Government of India
Ministry of Power

Report of High Level Committee
on
Standardization of Meter Protocol

Central Electricity Authority
New Delhi
December 2008

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REPORT OF HIGH LEVEL COMMITTEE ON STANDARDIZATION OF THE METER PROTOCOL

Contents

ANNEXES

Abbreviations

AMI	Advanced Metering Infrastructure
AMM	Advanced Meter Management
AMR	Automatic Meter Reading
AMRA	Automatic Meter Readers Association
ANSI	American National Standards Institute
API	Application Program Interface
APDRP	Accelerated Power Development & Reform Programme
BIS	Bureau of Indian Standards
CBIP	Central Board of Irrigation & Power
CDF	Common Data Format
CEA	Central Electricity Authority
CFC	Common Format Converter
CFW	Common Frame Work
CMRI	Common Meter Reading Instrument
COSEM	COmpanion Specification for Energy Metering
CPRI	Central Power Research Institute
DISCOM	DIStribution COMpany
DLMS	Device Language Message Specification
DLMS-UA	DLMS User Association
IEC	International Electrotechnical Commission
IEEMA	Indian Electrical and Electronics Manufacturers Association
IIT	Indian Institute of Technology
IT	Information Technology
MIOS	Meter Inter Operability Solution
MSEDCL	Maharashtra State Electricity Distribution Company Limited
NC	National Committee
OBIS	OBject Identification System
PSTN	Public Switched Telephone Network
R-APDRP	Restructured APDRP
SC	Sectional Committee
TC	Technical Committee
UHBVN	Uttar Haryana Bijlee Vitaran Nigam
WBSEDCL	West Bengal State Electricity Distribution Company Limited
WTO	World Trade Organisation
XML	eXtensible Markup Language

REPORT OF HIGH LEVEL COMMITTEE ON STANDARDIZATION OF THE METER PROTOCOL

EXECUTIVE SUMMARY

1. The process of integration of a modern electricity meter with the IT infrastructure attains complexity with numerous proprietary protocols available for each meter make/type. To ameliorate the difficulty in dealing with a number of proprietary protocols and to ensure inter-operability of different makes/types of meters, open protocols have been evolved and standardized by American National Standards Institute (ANSI) and International Electrotechnical Commission (IEC). A forum of nine Indian meter manufacturers under the aegis of IEEMA has also proposed Meter Inter-Operability Solution (MIOS). The adoption of an open protocol to enforce inter-operability of different makes of meters has been under consideration for past few years.

2. The Ministry of Power have constituted a High Level Committee under the Chairmanship of Member (Grid Operation & Distribution), CEA comprising members from Electricity Distribution Companies, IEEMA, NTPC, Director General, CPRI, for standardization of meter protocol to enforce inter- operability of different makes of meters, both existing and to be installed in future in the power sector.

3. Taking note of the deliberations on the subject that have already taken place during the past few years, discussions on the issues framed during of the Committee Meetings and consultation process with the concerned stakeholders, a consensus emerged in regard to the adoption of the open protocol as per IEC 62056 series of standards for future meters. In regard to legacy meters, it was considered appropriate that utilities may depending upon their requirement opt for MIOS or APIs for AMR applications.

4. After detailed deliberations the Committee recommends as under.

   4.1. The new meters to be procured in future may conform to the open protocol as per IEC 62056 series of standards.

   4.2. For the legacy meters utilities may adopt any of the following options:

      a) To use APIs / MIOS as developed by MIOS Forum.

      b) Replacement of existing old meters with IEC 62056 compliant meters.

      c) To make meter suitable for open protocol (IEC-62056) by incorporating protocol converter, if feasible.

   4.3. In order to operationalise the implementation of IEC 62056 in respect of new meters, following issues need to be addressed on priority.

      a) Application wise standardization of parameters for various meters including tamper list may be carried out by CEA along with CPRI and NTPC in consultation with utilities. The standard parameters may then be specified by all the utilities.

      b) Compilation of OBIS codes as per IEC 62056 for above parameters and identification of the parameters for which OBIS codes are not available and evolving codes for the same. CPRI to take necessary action in this regard.

      c) CMRI vendors may develop CMRI having IEC 62056 compatibility for standardized parameters.

   4.4. Ministry of Power may consider constituting a committee under the Chairmanship of DG, CPRI with members from CEA, meter manufacturers and standardization body

(BIS) to approve and channelise the incorporation of India specific requirement in the IEC 62056 as may be necessary at a future date.

4.5. Necessary action would be taken on the above points in a time bound manner to enable release of agreed common parameters at the earliest for procurement of IEC 62056 compliant meters.

4.6. Funds may be earmarked under R-APDRP for supporting implementation of open protocol and enhancing the facilities for testing of IEC 62056 compliant meters in the country.

REPORT OF HIGH LEVEL COMMITTEE ON STANDARDIZATION OF THE METER PROTOCOL

1. Introduction

A modern electricity meter offers features beyond conventional energy metering to enable storage of data of load profiles to facilitate further analysis, time of day metering, tariff & tamper notification, online demand side management etc. Realisation of full capabilities of the modern metering system would need its integration with the modern IT infrastructure to facilitate its communication directly with the AMR/AMM systems. The metering systems have evolved to the present stage through the innovation of the manufactures using the proprietary protocols for communication. Application Program Interfaces (APIs) were provided for each model of electricity meter to translate the information downloaded from the meter for further use/analysis. To overcome the difficulty of integration of data from meters of different makes and achieve interoperability, open protocols have been evolved over the time such as ANSI protocol in USA, Canada and DLMS by DLMS-UA.

The interoperability aspect of the electricity meters has been under discussions in the country for past few years. In view of large scale AMR and IT implementation proposed during the Restructured Accelerated Power Development and Reforms Programme during XIth Plan the interoperability issue of different makes and models of electricity meters needs to be resolved. In this regard, the Government of India has constituted a High Level Committee to make recommendations to enforce interoperability of different makes of meters.

2. Constitution of the Committee

The Ministry of power vide their order no 6/8/2008-EC/APDRP dated 21st October 2008 (Annex-I) and 27th October 2008 (Annex-II) constituted a High Level Committee as under:

1. Shri S. M. Dhiman, Member(GO&D), CEA ..... Chairman
2. Shri A. B. Pandey, Managing Director, MSEDCL
3. Shri Vijender Kumar, Managing Director, UHBVN
4. Shri Malay De, C.M.D, WBSEDCL
5. Shri R. C. Dhup, G.M., NTPC
6. Shri S. C. Sarkar, President Metering Division, IEEMA
7. IEEMA Representative
8. Shri P. K. Kognolkar, Director General, CPRI ..... Convener

Shri S. Jhalora, DGM, Sales, Secure Meters attended the meetings of the Committee as a representative of IEEMA.

Secretary CBIP and Shri N. Murugesan, Chief Manager from TATA Consulting Engineers Limited were invited to the 2nd meeting of the Committee.

3. Terms of Reference

The Committee was given a mandate to submit its recommendations by 30th November 2008 for standardization of meter protocol to enforce interoperability of different makes of meters for both existing and future application in the power sector.

4. Background

India has a large installed base of energy meters procured from numerous Indian and International manufacturers serving the Indian market. Constant monitoring and tracking of metering assets and electric usage have become very important for all the electricity Utilities. The requirement of complex analysis and load management applications has also emerged in the current scenario. Therefore, collection, validation and transformation of data from a large number of meters have to be carried out to realise benefit from the investments on the meters.

The advent of static meters has resulted in changes in the method of data collection. The reading can be taken manually, downloaded into a hand held device or transferred through a communication media to a Central location.

Evolution of the electricity meters using microprocessor based technology has historically taken place with proprietary protocols to provide internally stored values in formats unique to the manufacturer. With the change in requirements of the utilities, additional parameters and features have been added resulting in different versions of meters even from the same manufacturer. The users of these multiple versions of meters are burdened with multiple data formats on proprietary protocols. The Utilities have to buy and maintain separate Application Program Interface (API) software from each meter manufacturer in order to make use of the data from different versions of meters. In addition third party handheld readers and remote metering systems have to be updated for every new meter type/ version added to the utility system. The proprietary protocols results in dependence of the DISCOMs on the vendors of meters as the APIs are needed for integration of metering information with the IT infrastructure. This resulted in focus on the development of open protocol.

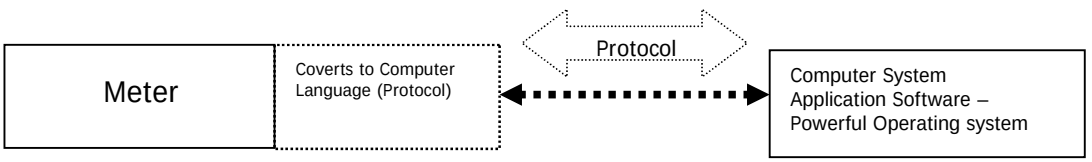
5. Interoperability

The interoperability is the capability of the data collection system to exchange data with meters of different makes and the capability of the metering equipment to exchange data with different type of data collection systems. This necessitates the presentation of the meter data in predefined common formats and address system for the meters which results in compact, low cost and efficient programming effort for AMR/AMM applications using IT infrastructure. The evolution of enhanced capabilities afforded by microprocessor based meters and the desire to harness the benefits of such capabilities led to development of open protocols independent of make /manufacturer. With the availability of open protocols, many options and features become available to the purchaser or software developer who may want to take advantage of them to optimize their operations or to maximise their commercial benefit.

