Gujarat Power Research & Development Cell
(A Govt. of Gujarat Initiative)
ujarat Urja Vikas Nigam Ltd
CIN: U40109GJ2004SGC045195,
IIT Gandhinagar Research Park, IIT Gandhinagar,
Palaj-382355, Gandhinagar, Gujarat, India
www.guvnl.com; www.gprd.in; guvnlrnd@gmail.com

TECHNICAL SPECIFICATIONS FORLoRa WAN BASED MODEM TO BE RETROFITTED WITH EXISTING DLMS METER, LORA WAN GATEWAY AND DEVELOPMENT OF SYSTEM DASHBOARD AND MOBILE APPLICATION

TENDER NOTICE No:-UGVCL/PROJECT/GPRD/CPC/LoRa WAN/079

Sr. No	Technical Specification No./Revision	Date of revision
1.	GUVNL/GPRD/TS/LoRA-WAN/P-006/R0	
2.		
3.		

Contents

TECHNICAL SPECIFICATIONS FOR A RETORO-FIT KIND OF LOW POWER, LONG RANGE RF TECHNOLOGY CALLED LoRA

1) OBJECTIVE:

Pilot research project for Development, Installation, Commissioning, Testing and Maintenance of communication of existing DLMS 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. Another objective is to achieve the data of various meters installed on AG consumers and Distribution transformers by way of interactive dashboard and there by identifying the loss prone areas of DISCOMs. Another objective is to provide a user friendly mobile app to enable the farmers to know their consumption pattern, billing data, etc.

2) BACKGROUND & GENERAL REQUIREMENTS:

Billing and metering is heart of any DISCOM as it is only the revenue source of the DISCOM. Also timely and errorless billing is very important for consumer service point of view. Remote meter reading is a demand of time for timely and errorless meter reading and billing. As the loss in the AG feeder is quite high, remote meter reading of various AG consumers along with the distribution transformer reading is highly required for energy auditing also. This will enable the utility to pin point the high loss area of the feeder and guide the utility to take necessary corrective action such as installation checking to the specific location.

The remote metering solution using LoRa WAN have the capacity of delivering data over long distances (high area coverage), and they offer good battery performance too. The power consumption is low so that the operating expenses will not go out of hand. Also, the capex requirement should be cost-effective and should cover as large area as possible with maximum no. of consumers covered.

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-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.

3) SCOPE OF WORK

Turnkey based work of Supply, installation testing and commissioning of LoRa WAN based modem and LoRa WAN gateway for AG consumers of selected subdivision of DISCOMs.

3.1)Supply of Hardware

- LoRa WAN based DLMS compliant modem with communication cable and antenna
- LoRa WAN Gateway(DCU) with Solar Panel, Charge controller, Li-Ion battery pack, Sim-card, SMC box, GPRS and high gain LoRa antenna, with necessary mounting accessories.

3.2)Supply of Software with following modules

- Energy auditing module
- Display module consisting of maps, graphs and tables
- Data synchronization module to fetch different master data from existing system of DISCOMs/GPRD.
- Reporting module should be able to generate reports such as billing, event, load survey, instantaneous, historical consumption pattern, power outage, modem availability, etc.
- Data archiving and reloading based on set parameters
- Mobile application API
- These software modules need to be integrated with our existing software of DISCOMs/GPRD.

3.3)Supply of Android mobile application

- Consumer of DISCOMs should be able to download and use application to view following information using mobile application in secured way
  - Current consumption
  - Historical consumption pattern
  - Billing history (up to last 13 months)
  - Their details such as address and contact information as per DISCOMs database
- Way to report power outage

3.4)Installation and commissioning of pole mounted gateway with all relevant hardware on PSC poles erected by DISCOMs.

- Installation and commissioning of LoRa WAN Master (DCU) with all relevant accessories such as Solar Panel, Charge controller, Li-Ion battery pack, Sim-card, SMC box, GPRS and high gain LoRa antenna, with necessary mounting accessories. For the same, the concern subdivision shall erect the PSC Pole on the location selected by the agency.

- Configuration of all supplied hardware with the system.

3.5)Installation and commissioning of LoRa WAN modem with the existing DLMS meter.

- Installation of modem with existing DLMS meter inside meter boxes already installed at consumer sites with necessary connecting cord.
- Configuration of supplied hardware

3.6)Monitoring and Maintenance work

- To run and test the supplied devices on site and check its data availability by continuously monitoring it for three years from date of commissioning.

