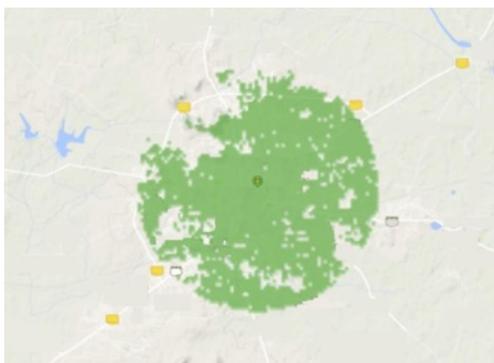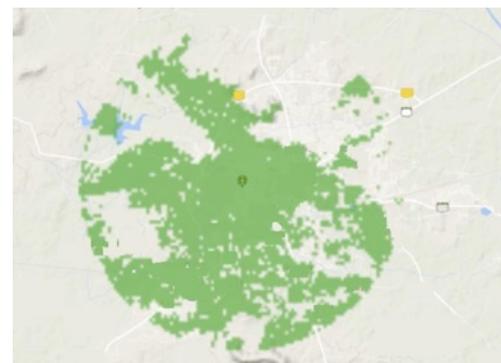*LoRaWAN® Implementation*

Figure 1

Figure 2

Figure 3

LoRaWAN®
IMPLEMENTATION

As a part of the project a city located in the central part of India selected 41 sites within their city limits where they requested to replace existing water meters or install new meters using LoRaWAN® enabled Smart AMI Ultrasonic Water Meters. Site locations for deployed water meters are illustrated in Figure 1.

Based on the site locations provided, a survey was conducted of the area to determine where the LoRaWAN® network infrastructure would be deployed to provide reliable, stable connectivity. Things that were looked at included accessibility of the site, power availability, backhaul capabilities, elevation above sea-level and ground- level, obstructions and clear line of site. Two sites were selected for this network deployment. Based on elevation above ground, gateways being deployed, and other factors mentioned above, a green field planning of the LoRaWAN® RF propagation was done and is illustrated below in Figure 2 and Figure 3.

To start with the water meter installation procedure, it was carried out as a green field installation and was only limited to the existing water distribution network in the city. The locations were identified randomly and in diverse areas for better understanding of the network deployment topology, network capability, and the transmit power of the actual smart ultrasonic water meters. The new ultrasonic water meters were deployed by the same deployment personnel deploying the traditional water meters in the city and it was noted that the installation of the new meters was completed without any issues, highlighting the ease of deploying these meters in comparison to traditional deployment manners. The smart meters were installed in between exiting piping leveraging pipe extenders to incorporate the new meters (see Figure 4 and Figure 5 on page 3)

After installation, a magnet was used to activate the LoRaWAN® module incorporated in the ultrasonic water meter, which in turn registered the device(s) successfully to the network.

Figure 6 (page 3) illustrates devices successfully communicating packets on the network provider's platform after registration.

With the LoRaWAN® enabled smart AMI water meters deployed in this project, the city is now for the first time able to obtain insight on the water metering data in real-time and make water management decisions virtually in a matter of seconds. The following table below explains the pitfalls in leveraging existing water meter solutions and explains the benefits of leveraging a smart AMI water meter solution