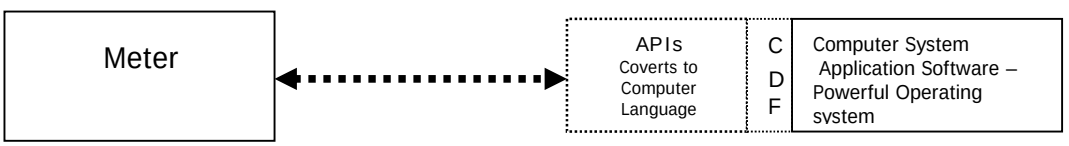
American National Standards Institute (ANSI), Automatic Meter Reading Association (AMRA) and Canadian Standards bodies collaborated to develop a solution to overcome the obstacles in the meter communications as discussed in preceding paragraphs. All the stakeholders viz. utilities, meter manufacturers, third party software providers, consultants and others interested in the field were involved to evolve ANSI protocol standards which is an open protocol. The protocol is being widely used in US and Canada.

Concurrently, the International Electrotechnical Commission TC-57 evolved DLMS (Device Language Message Specification) IEC 61334-41 to cater to the requirement of the open protocol for communication. Later TC-13 adopted this protocol and modified it as IEC 62056.

To achieve interoperability of meters, a forum of nine Indian meter manufacturers under the aegis of IEEMA started working since 2002 on MIOS through two committees viz. Core Committee and Technical Committee. MIOS defines data format at the data exchange level rather than at the meter communication level. This requires Common Frame-Work software (CFW) which serves as user interface and initiates actions to perform specific tasks. CFW is a master program which invokes Manufacturer reading Module (API1) to read the meter and store data and provides links to other application programs and database. The working of the common protocol model and MIOS model is illustrated in the figure below.



Common Protocol Model



MIOS Model

6. Options Available

During discussions, the committee considered the following two options to facilitate data collection and Interoperability of meters:

1. Adoption of non proprietary open common communication protocol.
2. Application Program Interface software for each make/type of electronic meters i.e. MIOS

6.1. OPTION ONE: Open Protocol

The American National Standards Institute (ANSI) and International Electrotechnical Commission (IEC) have developed non proprietary open protocols. Owing to the alignment of the Indian Standards with those of IEC, only IEC standards have been considered.

6.1.1. International Electrotechnical Commission (IEC)

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes international standards for all electrical, electronic and related technologies. The IEC is made up of members, called National Committees (NC), and each NC represents its nation's electrotechnical interests in the IEC. This includes manufacturers, distributors and vendors, consumers and users, all levels of governmental agencies, professional societies and trade associations as well as standards developers from national standards bodies. BIS is actively involved in the activities of the IEC and has participation status in 67 TCs / SCs of IEC. It may be mentioned that depending on suitability to Indian conditions and to align the IS Codes in line with IEC Codes, most of the IEC documents are also adopted for publication as IS Code under dual number scheme of BIS.

6.1.2. DLMS and IEC- 62056

The DLMS/COSEM specification is standardised by DLMS UA, Geneva and released later as IEC standard under TC-13 for meter Communication Protocol. It is a meter modelling standard to give presentation mechanism of the meter features at its communication interface irrespective of the manner in which the meter has been built. Therefore, the standard itself does not define a meter but provides standard object model for modelling any standard electricity meter and provides pre-defined external interface for communication purpose. Features of IEC 62056 are given in Annex- III.

6.1.3. BIS and IEC - 62056

India is a Participation Status Member of the TC-13 relating to electrical energy measurement, tariff and load control. CPRI are the convener of ET-13 Panel P1 to look into the metering protocols and their adoption for Indian conditions. The BIS has already circulated six documents of IEC 62056 relating to protocol for data exchange for meter reading etc. to the Members of its Sectional Committee (ET-13) and others, seeking their comments and views for adopting these as Indian Standards. The documents circulated by BIS are listed below:

IEC No.	BIS Document No.	Document Particulars
62056-21	ETD 13 (5997)	Electricity Metering – data exchange for meter reading, tariff and load control – Part 21 : Direct local data exchange.
62056-42	ETD 13 (5998)	Electricity Metering – data exchange for meter reading, tariff and load control – Part 42 : Physical layer services and procedures for connection oriented asynchronous data exchange.
62056-46	ETD 13 (5999)	Electricity Metering – data exchange for meter reading, tariff and load control – Part 46 : data link layer using HDLC protocol.
62056-53	ETD 13 (6000)	Electricity Metering – data exchange for meter reading, tariff and load control – Part 53 : COSEM application layer.
62056-61	ETD 13 (6001)	Electricity Metering – data exchange for meter reading, tariff and load control – Part 61 : Object Identification System (OBIS)
62056-62	ETD 13 (6002)	Electricity Metering – data exchange for meter reading, tariff and load control – Part 62 : Interface classes.

It may be mentioned that the above being a Protocol standard and as CPRI have the established laboratory for testing of various protocols namely IEC 60870 series, MODBUS, and IEC 61850 (under approval), IEC 62056, CPRI were nominated to be a convener for the 62056 series of metering protocol. The adoption of IEC 62056 series of standards is under consideration in the BIS.

6.1.4. Present DLMS-UA Membership

The DLMS-UA has at present 131 members from 37 countries. A list of the DLMS UA is available on the website (www.dlms.com). The country wise membership is given in Annex-IV. There are 5 members from India namely Secure Meters, L&T, Genus Infrastructure Limited, CPRI and Kalki Communication Technologies, Bangalore.

6.1.5. Availability of DLMS compliant meters

The data available on the DLMS-UA website provides a list DLMS/COSEM compliant meter types from various manufacturers. The list includes 8 meter manufacturers/suppliers based in India. They are (1) Elster Metering Pvt. Ltd., (2) Larsen & Tourbo Limited (3) Secure Meters Ltd (4) Genus Power Infrastructure Ltd. (5) Seimens Ltd. (6) Landis & Gyr Limited (7) Actaris and (8) Iskraemeco Seahorse Limited. It may be inferred that the country has enough capability to meet the immediate requirement of the IEC 62056 compliant meters required for implementation of the restructured APDRP.

6.1.6. Facilities for Conformance Testing

CPRI Bangalore is equipped with the facilities for conformance testing of meters for DLMS/COSEM/IEC 62056 protocol. The write up on CPRI protocol laboratory is at Annex- V. 30 meter types of Indian and foreign make have been tested at this facility including – 13 meter type of Indian manufacturers namely Secure, L&T and Genus. The test facility would need to be augmented to cater to the increased future testing requirement if open protocol IEC 62056 is implemented.

6.1.7. Tamper Conditions

Apprehensions have been expressed that the tamper conditions as experienced under Indian conditions have not been incorporated in the IEC 62056. It has been informed by CPRI, who is one of the members of DLMS-UA that 55 tamper conditions were identified by them in consultation with stake holders. These have been communicated to the DLMS UA. These have already been circulated by DLMS-UA (Annex-VI) to its members and are expected to be incorporated in the IEC standards shortly. It is learnt that OBIS codes for fraud related activities have already been assigned. Details of specific tamper events could be made country specific.

6.1.8. Data Security

The IEC provides three levels of data security as described in the IEC 62056-51 standard. Data security requires encryption/decryption/authentication of data based on the latest standard algorithms of data security. DLMS-UA is currently adding new security features which include data encryption based on International practice.

6.2. OPTION TWO: Meter Interoperability Solution (MIOS)

According to this solution all meter manufacturers will continue to maintain their existing design and communication protocols. However, they will provide application program interface (API) software analogous to a driver file which can be called by the Utility application software for provision of data in the desired format. The APIs will be of the following three types:

- API1 – Reading API
- API2 – MRI API
- API3 – Convert API

API1 collects the data from the meter. The API3 converts the gathered data to CFW for the application program to pick up. The white paper on MIOS is at Annex-VII.

The MIOS specification has attempted to fulfil following objectives.

(i) To provide Common Framework (CFW) for software & to specify interfaces so that modules can be attached with it. It is envisaged that the common software will have minimum functionality attached which is described below.

- To provide module (API) for reading the meter.
- To provide module (API) for exporting data in common format so that 3rd party software which is using the data for further processing will have uniform way

of handling the data irrespective of the manufacturer from which the meter is bought.

- To provide module (API) for checking integrity of the data.

(ii) The common framework will ensure that

- Future expandability is easy
- Backward compatibility for existing meter base
- Scalability of the software
- Accommodating the requirements of different utilities
- Simplicity of 'maintenance'
- Security of the data

(iii) The common framework software will operate on Microsoft Windows operating system & meter manufacturer will provide APIs for this platform. It is believed that meter manufacturer specific software will continue to operate. The software written from this specification will simplify utilities' every day work but there will still be few technical operations left out for which manufacturer's software will be used.

(iv) It has been assumed that the target application is to collect meter data from a fixed network on need basis. The specification evolved here does not address on line data collection application nor does it address SCADA application. Since different meters continue to operate in its own way different makes of meters will not be connected on the same connection point. Similarly meters can not operate with different baud rates on the same network.

(v) The common frame work software is not expected to operate on MRI. MRI's will continue to operate as it is operating today whereby different manufacturer's software co-exists on a common MRI.

(vi) This solution does not specify that all meters will supply the same information. It only suggests that the same parameter is represented in the uniform way.

(vii) MIOS must be available in public domain for use by any meter manufacturer without any constraint.

The facilities for conformance testing of the MIOS are yet to be developed. The certification of API is proposed to be evolved.

7. Comparison of Protocols

It is observed that the adoption of MIOS would also need the use of APIs. The flexibility/features provided by the IEC compliant meters outweigh the advantages indicated for MIOS and could be used for all new meters which are proposed to be procured for R-APDRP. However, for a large number of legacy meters, APIs may continue to be used and MIOS may help in the integration of meters with the IT backbone.

