



# GUJARAT POWER RESEARCH & DEVELOPMENT CELL

GUJARAT URJA VIKAS NIGAM LTD

## ABOUT US

Gujarat Power Research and Development (GPRD) Cell is a research center established by the Government of Gujarat for Gujarat Urja Vikas Nigam Limited (GUVNL) and its subsidiary Companies namely, GSECL, GETCO, DGVCL, MGVCL, UGVCL and PGVCL

GPRD Cell is working under Gujarat Urja Vikas Nigam Limited and funded by Government of Gujarat through GUVNL. GUVNL is a parent Company of GSECL, GETCO, DGVCL, MGVCL, UGVCL and PGVCL. GSECL is looking after electricity generation, GETCO is looking after transmission of electricity and DGVCL, MGVCL, UGVCL, and PGVCL are electricity distribution companies looking after the distribution, operation and maintenance of electricity up to consumer level in Gujarat.

The success of the leading Companies depends on the strength of their efforts employed towards R&D. Such Companies spare and spent huge amount of funds for R&D activities. With this concept and considering the future requirement of the power, an independent R&D Cell, called GPRD cell has been established

GPRD Cell has undertaken a pilot research project to address the difficulties faced by DISCOMs of manual Meter readings of remotely located scattered Consumers such as Agricultural Consumers.

## REMOTE METER READING IN REMOTELY LOCATED SCATTERED AGRICULTURAL AREAS THROUGH LoRa WAN (LONG RANGE WIDE AREA NETWORK)

## ABOUT LoRa WAN PILOT PROJECT

Pilot Research Project to develop communication of existing Static Meters by implementing a retro-fit kind of cost effective, reliable and Lo-Power RF Technology called LoRa on the Agri. Consumers and there by overcoming the present difficulties of manual Meter readings of remotely located scattered Consumers.

## CURRENT SCENARIO

Weakest link of any Power Sector from Energy Generation to Revenue Generation is a Meter reading and billing. Error less and timely billing is still unachieved due to economically unviable technology. As per the present practice, DISCOMs are taking Meter readings of all LT Consumers by taking manual reading with door to door visit. A Meter Reader needs to visit Meter physically, read the Meter and write down the readings and submit the Bill to the Consumers. Some Pilot Projects of Smart Meters have also been done. But, the scalability to the large scale is still a question due to its high cost (Running Cost, Installation Cost) as well as communication related issues.

## LIMITATIONS OF PRESENT SYSTEM

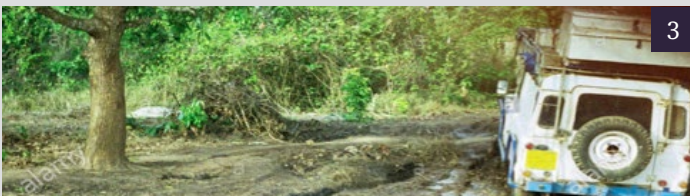
- Required to deploy more resources in present manual Meter reading system and it takes much Time;
- Human error and Intentional error cannot be avoided;
- Consumers of AG Feeders are scattered and distributed in the quite wide area;
- In some cases, Installations are not approachable by vehicle. Even one cannot ensure that such unapproachable meter readings are correct;
- In AG areas, 3-Phase power supply is being catered in rotation of day-shift, night-shift and Evening- shift. So it is much possible that, whenever meter reader visits the premises, it is found locked;
- The frequency of getting meter reading is also once in two months for residential, agriculture consumers and once a month in industrial consumers. Because of this less frequent data collection, this much data is not sufficient to be used for any other purpose then billing such as load pattern analysis, fault analysis, tamper analysis, etc;



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1. Formers are using automatic irrigation switch
2. Meters are intentionally burnt by consumer
3. Terrain of agriculture field are difficult to approach even by vehicle



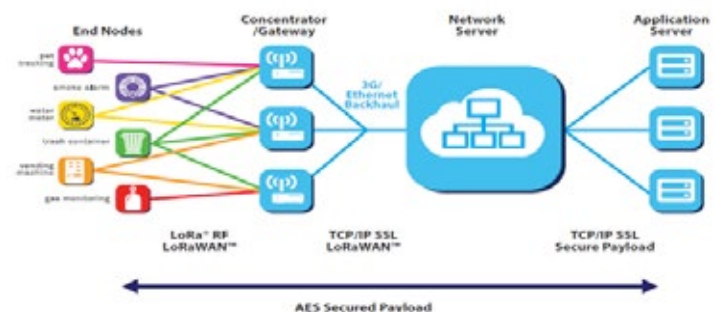
## WHAT IS LoRa WAN ?