Through the course of this project the integrated application server / platform has been able to provide the city with information which had never been available prior to this deployment. Leveraging cloud computing, artificial intelligence, complicated algorithms, and big data processing, the solution provider demonstrated several data sets which helped the city improve the existing water management, distribution, and consumption. Below is a list of key highlights which the platform has been able to provide to the city to date..
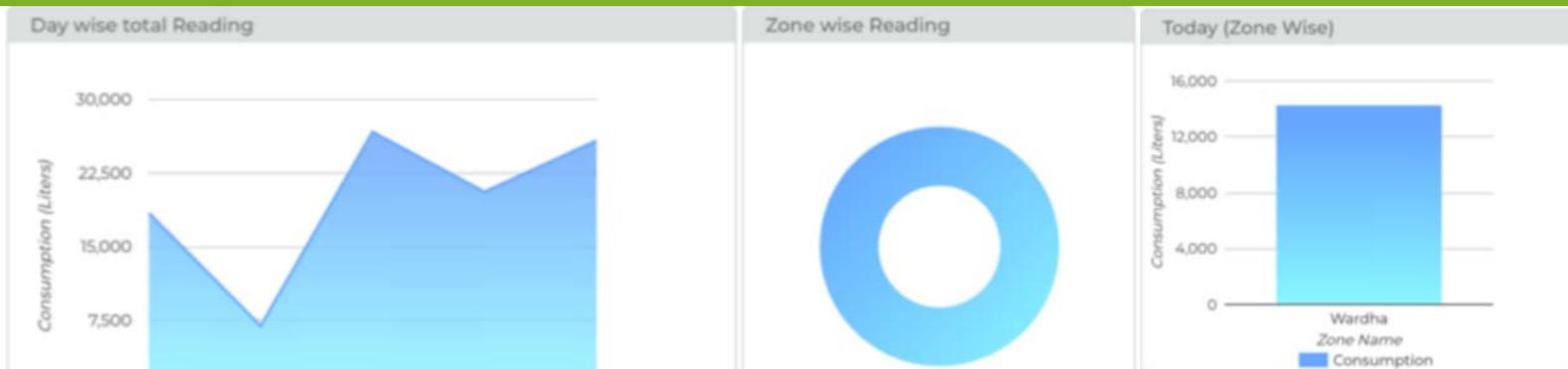
Display of real-time data with smart water meter locations
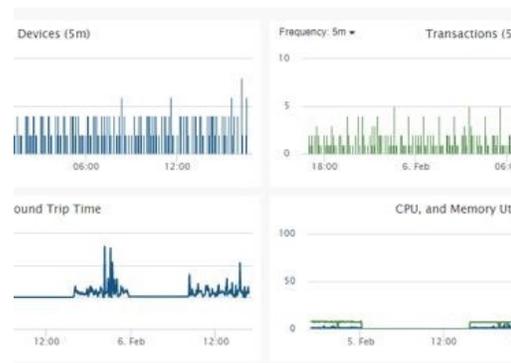

Figure 4

Figure 5

Figure 6

LoRaWAN®

BENEFITS

After the deployment of the water meters, we were able to develop a clear and efficient interface for data visualization where data sets are processed and represented in graphs, charts, and reports. .As a solution provider we were also able to demonstrate how end users can access their water meter data by simply accessing a mobile application which is integrated with their platform. With this application, the end user was able to see their water consumption on a daily, weekly, or monthly basis and determine how much their monthly bill will be. Other features have been implemented to educate the end user and provide incentives related to water conservation and cost savings. Below are screen shots of an end user's water meter data which was obtained by one of the water meters deployed as part of this project. Data is displayed for two consecutive days providing a comparison on how much water was consumed each day.

At the completion of the project, a follow-on report was distributed with a more complete set of data points which the platform was able to capture, analyze, and provide to the city such as

❑ Water consumption in specific areas of the city consistently had higher consumption levels providing insight on how to properly distribute water throughout the city

❑ Details of specific end user water consumption was available and provided insight on a day-to-day basis as well as month-to-month analysis on consumption levels.

❑ Comparisons of individual tenant's water consumption in multi-dwelling units were available allowing for proper billing management

❑ Water consumption was on average 3 times more during holidays which allows the city to conduct proper planning of water availability

❑ Flow of water in some installations were abnormal providing insight on potential leakage in the water pipe at specific locations

❑ Some water meters were improperly installed which in-turn triggered automated notifications in the system allowing for maintenance teams to know when and where to correct the installation issues.

CONCLUSIONS

Many technological advancements have been made to date to provide City decisions makers with the right tools to properly plan, manage, maintain their city as well as ensure a better quality of life for their citizens. In the case of wide area deployments of Smart Things, to include Smart City deployments, one needs to assess the available technologies present today and determine which solutions are best suited to address each set of requirements. In a true Smart City, one cannot limit themselves to a single technology or solution to address all of the City's requirements and needs. However, in the case of solutions which require long range and low data communication, it is believed that LPWAN, specifically LoRaWAN®, is the best technology and has been demonstrated successfully in the case of this Smart Water Meter PoC. Collaboration between several parties is required for a successful deployment and can be achieved with the right expertise and technology.