8. Previous Deliberations on the Subject

The interoperability aspect of the meters and the adoption of a protocol have been under consideration for last few years. A meeting of all the stake-holders comprising DISCOM, system integrators, meters manufacturers, IEEMA, CPRI was taken by Member (GO&D), CEA on 29th January, 2008 to discuss the matter regarding the adoption of the protocol to bring in competition, transparency and ease of integration with IT infrastructure. In the above meeting, a presentation was made by IEEMA on Meter Inter Operability Solution (MIOS). MIOS has been developed by the association of nine-meter manufacturers. A presentation was also made by CPRI on the DLMS/COSEM metering protocol/IEC 62056. The various aspects including the adoption of open protocol for future meters as also the protocol for existing large legacy meters was deliberated in connection with the implementation of IT based business activities in the distribution companies. Most utilities indicated the difficulties experienced by them in the use of APIs. The utilities and system integrators had indicated their preference for adoption of open protocol. The IEEMA proposed to bring out a White Paper on MIOS in three months time.

The White Paper received from IEEMA on 28th May, 2008 was circulated to all the utilities in the country for their comments. Response received from 24 distribution utilities, NTPC and PGCIL is enclosed at Annex- VIII. The 20 utilities have indicated their preference in favour of open protocol while 6 utilities have not given any specific preference/ views.

Subsequently a meeting was held in MOP on 30th September 2008 and the minutes of the same are at Annex- IX.

9. Meetings of the High Level Committee

The High Level Committee held meetings on 11th November 2008 and 27th November 2008. The minutes of the meetings are placed at Annex - X and Annex - XI. The CMD, WBSEDCL suggested that the selection of technology should not inhibit competition. Further he intimated that hardware and software restricted practices must be avoided and once the meter is supplied to a utility, ownership of protocol must rest with the utility. The solution of meter reading should be based on the option which is cost effective. The representative of Maharashtra informed that a study for adoption of metering protocol in the State was entrusted to Consultants PowerAnser Labs/IIT Mumbai. The Consultants held discussions with all stakeholders including system integrator and meter manufacturers and various issues associated with the protocols have been discussed in the Report in detail. He further stated that in their findings the Consultants have indicated that from the interoperability view point, IEC 62056 scores over the proprietary protocols and have recommended the adoption of IEC 62056 series of standards which are comprehensive open international standards for AMR applications. The recommendations of the Consultants PowerAnser Labs/IIT Mumbai are reproduced at Annex - XII.

The other issues discussed were in respect of the non availability of tamper features in the DLMS/COSEM, lack of proper security in communication of data, large overheads

and longer time for downloading of the data. CMD, WBSEDCL indicated the position of WTO agreement in regard to the inclusion of country specific OBIS codes in the IEC - 62056.

On subsequent consultations with DLMS-UA, it has been gathered that the proposal for inclusion of the 55 tamper features as per suggestions of CPRI have already been circulated. Though, larger over heads are required for transfer of data in case of DLMS/COSEM, it is possible to selectively download the data in much shorter time as compared to MIOS. The DLMS/COSEM provides three levels of data security as described in the IEC 62056-51 standard.

10. Standardisation of Parameters and Tamper Conditions

In the Meeting held on 27th November 2008, IEEMA and representatives of meter manufacturers indicated certain prerequisites for adoption of IEC 62056 series of standards. These included standardization of parameters to be downloaded from various meter (category wise/ application wise), tamper list, compilation of DLMS OBIS codes for these parameters, identification of gaps and evolve code for the same, CMRI support for DLMS. A list of parameters as furnished by IEEMA is enclosed at Annex - XIII. A common list of parameters compiled by CEA based on the available tender specifications of utilities is enclosed at Annex-XIV.

It was agreed that application wise standardization of parameters for various meters including tamper list may be carried out by CEA along with CPRI and NTPC in consultation with utilities. The standard parameters may be specified by all utilities in their procurements.

It was also agreed that CPRI who are a user member of DLMS and also convener of the BIS committee for protocols for meters may take necessary action in respect of compilation of OBIS codes as per IEC 62056 for the meter parameters and evolve codes for parameters for which codes are not available. The necessary action in this respect is to be taken immediately on priority to enable procurement of meters for the R-APDRP as per IEC 62056 series of Standards.

The measures to address the above issues raised by IEEMA during the discussions as also in their comments on the draft report circulated on 28th November 2008 have been incorporated in the recommendations as actionable points along with time schedule for their completion/finalisation.

In regard to temper conditions, it may be mentioned that the tampering of the meters is aimed at recording the energy consumption by the meter at a lower value. Some tamper conditions at consumer end can not be identified. Further, new tamper conditions may be evolved. Therefore, energy audit of the supply area through IT application can lead to the analysis to provide vital information in regard to the pilferage of energy. This along with vigilance and accountability of the area managers together with incentives for achieving target level of performance could result in efficient power supply management.

11. Recommendations

After detailed deliberations by the members of the committee on various aspects of implementation of open protocol for metering communication, to achieve interoperability of the meters, there was a consensus on adoption of open protocol as per IEC 62056 series of standards. The Committee recommends implementation as under.

1. The new meters to be procured in future may conform to the open protocol as per IEC 62056 series of standards.
2. For the legacy meters utilities may adopt any of the following options:
    (a) To use APIs / MIOS as developed by MIOS Forum.
    (b) Replacement of existing old meters with IEC 62056 compliant meters.
    (c) To make meter suitable for open protocol (IEC-62056) by incorporating protocol converter, if feasible.
3. In order to operationalise the implementation of IEC 62056 in respect of new meters, following issues need to be addressed on priority.
    (a) Application wise standardization of parameters for various meters including tamper list may be carried out by CEA along with CPRI and NTPC in consultation with utilities. The standard parameters may then be specified by all the utilities.
    (b) Compilation of OBIS codes as per IEC 62056 for above parameters and identification of the parameters for which codes are not available and evolving codes for the same. CPRI to take necessary action in this regard.
    (c) CMRI vendors may develop CMRI having IEC 62056 compatibility for standardized parameters.
4. Ministry of power may consider constituting a committee under the Chairmanship of DG, CPRI with members from CEA, meter manufacturers and standardisation body (BIS) to approve and channelise the incorporation of India specific requirement in the IEC 62056 as may be necessary at a future date.
5. Necessary action would be taken on the above points in a time bound manner to enable release of agreed common parameters at the earliest for procurement of IEC 62056 compliant meters. Schedule is enclosed at Annex-XIV.
6. Funds may be earmarked under R-APDRP for supporting implementation of open protocol and enhancing the facilities for testing of IEC 62056 compliant meters in the country.

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2. Website of DLMS (www.dlms.com)

3. Website of IEEMA (www.ieema.org)

4. Website of Metering India (www.meteringindia.com)

5. Website of CPRI (www.cpri.in)

6. An article on "Exploring ANSI standard in meter Communication" by Ted Work (www.electricity-today.com/et/sept00/ansi.htm)

ANNEXES

Annex-I

No.6/08/2008-EC/ APDRP
Government of India
Ministry of Power

Shram Shakti Bhawan, Rafi Marg,
New Delhi, the 21st October, 2008

ORDER

In view of large quantum of A M R implementation proposed during the Restructured Accelerated Power Development and Reforms Programme during XI Plan, the interoperability issue of different make and model of Electronic meters needs to be resolved. In this regard a High Level Committee is constituted comprising of following members for standardization of the meter protocol to enforce interoperability of different makes of meters, both existing and to be installed in future in the Power Sector.

1. Shri V.Ramakrishna , Member, Central Electricity Authority – Chairman
2. Shri P. K. Kognolkar , Director General, C.P.R.I. (Convener)
3. Shri A.B. Pandey, Managing Director, MSEDCL.
4. Shri Vijender Singh, Managing Director, UHBVN.
5. Shri S.C. Sarkar, President Metering Division, IEEMA.
6. IEEMA representative.
7. C.M.D., West Bengal S.E.D.C. (Shri Malai De).
8. G.M, N.T.P.C. (Shri R.C. Dhup)

2. The Committee has to submit its recommendations by 30th November, 2008.

(Ramesh Chand)
Under Secretary to the Government of India
Tele.No. 23705957

To

Shri V. Ramakrishna , Member, CEA
Shri P.K.Kognolkar,DG,CPRI
Shri A.B.Pandey, MD, MSEDCL
Shri Vijender Singh, MD, UHBVN.
Shri S.C.Sarkar, President Metering Division, IEEMA.
IEEMA representative,
C.M.D.,West Bengal S.E.D.C.
G.M., N.T.P.C. (Shri R.C. Dhup)

Copy to:

PPS to J.S.(D)/PS to Dir.(D)
AGM (RGGVY)/ DGM(APDRP)

Annex-II

No. 6/08/2008-EC/APDRP
Government of India
Ministry of Power

Shram Shakti Bhawan, Rafi marg,
New Delhi, the 27th October, 2008

ORDER

In continuation of this Ministry's order of even No. dated the 21st October, 2008 appointing Shri V.Ramakrishna, Member, C.E.A. as Chairman of the High Level Committee for standardization of the meter protocol to enforce interoperability of different makes of meters, both existing and to be installed in future in the Power Sector.

The Competent Authority has decided to appoint Shri S.M. Dhiman, Member (Grid Operation & Distribution), CEA as Chairman of this Committee in place of Shri V. Ramakrishna, Member , CEA. Other members will be the same.

Ramesh Chand

(Ramesh Chand)
Under Secretary to the Government of India
Tele.No. 23705957

To

Shri S.M. Dhiman, Member (Grid Operation & Distribution), CEA - **Chairman**
Shri V. Ramakrishna, Member (Power System), CEA.
A.K.Kognolkar, DG, CPRI.
Shri A.B.Pandey, MD, MSEDCL
Shri Vijender Singh, MD, UHBVN.
Shri S.C. Sarkar, President, Metering Division, IEEMA.
IEEMA representative.
CMD, West Bengal SEDC.
GM.NTPC (Shri R.C. Dhup)

Copy to:

PPS to J.S.(D)/PS to Dir.(D)
AGM(RGGVY)/DGM(APDRP)

Annex-III

Features of IEC 62056 (DLMS/COSEM)

DLMS/COSEM is the international standard used in Europe and elsewhere in the world for exchanging metering data.