3.7)Overall execution and performance evaluation

To evaluate the performance of this type of communication, it is required to conduct the pilot project as under:

- Modems will be installed with the existing DLMS meter of various capacities on site. This being a R&D project will be executed in the two parts. In Part-1, Kadi-1 subdivision of Mehsana circle of UGVCL shall be covered. Part-2 will be executed after completion of Part-1. In Part-2, Umarpada subdivision of Surat Rural circle of DGVCL and Kakanpur subdivision of Godhra circle of MGVCL shall be covered with necessary corrective measures required in the system if found during execution of part-1.
- Modem will be installed at DLMS meter of transformer centre or consumers of any category such that energy auditing module of software can be tested.
- The supply and erection of PSC pole as per the site selected by the agency will be in the scope of subdivision. The gateway should be installed on the PSC pole such that it can cover as large area as possible in the field with maximum possible no's of devices. However, the aerial range of each LoRa WAN Gateway (DCU) shall be **minimum 3 km** (Aerial distance from Gateway to modem). The successful bidder shall have to work closely with the engineer-in-charge of the project to check the best possible scenario of data frequency v/s. no. of devices and accordingly carry out the installation in the field.
- The bidder should explore possible option such as ADR (Adaptive Data Rates) technology or other remote configuration such that the max. No. of devices shall be covered with best possible data frequency. For the same, all devices shall be mandatorily compatible to have the OTA updates (Over the Air Update).

- The Gateway should be self-sustaining as it will have a solar panel with battery inbuilt. Modems are to be installed in the supervision of DISCOMs to ensure the right way of work and safety standard. The device should be plug and play type such that it should be easily understandable. The devices should have proper marking and tagging with unique serial no. with non-removable type sticker/embossing/engraving.
- Monitoring access to data on the web portal will be provided to DISCOM/GUVNL. Authority from DISCOMs/GUVNL can give feedback on the whole system periodically for the improvements till the acceptance of the software and thereafter minor modifications should be done by successful bidder at no cost for the period of 3 years. The dashboard should be designed such that various parameters should be visible on the List view/grid view with the pop-up view of live status.
- The dashboard should be able to provide the message and/or pop-up and/or report generation of the various critical parameters of the system as per requirement of the GPRD Cell/DISCOMs.
- The devices used shall ensure seamless interoperability of modem devices, gateway as well as server end for various make. For the same, the successful bidder shall be provided the standard JSON format. The successful bidder shall have to publish the data of all the parameters of final developed dashboard in that particular JSON format only. Hence, the dashboard should be compatible to be operated with all devices.
- The supplier has to handover the software with required license to run the system after completion of maintenance period. The maintenance period may be extended by mutual agreement between both the parties.
- The bidder should provide the training to the manpower with the scope of the diagnostic testing and installation of modems in the field up to 10 counts with no extra cost as per instruction of GPRD cell/DISCOMs. However, all the other arrangements for the training at site shall be in the scope of the DISCOMs/GUVNL.
- The LoRa WAN devices should follow the regulation of TRAI and it should be possible to update the firmware in OTA update (Over the Air update). The delicensed frequency band, no. of uplink and downlink channel, permitted according to TRAI and other governing body regulation should be only used.
- **Security: -** Device should be secured from both the end such that no one can access the wireless data transmission or local data without secure login and

password. Also, wherever found necessary, necessary encryption and decryption should be done such that, it should have high level of security. The same should be made available to the DISCOMs/GUVNL whenever found necessary.

- **Galvanic Isolation: -** All the circuits should be having the 1 Kv galvanic isolation such that, if any surges propagate from the system, should not damage the device. Testing on random sampling bases shall be carried out to check the device compatibility in this regard while PoC/Inspection.
- **Status of the modem: -**To have the information regarding the possible error, the modem should have following indicator in form of separate LEDs or LCD/LED Display.
    - **Mains/ Battery:-** Modem is powered ON/OFF (Modem getting power or not)
    - **Meter read:-** Modem is trying to communicate with the meter or not
    - **Sever Send:-** Modem is sending data to the Main DCU(Master device) or not

- **Status of the DCU/Gateway: -**To have the information regarding the possible error, the DCU devices should have following indicator which should be mandatory be visible on dashboard and optionally on the DCU.
    - Battery charging in percentage
    - Solar Generation parameters
    - GPRS connectivity signal strength

4) DETAILED SCOPE OF WORK

4.1)Survey

- The bidder should capture the geo-locations having accuracy <10 m. of all the devices to be retrofitted with the meters and master devices. The same shall be handed over to the owner and it should also be used in the consumer information of dashboard for the utility with the status of the user parameter as decided by owner.
- Bidder should ensure that the range overlapping of gateways should be as small as possible to ensure the cost-effectiveness of the project.
- Bidder should take in to consideration of obstacles which can introduce noise in the signals.

