

**Need for Open Communications Standard for Metering and suitability of
DLMS-COSEM**

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By

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Introduction

India's Metering Industry is growing and vibrant with a large install base of tariff meters, and numerous Indian and international manufacturers and service providers serving the market.

Currently there is a very vibrant debate going on in the metering industry by all its stakeholders on the issue of adoption of DLMS / COSEM [1] communication standards in India. This document puts the standardization process in perspective, and discusses the need for a open protocol standard for metering communications, and also discusses on the applicability of IEC 62056 / DLMS/COSEM in the Indian scenario.

Current Indian Metering Scenario

India Electricity market has a unique problem of large amount of losses, theft and unbilled power at the distribution level, and there is great impetus in bringing these under control. Theft is attributed to be the largest reason for loss in electrical distribution and there is large focus both from the government, the utilities and the manufacturers to address this issue. Hence over the years the metering specifications and features have been more and more adapted to detecting tamper in the meter as one its unique features.

Given the above scenario, constant monitoring and tracking of your metering assets and usage is becoming key to all utilities. So also is the requirement for a large number of analysis and load management applications to be deployed by utilities for managing its distribution network and making decisions on future investments and immediate corrective actions.

To manage these requirements, the utilities have been resorting for quite some time to ordering not only the meter, but also the metering software and communication system from a single meter vendor. When multiple vendors exist, a similar duplicate system exists at the utility. Data integration happens at a very higher level, where these different system data gets aggregated in some MIS/ERP system. These integrations and the low flexibility and great dependency on the vendors, is resulting in reduced operational agility for the utility as well as increased costs in deploying any new type of higher level management and reporting software's or implementing large scale remote metering systems.

Over the years a number of metering protocols have come to be existent in the Indian market. These are namely the older IEC standard of IEC 1107, the ANSI Standard, the PACT standard from secure meters and Modbus Standard. The Common Meter Reading Instrument is available from many vendors, which support manufacturer specific programs, which can read and convert the proprietary formats into user readable form.

These protocols have been consistently modified over the period by the manufacturers to meet many of the unique requirements of the utilities, from a functional point of view, especially with regard to theft and tampering. The manufacturers have also brought about many solutions that enable the utilities to deploy AMR, metering applications etc., using their meters.

The Indian Utilities were more or less ignorant of the communication issues and inter-operability requirements, open protocol requirements etc., and hence metering protocol, as one of the critical components to be considered in a meter purchase was never felt or implemented and was left totally in the scope of the manufacturer to decide on what to use. The manufacturers have been reluctant to open up their metering protocol for the public, and each manufacturer's protocol is private to itself, and drivers were provided to utilities on request. However with the existence of a number of specific standards and specific addressing in each of the meters, in the long run Utilities are facing problems in getting to communicate with their meters seamlessly, without getting bogged down by technical issues related to proprietary protocols, reading systems and lack of common remote reading capabilities and thereby not able to deploy MIS and management applications with automated metering as input in any fruitful way.

The biggest drawback with the current system is the large investment being made by individual metering companies, the system integrators, the software implementers and the utilities themselves in maintaining their own set of communication protocols, drivers, adapters, XML converters, and application solutions. There are instances of large government funded projects for AMR resulting in a real success rate of 20-30% of actual metered points from remote, due to lack of information on communication protocol being available. Thus a large amount of government funds get wasted in such projects with proprietary projects.

The distinct solutions also does not allow for a common platform for the utilities, the meter manufacturers and software solution providers need to learn, adapt and upgrade their basic meter, and its capabilities, address the issue of effective reading and management of theft, providing cost effective meter reading, implementing high end software solutions for their other critical function and adapting to the latest technological advancement easily in the communication, software and utility management systems space.

Implementation of a common metering standard in Indian Context

It has been recognized and proven world over that standards help to reduce cost, improve competition and provide a more level playing field. This is true of all

standards including communication protocols. The Indian experience in the standardization process also demonstrates the benefits of standardization. These standards help bring new technology and products to the mass market, enables competition, and thereby bring products at attractive costs as these standards are open, allow inter-operability and encourage numerous players into the market. The communication in itself never becomes the competitive advantage of a product, but the other features of the product become the competing point for the products.