DLMS was originally created as the Distribution Line Message Specification and subsequently evolved and renamed as Device Language Message Specification which is a generic protocol for accessing structured data models, and particularly metering data. The evolution is based on earlier standards / practices.

The DLMS/COSEM specification, defines the procedures for Modeling the Meter, Forming Messages and Transporting. The DLMS is well documented by the User Association (DLMS-UA) in the form of GREEN, BLUE and YELLOW books. These books narrate the above said procedures and also the testing process. In DLMS the meter is referred as Server and the Host is referred as Client.

The DLMS/COSEM specification is adopted by both the IEC and CENELEC. The three books of DLMS are brought out as standards having different Part numbers by IEC. The list is as follows:

IEC Part Number	Title
IEC 62056-21-2002	Electricity Metering – Data Exchange for meter reading, tariff and load control: Direct local data exchange.
IEC 62056-42-2002	Electricity Metering – Data Exchange for meter reading, tariff and load control: Physical layer services and procedures for connection oriented asynchronous data exchange
IEC 62056-46-2002	Electricity Metering – Data Exchange for meter reading, tariff and load control: Data link layer using HDLC protocol
IEC 62056-53-2002	Electricity Metering – Data Exchange for meter reading, tariff and load control: COSEM Application Layer
IEC 62056-61-2002	Electricity Metering – Data Exchange for meter reading, tariff and load control: OBIS Object identification system
IEC 62056-62-2002	Electricity Metering – Data Exchange for meter reading, tariff and load control: Interface Classes
IEC 62056-47-2006	Electricity Metering – Data Exchange for meter reading, tariff and load control: COSEM transport layers for IPv4 networks

The above standards are available for purchase from IEC or CENELEC stores.

Maintenance of the IEC 62056 (DLMS/COSEM) specification:-

The IEC has entrusted the job of maintaining the specification with DLMS UA. Any user of the DLMS/COSEM specification may propose an amendment. The association, based on the suggestions received, takes up amendment required for the specification to meet new requirements. Proposed amendments are discussed and approved by the Working Group Maintenance. Approved amendments are regularly added to the DLMS UA colored books. IEC and CENELEC standards are amended according to their maintenance schedule.

The salient provisions of the Standard

S.No	Provision	Inference
1	Meter Modeling	The Physical meter is viewed as logical units with a few functions. The functions are accessed through "interface objects" and identified through an Object Identification System (OBIS) which are unique. Interface objects contain the actual metering data. Interface objects are designed for metering data (eg Register object, Demand Register object, Profile object etc.)
2	Messaging	The procedure to form the packets (protocol data units) for information exchange with server (meter). The meter is accessed through interface objects. This covers the required services for mapping the interface Model.
3	Transporting	This addresses procedure to transport the messages over the communication channel. At present this standard supports Telephone line, GSM, Twisted Pair, Optical port and TCP/IP – services to access these communication medium are built in.
4	Interoperability	In a typical application (revenue metering) the DLMS meters of any make can coexist and exchange information with Host (Client) having DLMS service module. The compliance of a meter can be verified through Conformance Testing. Self description – By this process the server (meter) provides its (capabilities) model with objects / function to the client (Host) with which it can integrate the meter with application. Unique OBIS codes for majority of the functions. Provision for clearly identified country-specific OBIS codes and manufacturer-specific OBIS codes. Process exists for adding new OBIS codes through the DLMS-UA
5	Security	Supports three security levels. Meter can be programmed to expose different data using different security levels. Meter data can be divided into multiple "Associations" and a different security level can be specified for each association

		1. Low level security – Pass-words 2. High level security Challenges 3. Ciphering - A symmetric key algorithm AES-GCM128 has been selected, as specified in NIST SP 800-38-D. It provides authenticated encryption to xDLMS APDUs. 4. For key transport, the AES key wrap algorithm has been selected. This provides full interoperability.
6	Open Standard	The standard documents are available for public (professionals) use. Any vendor can develop the protocol stack / drivers / modules. These can be adopted by the meter manufactures for implementing the dlms protocol. The Application (eg-energy accounting) developers can also adopt those off the shelf soft products for development. The system integrators can put together a dlms based system freely.
7	Information Access	Through Interface Classes / OBIS codes / logical names / functions / attributes to read - Instantaneous values, profiles, events, clock, cumulative, demand, power quality parameters etc. The attributes are names, values, units, scalars etc. Model allows data to be identified as instantaneous values, historical values, values per tariff, values per phase etc.
8	Legacy System	1. A cluster of existing meters with proprietary protocol can be interfaced through a Concentrator to a dlms based Host machine running the client application. The Concentrator input will be proprietary protocol meters and out put will be dlms protocol output. 2. In built converter from proorietary to IEC 62056

The security specification is available on request. It is being integrated into the Blue Book and the Green Book, and international standardization will be launched.

Annex-IV

Country wise Membership of DLMS-UA

S.No.	Country	Number of Member	S.No.	Country	Number of Member
1	Australia	2	20	Lithuania	1
2	Belgium	5	21	Netherlands	5
3	Bosnia	1	22	Norway	1
4	Brazil	2	23	Poland	4
5	Canada	2	24	Portugal	4
6	China	13	25	Moldova	1
7	Croatia	1	26	Romania	1
8	Czech	2	27	Russia	2
9	Denmark	1	28	Saudi Arabia	2
10	Egypt	1	29	Serbia	4
11	Finland	1	30	Slovenia	1
12	France	7	31	Spain	5
13	Germany	16	32	Sweden	3
14	Hungary	2	33	Switzerland	4
15	India	5	34	U K	5
16	Iran	3	35	U Krain	2
17	Italy	1	36	UAE	1
18	Japan	1	37	USA	6
19	Korea	13		Total	131

Annex-V

CPRI - PROTOCOL LABORATORY

This division has established the state of the art Protocol Laboratory which is unique in its kind in this part of the world. This is the only laboratory available outside Europe. This laboratory is equipped with test tools for carrying out protocol conformance tests as per the following standards:-

a) IEC – 62056 - For Energy Meters.

b) I EC – 60870 - 5- 101 - For RTU

c) IEC – 60870 - 5 -103 - For Protective equipment

d) IEC – 60870 - 5 - 104 - For RTU

e) IEC – 60870 - 6 - ICCP - For control centre

f) IEC – 61850 - For Communication Network and systems in substation.

g) Modbus - For Relays, Energy Meters, RTU etc.

h) DNP - For Relays, RTU etc

The laboratory has already tested Energy Meters from foreign and Indian manufacturers for IES 62056 and MODBUS compliance. The laboratory extends support for developmental assistance and certification testing.

Energy Meters Tested At CPRI AS ON - 29-10-2008

Company	Product	Date	RegNo.	CTT
1. LS Industrial Systems, South Korea	LSKLK1210DRA-120	12 Oct 2005	1018	1.01
2. LS Industrial Systems, South Korea	LK1210CT-005	28 Dec 2005	1019	1.02
3. LS Industrial Systems, South Korea	LK1210DRa-040	28 Dec 2005	1020	1.02
4. LS Industrial Systems, South Korea	LK1210DRa-120	28 Dec 2005	1021	1.02
5. LS Industrial Systems, South Korea	LK3410DRb-040	28 Dec 2005	1022	1.02
6. LS Industrial Systems, South Korea	LK3410DRb-120	28 Dec 2005	1023	1.02
7. LS Industrial Systems, South Korea	LK1210DRb-040	10 May 2006	1026	1.02
8. LS Industrial Systems, South Korea	LK1210DRb-120	10 May 2006	1027	1.02
9. LS Industrial Systems, South Korea	LK3410CT-005	10 May 2006	1028	1.02
10. LS Industrial Systems, South Korea	LK1210CTa-005	10 May 2006	1029	1.02
11. OMNISYSTEM Co., Ltd., Korea	OMWH-1205M	5 April 2007	1053	1.02
12. OMNISYSTEM Co., Ltd., Korea	OMWH-1240M	5 April 2007	1058	1.02
13. OMNISYSTEM Co., Ltd., Korea	OMWH-12120M	5 April 2007	1059	1.02
14. OMNISYSTEM Co., Ltd., Korea	OMWH-3405M	15 May 2007	1060	1.02
15. OMNISYSTEM Co., Ltd., Korea	OMWH-3440M	24 April 2007	1061	1.02
16. OMNISYSTEM Co., Ltd., Korea	OMWH-34120M	24 April 2007	1062	1.02
17. Genus Power Infrastructures Ltd, India	FEEE3DP9D	6 Nov. 2007	1073	2.0
18. Genus Power Infrastructures Ltd, India	FEEE3DP8D	6 Nov. 2007	1074	2.0
19. Genus Power Infrastructures Ltd, India	FEEE2DQ3D	6 Nov. 2007	1075	2.0
20. Genus Power Infrastructures Ltd, India	FEEE2DP6D	6 Nov. 2007	1076	2.0
21. Genus Power Infrastructures Ltd, India	FEEE1APFD	21 Dec. 2007	1077	2.0
22. Larsen & Toubro Limited, India	ER300P-M4CHA0502	25 Feb. 2008	1080	2.0
23. Larsen & Toubro Limited, India	ER300P-M4DLC1010	2 April 2008	1082	2.0
24. Larsen & Toubro Limited, India	ER300P-M4DLC1006	2 April 2008	1083	2.0
25. Larsen & Toubro Limited, India	ER300P-M4CHA0102	2 April 2008	1084	2.0
26. Larsen & Toubro Limited, India	ER300P-M4CHB0502	2 April 2008	1085	2.0
27. Siemens Energy Services UK	CM-32	2 April 2008	1086	2.0
28.PRI Ltd., Winchester, UK	PRI-P3T000/xxG	16 June 2008	1090	2.0
29. SECURE METERS LIMITED	EHL-E3T000/xxG	16 June 2008	1091	2.0

30. SECURE METERS LIMITED	EHL-E3M000/xxG	16 June 2008	1092	2.0

The laboratory also offers consultancy on Automation related to substations to all major utilities in the country. The laboratory also conduct training, seminar and conferences both at national and international level frequently to be ahead of the technology by updating our personal and also for personal from utilities, manufacturers, industry, educational institutions, etc from India and overseas.