4.2)Modem Installation

- Each device shall be having its unique serial no. embossed/stick and should be non-removable type.
- Installation and commissioning of the node devices with the existing meter with magnet type MRI port or RJ11/RJ9 connector according to meter make shall be in the scope of bidder.
- Respective DISCOM should extend necessary support by giving allotment of the optimum manpower for the particular task throughout the execution of the project to the successful bidder so that the manpower hours of both the bidders and DISCOMs shouldn't be wasted and the project can be completed within the timeline. However, whenever feasible and mutually agreed upon by both the parties, the material or work shall be provided by concern utility, against which the necessary charge quoted against the item shall be deducted from the order value.
- Wherever, non-DLMS meter/electromechanical meters are installed, it should be replaced by the DLMS meters by the DISCOM staff and then the retrofitting with the existing meter shall be carried out. However, necessary cooperation in all respect for the same shall be extended by concern agency to cop up with the utility staff. In this regard, list of consumers along with their make of meter and model shall be provided by the DISCOMs/GUVNL. Once inform by bidder about non-DLMS meter or faulty meter, DISCOM shall replace it with DLMS meter within a week time and intimate to the supplier.
- Installation and Configuration of Node devices with the server according to standard JSON shall be in the scope of the bidder.

4.3)Gateway (DCU) Installation

- Each device shall be having its unique serial no. embossed/stick and should be non-removable type.
- After intimation of bidder about the selection of location for gateway installation, the DISCOMs should carry out the erection of pole work at stated location within a week time

and intimate to the bidder. Installation and commissioning of the Gateway along with GPRS connectivity, solar panel, charge controller, etc. shall be in the scope of the bidder. However, whenever feasible and mutually agreed upon by both the parties, the material or work shall be provided by concern utility, against which the necessary charge quoted against the item shall be deducted from the order value.

- Selection of the appropriate location for placement such that it shall cover the maximum possible area shall be in the scope of the bidder.

- Prepare the site (cleaning, digging, etc.) for the placement of pole on which Gateway will be rested shall be in the scope of DISCOMs

- The liability for the safety of carrying out the installation and commissioning throughout the scope of work shall be solely of the concern agency. All necessary safety precaution according to CEA safety regulation and other safety measures has to be taken in to consideration by concern agency.

- Configuration of the Gateway shall be in the scope of the bidder.

4.4)Software

- Develop a system for visualization of metering data in user friendly and informative form and integrate with our existing system.
- The space for the hosting of the website shall be provided on the GPRD server/GUVNL Server. Wherever handover is required from one server to another server of DISCOMs, same should be provided with no extra cost.
- As and when required, the data backup of the all devices shall be arranged to be transferred at the place and in the format required by the GPRD cell/DISCOMs.
- At end of software maintenance period handover server software with source code such that GUVNL or its subsidiaries can use this software for their internal use without any kind of restriction such as time or number of consumers/users. Supplier will be allowed to use source code outside.
- The maintenance period may be extended by mutual agreement between both the parties.

4.5)Mobile application

- Mobile application should be user-friendly and in both the language Guajarati and English.
- User should have way to self-register himself without contacting DISCOMs and maintain login such as change/reset password by OTP verification on registered mobile no. available with DISCOMs.

- Application should display current consumption data, historical consumption pattern for last 13 months (if available) in bar chart form and consumer contact information as per DISCOM's record.
- At end of software maintenance period handover server software with source code such that GUVNL or its subsidiaries can use this software for their internal use without any kind of restriction such as time or number of consumers/users. Supplier will be allowed to use source code outside.
- Publication of mobile app in play store/app store shall be in the scope of GPRD Cell/DISCOMs.
- The maintenance period may be extended by mutual agreement between both the parties.