The situation in the case of communication standards for utility automation, under the IEC Working Group 13, Technical Committee 57, is also another milestone in question where different communication protocols that have been defined have resulted in more inter-operability and higher competition and lower cost to end customers. The TC 57 Technical Committee has stipulated a number of communication protocols that standardizes different aspects of utility communication including protocols between RTU and Control Center (IEC 60870-5-101 / IEC 60870-5-104), between control centers (IEC 60870-6 or ICCP/TASE.2), within sub-stations (IEC 61850), for relays and protection equipments (IEC 60870-5-103) and for DMS/EMS Systems as well as Enterprise Integration for connecting data between utility systems and ERP, Asset Management, Trouble Call Management and between Different Energy Participants and ISO's (IEC 61970 / IEC 61968). These standards define the various aspects of the utility communication requirements, and are playing an important part globally in the last 10-15 years in bringing about more uniform communication mechanisms with in the utility domain.

The TC 57 working group also has adopted the DLMS / IEC 62056 as the standard for metering. This effort greatly enhances the value of DLMS as a universal standard for metering. Some of the key advantages of DLMS includes its object oriented nature, support for different communication media including Ethernet TCP/IP, standardized object identification codes, thereby removing ambiguity and a standard communication profile, which is open that addresses how the various devices can interoperate and communicate. The DLMS also provides for a conformance standard that helps manufacturers and utilities to ensure that suppliers comply to the standard. The DLMS architecture is thus complying to the overall long term objectives of the IEC TC57 committee on utility communications and hence has been adopted as an IEC standard.

Indian Electricity Network is slated to be the 3rd Largest in the world, and is rapidly expanding to meet the varying requirements brought about by exponential demand increase, large grids being deployed, large investments in distribution automation, large rural electrification drive and an increasing focus on monitoring and control of billed and free power. It is important that such a large network be standardized with respect to communication aspects in metering, since there are already applicable standards for metering and almost all other utility equipment already stipulated and followed. Only communication in this sector is currently

not standardized. Without standardization in metering communications the whole concept of standardization of products becomes irrelevant, since this is the most critical aspect in building a networked electricity infrastructure.

In India, all the major utilities have adopted most of the protocols under the IEC TC57 committee including IEC 60870-5-101 and IEC 60870-5-104 for sub-station to control center communication, IEC 60870-5-103 for IED / Relay Communication, Inter Control Center Protocol (ICCP/TASE.2 or IEC 60870-6) for communication between control centers under the ULDC scheme and most recently adopted IEC 61850 for communication within sub-stations. Thus the Indian utilities and Indian transmission, distribution and generation companies have gone a long way in the adoption of the latest IEC TC57 standards for their various communication requirements.

It is important hence for the Indian Power Ministry, the Bureau of Indian Standards, CPRI and CPIB to work with Indian Meter Manufacturers and Utilities to evolve a common communication standard for meters. This standard need not necessarily be DLMS since what India requires currently is an open standard, with object oriented architecture and common communication and security profiles. A starting point can be made in this direction by one of the leading manufacturer opening up their metering protocol, and making it available to a standing technical committee for evaluation and up gradation. The first version of the Indian metering standard can be adopted as the Meter manufacturers protocol in its current form, with a road map for revisions. This is true for the metering standards for pre-paid metering too.

Indian Metering and Utility Industry however can make a huge leap in terms of its products being adopted globally, if it follows the IEC Standards, and BIS plays an active role in the IEC WG13, not only as participant with observer status (in many committees), but as a full voting member, and fully working towards ensuring the interests of Indian Utility Industry and Indian Manufacturers. This is the way ahead for the Indian Industry that will give Indian Manufacturers the maximum benefit in not only bringing standards based products to India, but also in being able to compete globally.