The current version of the Conformance Test Tool for IEC 62056 is 2.0. This CTT is continuously upgraded. The OBIS codes are also continuously revised and made available in the public domain. This laboratory may be required to be augmented in line with the recommendations of the High Level Committee for standardization of metering protocols.

Member

DLMS User Association

Tamper Handling in DLMS

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Table of Contents

1 Introduction

This document describes handling of tamper information in DLMS protocol. Sections 3 and 4 in this document throws light on modeling DLMS objects to store instantaneous/historic tamper information. The last section briefly explains the role of Application layer in notifying the captured events.

2 References

Reference	Title
DLMS UA 1000-1:2007, Eighth Edition	DLMS UA Blue book : COSEM identification system and Interface classes
DLMS UA 1000-2:2007, Sixth Edition	DLMS UA Green book : DLMS Architecture and Protocols
BlueBook 9th_V01_GK080804	Pre-release v0.1 DLMS UA Blue book : COSEM identification system and Interface classes
dlms_014_1.3_smart_GK081117	Proposal to add new interface class

3 Object modeling in DLMS

DLMS models all meter data as objects , which contributes to its salient features such as interoperability, usability for various energy types etc. This section explains some of the object modeling basics which will be referred in later sections.

3.1 Objects

An object is a collection of attributes and methods. The information of an object is organized in attributes. They represent the characteristics of an object by means of attribute values. The value of an attribute may affect the behavior of an object. The first attribute in any object is the “logical_name”. It is one part of the identification of the object. An object may offer a number of methods to either examine or modify the values of the attributes

Attributes		
Attribute ID	***Name***	
1	Logical Name	
2		
n		
Methods		
Method ID	***Name***	

3.2 Interface classes

Objects that share common characteristics are generalized as an interface class with a class_id. Within a specific class, the common characteristics (attributes and methods) are described once for all objects. Instantiations of an interface class are called COSEM interface objects.

The set of different interface classes form a standardized library from which the manufacturer can assemble (model) its individual products. The elements are designed so that with them the entire range of products (from residential to commercial and industrial applications) can be covered. The choice of the subset of interface classes used to build a meter, their instantiation, and their implementation are part of the product design and therefore left to the manufacturer. The concept of the standardized metering interface class library provides the different users and manufacturers with a maximum of diversity without having to sacrifice interoperability.

Four interface classes which will be used in event capturing/profiling context are explained in detail

3.2.1 Data(class_id: 1)

This IC allows to model various data, such as configuration data and parameters. The data are identified by the attribute *logical_name*.

NOTE: The first attribute of all interface class will be Logical Name, which stores the OBIS(OBject Identification System)code – 6 field value for uniquely identifying each object.

Data	**0…n**	**class_id = 1, version = 0**			
Attribute(s)	***Data type***	***Min.***	***Max.***	***Def.***	**Short name**
1. logical_name (static)	octet-string				x
2. value	*CHOICE*				x + 0x08
Specific methods	**m/o**				

```
CHOICE
{
        --simple data types
        null-data               [0],
        boolean                 [3],
        bit-string              [4],
        double-long             [5],
        double-long-unsigned    [6],
        octet-string            [9],
        visible-string          [10],
        bcd                     [13],
        integer                 [15],
        long                    [16],
        unsigned                [17],
        long-unsigned           [18],
        long64                  [20],
```

```
        long64-unsigned         [21],
        enum                    [22],
        float32                 [23],
        float64                 [24],
        date-time               [25],
        date                    [26],
        time                    [27],
        --complex data types
        array                   [1],
        structure               [2],
        compact-array           [19]
}
```

3.2.2 Register(class_id: 3)

This IC allows to model a process value or a status value with its associated unit. “Register” objects know the nature of the process value or status value. It is identified by the attribute *logical_name*.

Register		**0...n**	**class_id = 3, version = 0**			
Attribute(s)		***Data type***	***Min.***	***Max.***	***Def.***	**Short name**
1. logical_name	(static)	octet-string				x
2. value	(dyn.)	CHOICE				x + 0x08
3. scaler_unit	(static)	scal_unit_type				x + 0x10
Specific methods		***m/o***				
1. reset (data)		o				x + 0x28

```
CHOICE
{
        --simple data types
        null-data               [0],
        bit-string              [4],
        double-long             [5],
        double-long-unsigned    [6],
        octet-string            [9],
        visible-string          [10],
        integer                 [15],
        long                    [16],
        unsigned                [17],
        long-unsigned           [18],
        long64                  [20]
```

```
        long64-unsigned     [21],
        float32             [23],
        float64             [24]
}
```

3.2.3 Extended Register(class_id: 4)

This IC allows to model a process value with its associated scaler, unit status and time information. “Extended register” objects know the nature of the process value. It is described by the attribute *logical_name*.

Extended register		**0...n**	**class_id = 4, version = 0**			
Attribute(s)		***Data type***	***Min.***	***Max.***	***Def.***	**Short name**
1. logical_name	(static)	octet-string				x
2. value	(dyn.)	CHOICE				x + 0x08
3. scaler_unit	(static)	scal_unit_type				x + 0x10
4. status	(dyn.)	CHOICE				x + 0x18
5. capture_time	(dyn.)	octet-string				x + 0x20
Specific methods		***m/o***				
1. reset (data)		o				x + 0x38

```
CHOICE
 {
        --simple data types
        null-data           [0],
        bit-string          [4],
        double-long-unsigned [6],
        octet-string        [9],
        visible-string      [10],
        unsigned            [17],
        long-unsigned       [18],
        long64-unsigned     [21]
}
```

3.2.4 Profile generic(class_id: 7)

Profile generic object can be used to record historic values, where as the interface classes discussed above can store only one(most recent) value at a time.

Profile generic	**0...n**	**class_id = 7, version = 1**			
Attribute(s)	***Data type***	***Min.***	***Max.***	***Def.***	**Short name**

1. logical_name	(static)	octet-string				x
2. buffer	(dyn.)	compact-array or array				x + 0x08
3. capture_objects	(static)	array				x + 0x10
4. capture_period	(static)	double-long-unsigned				x+ 0x18
5. sort_method	(static)	enum				x + 0x20
6. sort_object	(static)	capture_object_ definition				x + 0x28
7. entries_in_use	(dyn.)	double-long-unsigned	0		0	x + 0x30
8. profile_entries	(static)	double-long-unsigned	1		1	x + 0x38
Specific methods		***m/o***				
1. reset (data)		o				x + 0x58
2. capture (data)		o				x+ 0x60
3. *reserved from previous versions*		o				
4. *reserved from previous versions*		o				

One or more instantaneous value(object attributes) can be defined as Capture object of a profile. If the Capture period(in seconds) is greater than one, then automatic capture is assumed; else capture should be triggered externally. Every capture result in adding new set of values(entry) to the profile buffer.

4 Event related objects

4.1 Event code

An event code object is used to hold the identifier corresponding to most recent event. Data, Register or Extended Register classes can be used to model this object. DLMS allows to define country specific reference table defining all possible events with corresponding identifier.

Event code	IC	OBIS code					
		A	B	C	D	E	F
Event code	1, Data, 3, Register, 4, Extended register	0	*b*	96	11	e	255

Value group E allows to classify events as needed such as power related, vectors related, hardware related, fraud related etc. Currently DLMS allows 10 values(0...9) for value group E enabling user to define up to 10 event categories.

Note: Value group E refer only to the broad categorization of event and there is no limit to the number of events(event code) defined in reference table.

Table 1: Event code object definitions

OBIS code	Meaning	Example
0.b.96.11.0.255	Event code #0	Power related
0.b.96.11.1.255	Event code #1	Vectors related
0.b.96.11.2.255	Event code #2	Hardware related
0.b.96.11.3.255	Event code #3	Fraud related
0.b.96.11.4.255	Event code #4	
0.b.96.11.5.255	Event code #5	
0.b.96.11.6.255	Event code #6	
0.b.96.11.7.255	Event code #7	
0.b.96.11.8.255	Event code #8	
0.b.96.11.9.255	Event code #9	

Illustration

Table 2: Event reference table

Event identifier	Event description
1	
2	
37	HV , 35kV abnormal ESD disturbance tamper Status bit = 18
38	Unauthorized time setting

With reference to table-1(Event code object definitions), object to store fraud related events is 0.0.96.11.3.255(Interface Class: Data). When ever an abnormal ESD disturbance tamper occur, the corresponding event identifier (37) will be stored in the “value” attribute of 0.0.96.11.3.255 object.

The event code object stores instantaneous values only; which means a new event will over write a previously captured event code. Event logs allows to historically record all events occurred.

4.2 Event logs

These are profile generic objects to store historic values in its buffer attribute. The capture object

contains object attribute definitions of interested data. Interested data includes event code and other relevant information such as timestamp, instantaneous electricity related information(such as current/voltage/energy register contents).