4.6)Integration of Gateway with cloud and legacy system

- Integration in all respect with all necessary software's and hardware shall be in the scope of work of bidder.
- The dashboard should able to generate the raw data file in the format which can be directly uploaded to the metering and billing legacy system of the DISCOMs. Necessary provision should be given for the same in the dashboard report generation.

4.7)Testing, Commissioning, Maintenance and Supervision of the network

- After all hardware connection, along with hardware-cloud integration, the whole system should be checked and tested.
- Make corrections in hardware or software wherever it is required with a view to increase the efficiency and accuracy of data.
- Regular data for the period of three year shall be the responsibility of the bidder. The data reliability should be displayed on the dashboard. The percentage data reliability shall be calculated as daily one stamp of data for each meter. In case any meter data is not received consecutively for 5 days, it should be attended and rectified within a 7 days' time. In case of any disconnection or power outage for long duration, the bidder should be informed by concern subdivision to avoid unnecessary site visit.
- If the three year is not sufficient, GPRD cell may increase the testing duration as per mutually agreement between both the parties.

4.8)Feedback system

- Authorities will give Feedback periodically of the working of the system and issues if any.
- As per feedback, necessary corrective actions shall be taken by the agency.
- Agency shall inform their concern engineer to take necessary corrective action on priority basis. In case the maintenance work required is estimated to take long time and longer shutdown is anticipated than the successful bidder should make necessary arrangement prior in case to be terminated for short duration because of the improvement/diagnostic

check. In case the duration found long by the authority, the agency shall have to make necessary arrangement for the temporary availability of data as prescribed at his own cost.

4.9)Reports

- Provide Lora WAN Gateway Report Every Month or as per the duration decided by the authority to the dashboard in downloadable format in consultation with GPRD cell/GUVNL.
- Parameters of battery health and Solar Panel should be monitored on the dashboard.

4.10)*Proof of Concept (PoC):* If required, GPRD Cell and UGVCL may ask bidders to perform PoC on the system consisting of up-to 5 modems and 1 Gateway. Once intimated, the PoC shall be performed within a week time.

5) GUARANTEED TECHNICAL PARTICULARS (GTP) FOR LoRA WAN MODEM TO BE CONNECTED WITH METER

Sr. No.	Technical Spec (Required)		Technical Spec (Provided)	Confirm or not?
5.1	**Electrical Characteristic (room temperature 25 ℃)**.			
	Rated input voltage	: 100-240VAC		
	Input voltage range	: 90-264VAC		
	Operating Frequency	: 50-60Hz		
	Maximum input current	: < 0.2A		
	Maximum Power Consumption	: < 2W		
	Input current surge	: < 10A		
	Maximum input voltage	: < 270VAC		
5.2	**RF Characteristic**			
	RF Frequency	: 865-867 MHz (Delicensed)		
	Output Power of Radio	: As per regulation		
	Antenna Gain	: 3dBi (Minimum)		
	Antenna Type	: External		
	Modulation Type	: LoRa WAN		
5.3	**Interface Characteristic**			
	Meter Communication Type	: DLMS of any make		
	Protection	:1000Vrms Galvanic		
	Connection Type	: Screw Terminal/ RJ11/MRI Magnetic port		
5.4	**Other**			
	Operating Temperature	: -20'C to 60C		

6) GUARANTEED TECHNICAL PARTICULARS (GTP) FOR LORA WAN GATEWAY & ITS ACCESSORIES TO BE INSTALLED ON POLE

Sr. No.	Technical Spec (Required)		Technical Spec (Provided)	Confirm or not?
6.1	**LoRA WAN Gateway**			
	Internet Connectivity	:WiFi / Cellular		
	Modulation Type	: LoRa WAN		
	GPS Receiver	: Optional		
6.2	**RF Characteristic**			
	Antenna Fitting Type	: External		
	Antenna Gain	: >= 10dBi		
	Input Impedance	: 50 Ohm		
	Polarization	: Vertical		
	Lightning protection	: DC Ground		
6.3	**Solar Panel, Battery and accessories**			
	Solar panel Rating	: 100W		
	Solar panel output voltage	: 12/24Vdc		
	Charge Controller Operating Voltage	:12/24Vdc		
	Charge Controller Max. Current	:12A		
	Charge Controller Type	:PWM		
	Battery Chemistry	: Li-Ion		
	Rated Battery Voltage	: 11.1Vdc		
	Battery Capacity	: 40 Ah		
	Operating Temperature	: -20'C to 60C		