Features of DLMS-COSEM Standard for Electricity Metering as adopted by IEC WG 13, TC 57

DLMS/COSEM provides a common meter model at its communication interfaces so that the external interfaces are open and standardized. The standard in itself does not define a meter, but provide standard object models for modeling any standard electrical meter and also provide very pre-defined external interface for communication purposes.

The Object Models as defined by the standard in no-way determine how the meter has to be built or modify the actual metering system. It only gives a

presentation mechanism of a given meters features at its communication interfaces. Hence every meter manufacturer is left to define his own standard meter models. The DLMS/COSEM also defines standard metering object identification system, which are fixed for standard meter functions. This enables every meter reading system to understand a value by its identification system, irrespective of the meter. The DLMS/COSEM also allows for uploading the Objects supported by a meter, and then reading the meter values, which enable any DLMS/COSEM Compliant Client software to read any manufacturer meter.

The DLMS/COSEM specification is standardised by both the IEC and CEN, the standards are available for anybody at nominal cost. There are no license fees payable or any like costs.

DLMS/COSEM:

- covers all metering functions required on the liberalised market. The functions are modelled using metering domain specific interface objects. This allows developing meters meeting exactly customer needs, using standard building blocks. It also allows innovation and competition by enhancing functionality in a standard way as required while maintaining interoperability.
- ensures unique identification of all metering equipment world-wide and unambiguous identification of all data elements.
- ensures unambiguous interpretation of all metering data.
- allows controlled and selective access by various parties to application relevant data.
- improves efficiency through effective data organisation and encoding.
- provides various levels of security mechanisms to control access to data depending on authentication and access rights.
- covers all type of metering equipment, including electricity, gas, water, heat etc.
- is suitable from the simplest devices to the most complex ones.
- opens the way for exchanging data over various communication media, as the meter data model is independent of the communication protocol stack.
- brings interoperability, and therefore lowers costs, as it is based on a standard data model and internationally approved standard protocols.
- provides mechanisms to facilitate installation, as the data collection system is able to learn the data structure of the newly installed meter and to download the parameters as required by the application and metering site.
- allows developing a genuine driver, as the meter describes the functions available and sends all information necessary to interpret data. This allows meter manufacturers and data collection system providers to concentrate on

the applications relevant for their customers rather than on connectivity and interfaces;

comes complete with a conformance testing scheme to guarantee interoperability.

Some of the key aspects of DLMS is as follows:

- DLMS/COSEM is open
- Energy type, manufacturer and communication media independent interface model
- DLMS/COSEM support functionality for the measurement of all energy types
- The COSEM model supports any device complexity
- All data can be unambiguously identified
- Clear and unambiguous data interpretation
- DLMS/COSEM supports innovation and competition
- Support of various communication architectures and protocols
- Efficient, secure, controlled and selective data access
- Safe data transport via leased lines, PSTN, GSM
- Meter data exchange via the internet
- Low protocol overhead and efficient encoding
- System integration, meter installation and maintenance facilitated
- DLMS/COSEM is self-descriptive allowing to develop generic drivers
- Cost reduction through interoperability
- Conformance testing
- Provides a mechanism for expanding the Object Identification Codes and new data types. This in India can be stipulated by BIS as an Indian Standard and later given to DLMS UA for standardization process

Implementation of DLMS/COSEM in Indian Context

Implementation of DLMS/COSEM in the Indian Context throws open more a Pandora's box with more questions than it can answer. The major constraint that is facing the Indian Industry is the existing install-base of meters, which all have proprietary protocols. The Indian Industry requires a two step approach to attacking this problem. First is to address the issue of existing meter install base and the second is to plan for the new and expanding requirement of enhanced communicable standard meters for the future.

The **meteringindia.com [2]** approach is a good first step to address the existing install-base of meters. Adoption of any new technology will result in a migration environment, which is not smooth. However this in no way should take away the benefit of the new technology. The Industry hence has to adopt means to adapt to the new technology, and at the same time, for a considerable period of time, support the old install-base. The current meteringindia.com approach to having a coming API for meter reading, with different protocol drivers for different meter model's, is an intermediate solution as the Industry migrates to the new technology. It has to be noted that current architecture for AMR and remote metering and meter reading as per the meteringindia.com approach, results in increased meter reading time, enhanced investment in integration issues and implementation of own application software which shall interface with the architecture as proposed. However to ensure that the current investments does not go waste, this approach is inevitable.