Event logs	IC	OBIS code					
		A	B	C	D	E	F
Event log	7, Profile generic	0	*b*	99	98	*e*	255 [a]

Value group E allows to classify event logs as needed such as power related, vectors related, hardware related, fraud related etc. Currently DLMS allows 10 values(0...9) for value group E allowing to define up to 10 event log categories.

OBIS code	Meaning	Example
0.b.99.98.0.255	Event log #0	Power related
0.b.99.98.1.255	Event log #1	Vectors related
0.b.99.98.2.255	Event log #2	Hardware related
0.b.99.98.3.255	Event log #3	Fraud related
0.b.99.98.4.255	Event log #4	
0.b.99.98.5.255	Event log #5	
0.b.99.98.6.255	Event log #6	
0.b.99.98.7.255	Event log #7	
0.b.99.98.8.255	Event log #8	
0.b.99.98.9.255	Event log #9	

Illustration

An event log object for recording historical fraud related events is modeled using 0.b.99.98.3.255. The capture object contains event code object for fraud related tamper, timestamp of the occurrence of event and the value of an energy register at the time of tamper. Thus every time a fraud related tamper occurs, a new entry is added in profile buffer.

Table 3: Event log

	Event Identifier	Timestamp	Energy register value
Entry #1			
Entry #8	37	1-Jan-2008 10:10:00	XX volts
Entry #9	38	3-Jan-2008 06:00:00	YY volts

4.3 Error register

Error register objects are used to communicate error indications of the device. The different error registers are held by the *value* attribute of “Data” objects, with data type or *bit-string*, *octet-string, unsigned, long-unsigned, double-long-unsigned or long64-unsigned.*

The individual bits of the error register may be set and cleared by a pre-defined selection of events. Depending on the type of the error, some errors may clear themselves when the reason setting the error flag disappears.

Error register	IC	OBIS code					
		A	B	C	D	E	F
Error register 1…10 object	1, Data	0	b	97	97	0…9	255

4.4 Error profile

If more than one instance of Error register is used, it is also allowed to combine them into one instance of the IC "Profile generic". In this case, the captured objects are the “Data” objects, the capture period is 1 to have just actual values, the sort method is FIFO, the profile entries are limited to 1.

Error profile	IC	OBIS code					
		A	B	C	D	E	F
Error profile object	7, Profile generic	0	b	97	97	255	255

4.5 Alarm register

A number of objects are available to hold alarm flags. The different alarm registers are held by the *value* attribute of “Data” objects, with data type or *bit-string*, *octet-string, unsigned, long-unsigned, double-long-unsigned or long64-unsigned.* When selected events occur, they set the corresponding flag and the device raises an alarm. Alarm flags do not re-set themselves; they can be reset by writing the *value* attribute only.

Alarm register	IC	OBIS code					
		A	B	C	D	E	F
Alarm register objects 1…10	1, Data	0	b	97	98	0…9	255

4.6 Alarm profile

If more than one instance of Alarm register is used, it is also allowed to combine them into one instance of the IC "Profile generic". In this case, the captured objects are the “Data” objects, the capture period is 1 to have just actual values, the sort method is FIFO, the profile entries are limited to 1.

Alarm profile	IC	OBIS code					
		A	B	C	D	E	F
Alarm profile object	7, Profile generic	0	b	97	98	255	255

4.7 Alarm register filter

The alarm filters define if an event is to be handled as an alarm when it appears. The different alarm filters are held by the *value* attribute of "Data" objects, with data type or *bit-string*, *octet-string, unsigned, long-unsigned, double-long-unsigned or long64-unsigned.* The bit mask has to same structure as the alarm register object. If a bit in the alarm filter is set, then the corresponding alarm is enabled, otherwise it is disabled.

Alarm register filter	IC	OBIS code					
		A	B	C	D	E	F
Alarm filter objects 1…10	1, Data	0	b	97	98	10…19	255

4.8 Objects for monitoring cover openings

Object for monitoring cover openings	IC	OBIS code					
		A	B	C	D	E	F
Event log	4, Extended register	0	*b*	96	15	*0*	255

Value group B is used to identify the cover.

OBIS code	Meaning
0.0.96.15.0.255	Main cover
0.1.96.15.0.255	Terminal cover
0.2.96.15.0.255	Battery compartment

5 DLMS model for storing/notification of tampering information in Indian context

5.1 Reference table

The country specific authority is responsible for creating and maintaining event reference table. A reference table defining possible Indian event/tamper identifier and description is as below

Tamper identifier	Name	Status_bit	Remarks
1.	Phase 1 PT Link miss tamper	0	
2.	Phase 1 PT Link miss tamper restore		
3.	Phase 2 PT Link miss tamper	1	
4.	Phase 2 PT Link miss tamper restore		
5.	Phase 3 PT Link miss tamper	2	
6.	Phase 3 PT Link miss tamper restore		
7.	Phase 4(neutral) PT Link miss tamper, also neutral miss in 1 phase	3	
8.	Phase 4(Neutral) PT Link miss tamper(also neutral miss in 1 phase) restore		
9.	Phase 1 CT reverse tamper	4	
10.	Phase 1 CT reverse tamper restore		
11.	Phase 2 CT reverse tamper	5	
12.	Phase 2 CT reverse tamper restore		
13.	Phase 3 CT reverse tamper	6	
14.	Phase 3 CT reverse tamper restore		
15.	Any CT bypass tamper (poly or 1ph meters including earthed load)	7	phasor sum of I_phase minus I_neutral not equal to zero
16.	Any CT bypass tamper (poly or 1ph meters) restore		
17.	Phase 1 CT open tamper	8	
18.	Phase 1 CT open tamper restore		
19.	Phase 2 CT open tamper	9	
20.	Phase 2 CT open tamper restore		
21.	Phase 3 CT open tamper	10	
22.	Phase 3 CT open tamper restore		
23.	Current unbalance (in poly-phase only)	11	
24.	Current unbalance (in poly-phase only) restore		

25.	Voltage unbalance (in poly-phase only)	12	
26.	Voltage unbalance (in poly-phase only) restore		
27.	1 phase miss (split phase condition to run 3ph motor with capacitor using the 2 available phases)	13	1 phase miss and Very low PF
28.	1 phase miss (split phase condition to run 3ph motor with capacitor) restore		
29.	Any one phase and neutral miss (in poly-phase only)	14	in this condition meter gets 415V/2=207.5V in 2 phases but the load is given all the 3 phases and earth
30.	Any one phase and neutral miss (in poly-phase only) restore		
31.	Magnetic tamper	15	
32.	Magnetic tamper restore		
33.	Top cover open tamper	16	
34.	Top cover open tamper restore		
35.	Terminal cover open tamper	17	
36.	Terminal cover open tamper restore		
37.	HV , 35kV abnormal ESD disturbance tamper	18	
38.	HV , 35kV abnormal ESD disturbance tamper restore		
39.	Phase sequence reversal tamper (in poly-phase only)	19	
40.	Phase sequence reversal tamper (in poly-phase only) restore		
41.	Neutral disturbance	20	ac or dc or chopped wave superimposed on neutral
42.	Neutral disturbance restore		
43.	kW Overload	21	kW Demand exceeding sanctioned load or a predefined threshold
44.	kW Overload restore		
45.	kVA overload	22	kVA Demand exceeding over sanctioned load or a predefined

			threshold
46.	kVA overload restore		
47.	Over voltage	23	Phase to phase voltage
48.	Over voltage restore		
49.	Low voltage in any phase	24	V<-40% Vn but v> 10% Vn, I present in that phase
50.	Low voltage in any phase restore		
51.	RTC bad	25	
52.	Battery bad	26	
53.	Memory error	27	
54.	No of interruption(power ups) exceeding a predefined threshold	28	The frequency (hourly/daily/monthly) and threshold to be defined by the utility.
55.	POH less than a predefined threshold.	29	The threshold to be defined by the utility.

5.2 Event code object

An instance of Interface Class Data can be used to model event code object; the value attribute of this object will hold the identifier corresponding to most recent event. The data type of “value” attribute should be defined such that it must be capable of holding the biggest event identifier value. Data type “unsigned” can hold value up to event identifier = 255 and will suffice reference table requirements(unless the number of events exceed 255).

OBIS code = 0.0.96.11.3.255, IC = 1(Data)		
Attributes		
Attribute ID	**Name**	**Data type**
1	Logical name	Octet string
2	Value	unsigned
Methods		

5.3 Defining new tamper information

The country specific authority can add new entries into reference table(section 5.1) as need arises. To cope with the latest reference table, all that meter manufacturer need to do is to define a big enough data type to the “value” attribute of event code object.

5.4 Error and alarm register

0.0.97.97.3.255 and 0.0.97.98.3.255 (IC: Data)can be used to model error register and alarm register respectively. When an event defined in reference table occur, the corresponding bit(specified as status bit) is set in error register and/or alarm register.

Error register		
OBIS code = 0.0.97.97.3.255, IC = 1(Data)		
Attributes		
Attribute ID	**Name**	**Data type**
1	Logical name	Octet string
2	Value	Bit-string / octet-string / unsigned / long-unsigned / double-long-unsigned / long64-unsigned
Methods		

Alarm register		
OBIS code = 0.0.97.98.3.255, IC = 1(Data)		
Attributes		
Attribute ID	**Name**	**Data type**
1	Logical name	Octet string
2	Value	Bit-string / octet-string / unsigned / long-unsigned / double-long-unsigned / long64-unsigned
Methods		

5.5 Alarm filter

An alarm register filter object holds a bit mask to (temporarily)enable/disable an alarm irrespective of the occurrence of the corresponding event.