LoRa is acronym for Long Range, developed by Semtech Corporation. LoRa is the physical layer or the wireless modulation utilized to create the long range communication link. It is the specially developed modulation Technology based on CSS (Chirp Spread Spectrum) modulation. It is the modulation, which maintains the same low power characteristics as FSK modulation but significantly increases the communication range. Chirp Spread Spectrum (CSS) has been used in Military and Space Communication for decades due to the Long Communication distances that can be achieved and robustness to interference but LoRa is the first low cost implementation for commercial usage.

- Actual Real Time Distribution Loss Calculation is not possible with the present manual System. As a result wholehearted efforts are not made to reduce the Distribution Losses as the Real Loss is not known and result of efforts made to reduce the losses cannot be ascertained;
- In some of the cases, meters are intentionally burnt by mischievous Consumers to restrict the utility from billing on actual Kwh. In absence of any historical data between months, utility loses millions of units from billing.

## ADVANTAGES OF LoRa WAN

- Nodes are not associated with a specific Gateway. Instead, Data transmitted by the Node is typically received by multiple Gateways;
- It has quite a Low Power Consumption. So, the Battery Life is as high as 10-20 years;
- It has quite a Long Range (2-5 km in urban areas and upto 15 KM in Sub-Urban areas);
- If a Node is Mobile or moving, there is no handover needed from Gateway to Gateway, which is a critical feature to enable Asset Tracking Applications;



(Source : Semtech)

- It has high robustness to interference for quite Long Range. LoRa is the Spread Spectrum based Modulation Technique, in which Signal is received with a Negative Signal to Noise Ratio. This enables the Technology to perform in both High Noise and Low Noise environment quite efficiently. In the absence of any Interference, the Signal can be received as it is below the Noise level. This enables the Technology quite robust to any interference.

## COMPARISON OF VARIOUS COMMUNICATION TECHNOLOGY

The widely used short-range radio technologies (e.g., NFC, Bluetooth) are not adapted for scenarios that require long range transmission. Medium range communication technologies such as zigbee, 6 LowPAN, etc. require much infrastructure in the application which covers wide area and require low data to be transmitted. Solutions based on Cellular Communications (e.g., 2G, 3G, and 4G) can provide larger coverage, but they consume excessive device energy and has high running cost. Also, in rural areas there is an issue of GPRS/GSM signal strength.

Therefore, IoT application requirements have driven the emergence of a new Wireless Communication Technology: Low Power Wide Area Network (LPWAN).

It is quite evident that, LPWAN technologies has edge over the other communication technology for application of remote meter reading in AG areas/Rural areas. As the data reading frequency required for the AG areas

are not as critical as HT Consumers, the low data rates would not hamper the usefulness of the technology. Also, the capex requirement is very low, in case we want to retrofit the module with the existing Static Meter. The running cost is as low as 20 paisa/node (considering 100 meters cover under single gateway).



## DETAIL REPORT OF INNOVATION

The Remote Metering Solution using LoRa have the capacity of delivering small amounts of Data Over Long Distances (High Coverage), and they offer good Battery performance too. The Power consumption is low so that the operating expenses will not go out of control.

LPWAN Technologies are ideal and LoRa Technology offers several advantages over the other options. Unlike other Technologies that use mesh Networks (which typically pulls down Battery performance and Network Capacity levels), LoRa uses a 'Star-of-Stars' Topology - to deliver Seamless Long-Range Connectivity with Battery preservation (the Adaptive Data Rate, or ADR, is crucial for this). In addition, the Chirp Spread Spectrum (CSS) based Spectrum of LoRa WAN delivers considerably higher communication range than the FSK (Frequency Shifting Keying) Modulation used in many other standards. The unlicensed 865-867 MHz ISM band is used in India for designing LoRa-based Smart devices so no Spectrum Licensing required.

The objective of this Research is to implement an Innovative Solution for providing proper, reliable, long life, feasible and less expensive system for Meter Communication to overcome the disadvantages of existing Manual Billing System

## AIM OF THE PROJECT

- To explore the Technical Feasibility of the LoRa WAN Technology to penetrate through Long Range;
- To overcome the present issues of Manual Meter reading, especially in AG areas where Meter reading is less accurate and difficult to take;
- Monitoring the Data of the LoRa WAN periodically and check whether any communication issue found or not;
- To come up with the Technology which has very low running cost and very less **Capex** is required to Stretch Test the limit of Technology to find out up to what extent the Data Frequency and Data Density could be achieved.