This hence is a good approach provided this is the first step towards an open standard. As a second step, all new tenders and procurements should be done for DLMS meters. Indian manufacturer's should not be disqualified in any tender's but shall be allowed to quote for DLMS's meter tenders, provided they already have meters of the same class, and a proven track record with albeit proprietary interfaces. They will hence take orders and implement DLMS meters and DLMS compliant products duly certified by CPRI.

The meteringindia.com with assistance from APDRP/CPRI/CBIP/BIS etc., should come out with INDIA specific Objects in DLMS, if it is found that the standard DLMS features cannot address any India specific issues. It should be however noted that globally, intelligence in the meter to detect tampering, has reached a saturation point, since the meters themselves have limitations, to the number of analysis it can do, and the number of parameters on which it can do analysis. Hence loading the meter with more capabilities that are very specific in nature results in a non-standard product in the long run, which becomes costly to the utility and does not still fully satisfy its requirements.

Effective control of losses as well as theft and tampering data can be obtained, by increasing the metering points along the distribution network, with implementation of open AMR and Energy Management and Distribution Management Systems, which will provide the utility with clear insight into the usage pattern of its customers and then arrive at points where energy loss and theft happens and address this problems in a holistic and systematic way

Advantage to Indian Industry

Adopting DLMS/COSEM by Indian Meter Manufacturers enable them to develop products, which are future proof, and reduces integration costs, and enable the future applications that enable proper monitoring and control of Electricity Distribution and Loss Reduction in India, and the overall savings is tremendous.

The DLMS/COSEM if supported by Indian Manufacturer's enable Indian Manufacturers to compete on a level footing in the Global Markets. Also this enable the Indian Industry to develop new and innovative applications integrating meters, for the evolving requirement of energy savings, loss reduction, liberalized energy markets, energy trading etc.,

Also, with the increased use of Gas in the Indian Industry, this also provides for using the meters for Gas/Water Metering applications in future, with a very similar protocol.

Conclusion

It is important to ensure that the Indian electrical metering industry and all its stakeholders recognize and approve a common and open standard for metering communications. This will result in large savings in time, money and ease of deployment of advanced energy management and automation systems that will make the utility competitive and profitable in the months and years to come.

This standard can rely on open standards like DLMS-COSEM adopted by IEC TC 57 or follow a phase wise approach, with the Indian manufacturers opening up their communication protocols for standardization, and developing an Indian standard, as a first step, and later go in for a next version of the same, incorporating the best available in the world at that time.

However what is important at the moment to recognize that when India is following the latest standards in a globalize scenario on all aspects of a utility's business, metering should not be left behind, since this is the most critical, and hence the first to be opened up. Globally it is recognized that open systems are cheaper and have lesser problems of security than closed systems and Indian story will in no way be different.

Reference:

- [1] DLMS-COSEM: Distribution Line Messaging Specification – Companion Standard for Electricity Metering, is an IEC Standard for Energy Meter Communication and Energy Meter Object Identification and Modeling and is defined by various IEC Standards Including IEC IEC 61334-4-41:1996, IEC 62056-21, IEC 62056-42:2001, IEC 62056-46, IEC 62056-61, IEC 62056-62,
- [2] www.meteringindia.com web site related to the specifications for metering using API's and XML
- [2]

Abbreviations:

DLMS	–	Distribution Line Message Specification
COSEM	–	Companion Specification for Electricity Metering
IEC	–	International Electrotechnical Commission
TC 57	–	Technical Committee 57
WG 13	–	Working Group 13
AMR	-	Automated Meter Reading
CPRI	-	Central Power Research Institute
BIS	-	Bureau of Indian Standards
CBIP	-	Central Board of Irrigation and Power
APDRP	-	Accelerated Power Development Program
PSTN	-	Public Switched Telephone Network