Alarm register filter		
OBIS code = 0.0.97.98.13.255, IC = 1(Data)		
Attributes		
Attribute ID	**Name**	**Data type**
1	Logical name	Octet string
2	Value	Bit-string / octet-string / unsigned / long-unsigned / double-long-unsigned / long64-unsigned
Methods		

6 Application layer services

6.1 Event notification

Data exchange between data collection systems and metering equipment using the COSEM interface object model is based on the client/server paradigm. Metering equipment play the role of the server. Event notification is the only non client server service supported by DLMS application layer as this need to be initiated from the server.

Event notification is an unconfirmed service requested by the server, upon the occurrence of an event, in order to inform the client of the value of an attribute, as though it had been requested by the COSEM. Upon the reception of the .request primitive, the Server Application Layer builds the EVENT-NOTIFICATION-Request APDU(Application Protocol Data Unit).

6.2 Trigger event notification

In some cases, the supporting lower layer protocol(s) do (does) not allow sending a protocol data unit in a real, unsolicited manner. In these cases, the client has to explicitly solicit sending an Event notification frame, by invoking the Trigger EventNotification service primitive.

WHITE PAPER
ON
INTEROPERABLE SOLUTION FOR ENERGY METERS

By

Meter Inter - Operable Solution (MIOS) Forum

TABLE OF CONTENT

1. INTRODUCTION

The electricity utilities across the country have invested huge sum of money in electronic metering over the years. These meters have been purchased from different manufacturers. Since different manufacturers deploy different techniques to transfer the data, there is a need to evolve an interoperability standard that allows seamless integration of the data between various electronic meters and also provide integration with other developed application software like billing, load profile analysis, revenue protection analysis etc. irrespective of the make of meter in the field.

2. BACKGROUND – NEED OF SYSTEM

Many attempts have been made around the world to evolve common standards for communicating with and interpreting data from the meter. The approaches so far have been to adopt one of the many proposed standards of data exchange for electronic meters. Some attempts have also been made to use standards of data exchange coupled with standards of data interpretation.

Such attempts have not yet yielded manufacturer-independent high level software and were also having the following issues in implementing the same:

a. Existing installed base of meters

The interoperability standard for Indian system should be designed such that existing installed base of electronic meters can be read and integrated into the application software. Any new data reading protocol (like IEC 62056-21) would be unable to meet this requirement.

b. Flexibility to adapt

The solution must be designed to adapt to the continuously evolving requirement / specifications of the meters regardless of the requirements specific to a customer, utility or country.

c. Portability to application software

The standard should be such that it can be easily ported into existing (and yet to be developed) application software for billing, revenue protection, load and engineering analysis. In this context, any new meter-data reading protocol would mean communication interface level implementation on this software, which is not only difficult, sometimes impossible to achieve.

d. Practical approach

Over the years different bodies throughout the world have tried to standardize the data communication protocol with meters with the intention to design unique software that would be able to read all meters but none of them have achieved the goal of unique software. Further, in the Indian context the unique anti tamper requirements would need further customisation of the meter

protocol as well as the software in case of any common protocol. This makes common communication protocol unfeasible.

e. Retaining the efficiency of individual meter protocols

Collection of data from meters involves large file transfers of critical information. Hence speed and accuracy are of prime importance. So implementing common protocol will impose overheads on the data which will increase the total data size resulting in longer data transfer time taken for the same set of parameters.

f. Hardware Dependency

The solution should be hardware independent so that it could provide backward & forward compatibility rather than requirement of specific hardware in the meter to provide interoperable solution, as in the case of common protocols.

g. Communication Protocol

To keep abreast with the changing metering requirements, the solution should be independent of communication protocol. The solution should be capable to adapt to available standard or proprietary protocol.

h. Ease of Implementation

Managing and implementing changes in standard protocol is quite cumbersome and is a time consuming process. Dependency on International agencies is high. The required solution should have a simple administrative methodology for change management.

Therefore, such attempts of using common protocol have seldom yielded truly manufacturer-independent application software.

After reviewing the various options for data communication protocols; the Indian Metering industry under the auspices of IEEMA, concluded that most of the existing solutions did not meet the basic requirement of being able to harness the capabilities of the existing installed base of metering assets and addressing the future requirements or of providing one common software for reading all makes of meters.

To find a suitable solution meeting all the requirements, a MIOS forum was created under IEEMA.

3. ABOUT THE FORUM - METER INTER-OPERABLE SOLUTION (MIOS)

Meter Inter-Operable Solution (MIOS) forum is a forum under IEEMA, working on Interoperability standards for energy meters.. MIOS is having two committees as given below:

- Core Committee
- Technical Committee

Membership to the forum is open to all Meter Manufacturers, Utilities, Third party Software vendors, System Integrators, and Solution providers.

The objective of the MIOS is - to provide a possible solution for utilities to use common IT infrastructure to gather information from meters of different manufacturers already in use as well as meters which may be purchased in the future, and also to ensure vendor independent integration of meter data to utility business processes through interoperability.

The solution does not bind meter manufacturers for doing things in any particular way. The meter manufacturers can continue with their existing protocols but will have to supply APIs complying with the specification. Further integration of the meter data with the utilities' existing or yet to be developed business process software can be done by third party software vendors, system integrators or by the meter vendors as well.

The proposed solution provides scope for both the vendors (meter, software) to use innovative ways of providing solution. The interoperability standard designed by the MIOS forum meets all the requirements outlined above and does not lose sight of the key objectives of the electricity utilities.

4. MIOS CONCEPT & SOLUTION

The concept of MIOS is similar to the Microsoft® Windows® applications which support different printer drivers. Whenever a new printer is added to the network, the relevant driver is loaded in the PC. When a printout needs to be taken, appropriate printer needs to be selected by the user and accordingly, based upon the request received from the user, the software prints the document on the selected printer using the relevant printer driver.

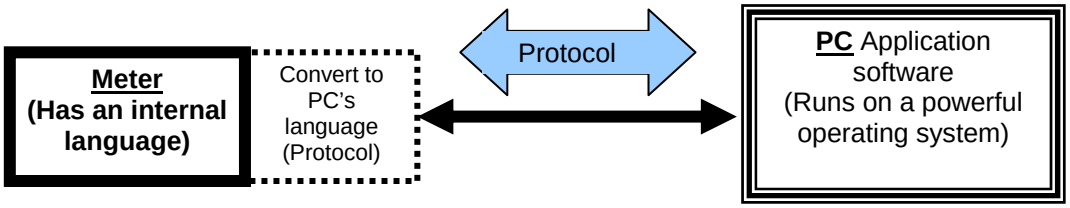
In the above case printer is a Slave program where as Microsoft Windows application becomes a Master program.

On the similar lines MIOS suggests software in two parts as given below:

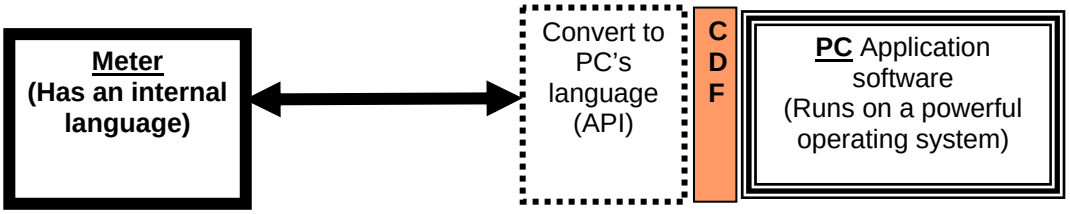
- Common Framework software (3rd party)
- Meter manufacturer's program/driver (APIs).

So according to this proposal, all meter manufacturers will continue to maintain their existing meter designs as optimised for their architecture and as they deem fit. However, they will each provide an executable plug-in (e.g. a DLL file) that can be called by any third party high level software. The executable file will allow reading the meter data, check security, interpret and provide data in a common agreed data format.

Such an agreed data format should be flexible for future expansion and adaptable to various customer needs. Open formats using languages like XML (eXtensible Markup Language) is quite well suited for this kind of application.



Common Protocol Model



MIOS Model

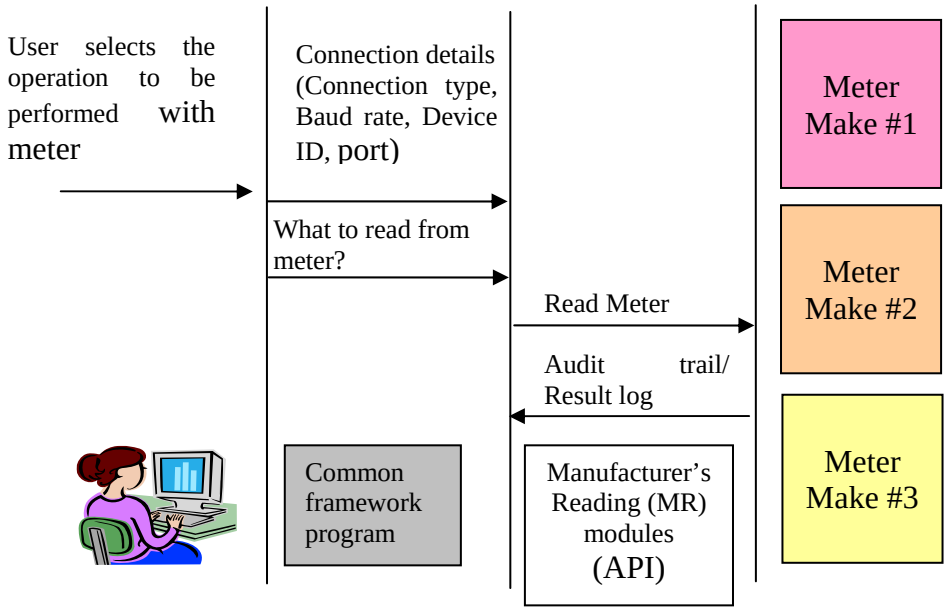
Each of the three elements – meter, its driver software and the application software shall have distinct roles to play in the overall system. The meter and the driver software together shall be responsible for measuring and providing the data in the standard interoperability format. However, the application software shall be responsible for scheduling and creating (making the telephone call and holding the line in a PSTN/GSM AMR for example) and the communication link. Data security can be managed by any open standard public domain technology so that it is verifiable and yet secure.

a. Common Frame Work (CFW)

Common Frame Work (CFW) is a master program. It provides user interface and initiate actions to perform specific tasks. It may also be made responsible to maintain & execute meter reading schedule and provide links to other application programme & database.