## DELIVERING TOWARDS THE SITUATION BY USING LoRa WAN TECHNOLOGY FOR METERING

This type of Meter reading will be cost effective and solid Technical Solution, especially in the areas where the line of sight is clear like AG areas. Only with single GPRS device, we can take readings of many Meters in the nearby vicinity of 4 KM Diameter Circle area or so. The automation will not only help to make the reading more accurate but also allow to monitor the parameter remotely.

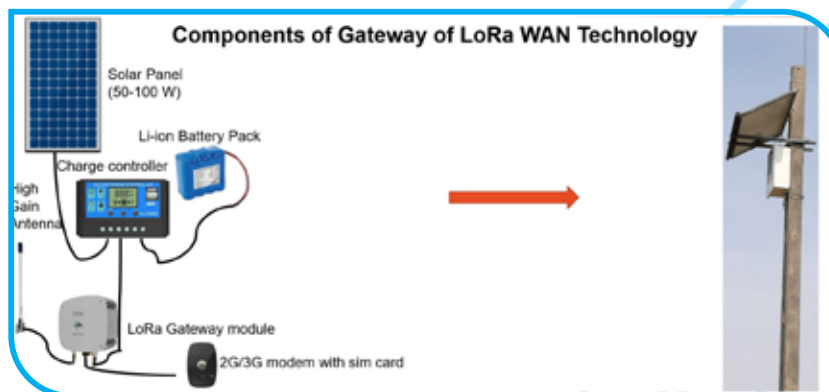
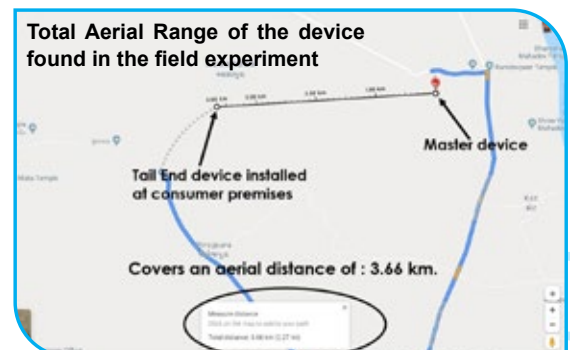
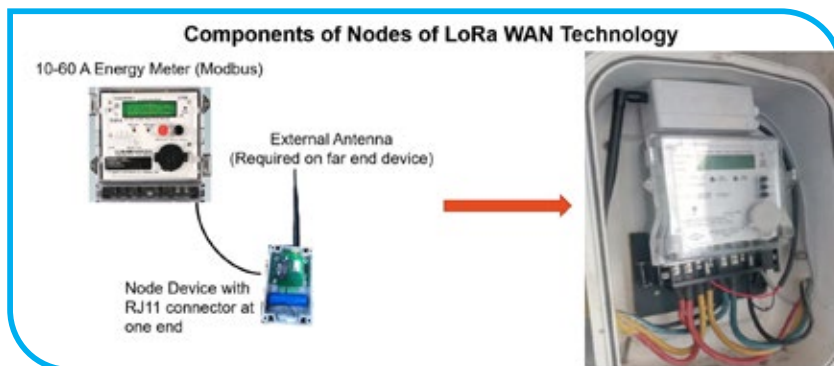
- Smart Meter (GPRS, Zigbee) is too costly to implement and also have high running cost;

- Data Frequency is not too critical in AG areas;
- Existing Meter reading accuracy in AG area is very poor;
- LoRa is having low speed which make Data Frequency less (1-3 Hour/Meter in case of 100 Meters/Gateway) but at the same time it covers very Long Range.

## FIELD STUDY REPORT

The Pilot Project was carried out in UGVCL at Ladol Sub-Division of Vijapur Division of Mehsana Circle.

## VARIOUS COMPONENTS OF THE LoRa WAN



## CONCLUSION

The said technology is most efficient and cost effective technology metering and billing where frequency and quantum of the data is not critical. This will prove as a most useful technology in case of meter reading in Agricultural sector.

**FOR MORE DETAILS, PLEASE CONTACT US WITHOUT HESITATION,  
WE ARE READY TO HEAR AND SERVE YOU AT:**



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