The meter reading function enables CFW to read meter of any make. User will select the data to be read from meter. CFW will generate configuration file which will specify connection details and data to be read from meter. CFW will invoke Manufacturer reading module (API1) to read the meter and store the data in manufacturer specific format in manufacturer folder.

Multiple meter reading option is applicable only when more than one meter is connected on the same network (or on the same telephone line). When multiple meters reading option is chosen each meter is read sequentially. Next meter reading is started once first meter reading is completed.



b. Application Program Interface (API)

Application Program Interface (APIs) are executable exes or batch files (i.e. .EXE or .BAT). APIs do not work stand-alone and are controlled by CFW. Therefore no API's handle screen or keyboard request directly. All messages will either be passed on via configuration file or via the command structure described.

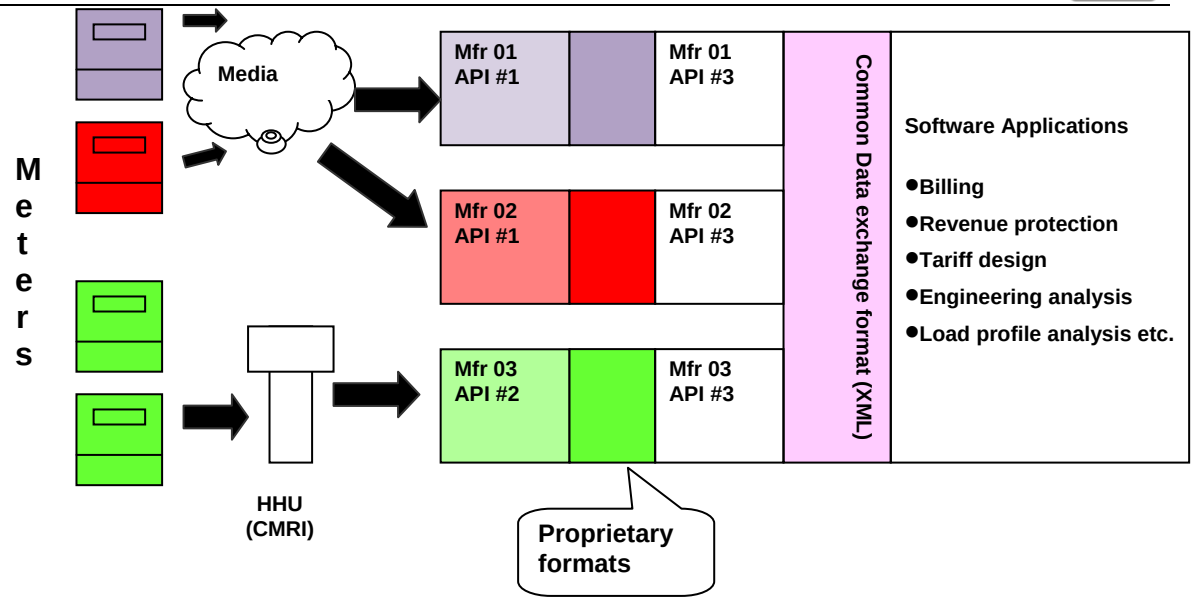
APIs transfer the messages via MII protocol. Longer message to API is passed on via configuration file. API will give acknowledgement of any command within 3 seconds. Success of the job is to be declared only if last step of the operation is done such as file generated for a given command is stored at the indicated (or predefined) location. In case of failure, APIs report errors either meter specific or API specific.

APIs may drop some of the tags due to unavailability of information from the meter.

API shall take path/filenames and other parameter specified in configuration files provided to the API (the path/filenames are not hardcoded).

Result file and common data format file generated will have - XML tags for each parameter. API will also create log file which can be used for debugging/troubleshooting purpose.

- API 01- Read API
  - Initiate and read session from the meter
  - Save data in mfg specific format
- API 02 – CMRI API
  - Read data from CMRI
  - Store data in mfg specific format
- API 03 – Convert API
  - Convert data from mfg specific format to XML CDF (Common Data Format)

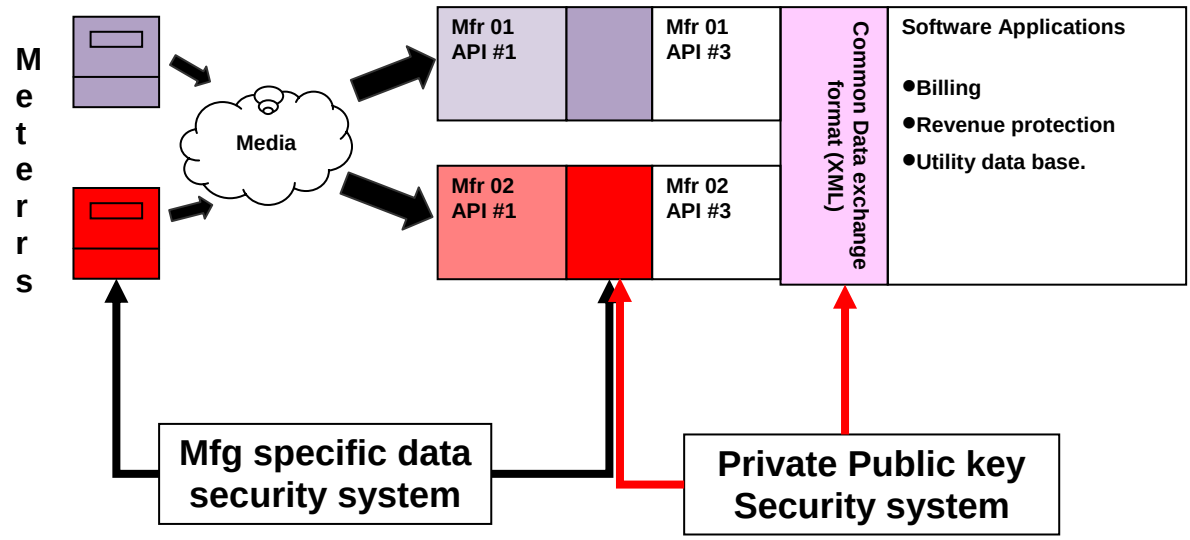


MIOS ARCHITECTURE

5. DATA SECURITY

MIOS Solution also provides data security. An authenticator will be generated when the data is converted through API3 in CDF (XML) and just after converting into CDF authenticator / signature will be added on the bottom of CDF.

In case, any tamper to the XML file is suspected and utility wants to verify the same, it could be done using a separate tool along with the Public Key published on the MIOS web site/provided to the utility, by the meter manufacturer, at the time of shipping meter to utility.



6. FEATURES OF MIOS INTEROPERABLE SOLUTION:

The solution is common for present installed base meters & future purchases also. This is a hardware independent interoperable solution.

Following are the main features of MIOS:

a) Supports existing installed base of meters.
b) No changes in existing CMRI solution.
c) Single data collection software for different make / model / protocol supported meter.
d) Allows third party to collect metering data & integrate with utility's IT system-Meter Manufacturer independent.
e) Easy portability of data to existing and developing billing systems.
f) Flexibility to adopt continuously evolving requirements.
g) Flexibility to adopt diverse customer needs & customer's diverse needs.
h) Futuristic & Scalable system.
i) Retention of data security and integrity.
j) Minimum cost of transition and administration.
k) Addition of Tags is easier & quicker than in case of any common protocol
l) <u>An Indian solution suited to Indian requirements</u>

The advantage of MIOS is that the way the specifications are defined, its not limited to any one protocol. Rather under MIOS solution any common, open or proprietary protocols can be defined and used in the form of APIs, without changing hardware or major changes in software. Hence MIOS solution is a bigger umbrella under which any protocol can be incorporated in form of APIs and data can be represented in common format.

Above all, the utilities want to have a common & practical system keeping their investment made in metering & IT (infrastructure & software) and also security features intact, and the MIOS solution provides the same.

7. CERTIFICATION PROCESS

MIOS has released the following specification documents for CFW, interface between APIs & CFW, test compliance, test cases, etc:

SL. No.	Document Name	Description
1	MIOS Universal Meter Reading & Common Format (MUMRCF) (Published version 1.17)	Specification document of back end software to invoke API and interface between APIs & CFW.
2	MIOS CDF Tag List	XML tag list document.
3	MIOS API Test Procedure	API compliance document.
4	MIOS Test cases for APIs	API test case document

The documents also clearly define the process to be followed by independent test agencies for certification of the APIs.

MIOS has requested CPRI & ERDA for testing of APIs and during the discussions they have agreed for the same.

8. MIOS Membership Categories

Parties who are interested in the technology and who agree to participate in furthering the aims of the MIOS are encouraged to join the forum.

Interested parties may include electricity utilities, standardization bodies, software companies or meter manufacturers (IEEMA members or other non IEEMA meter manufacturer), consultants or organization involved in or interested in encouraging the UMRCF standard under MIOS.

There are three categories of membership as detailed below.

i. Core Members

These members would be any meter manufacturer, who is an IEEMA member. These members decide the strategy and take policy decisions for the administration of the forum.

ii. Associate members-GS (Government Sector)

These members would be from any Utilities, Government agencies (like NTPC, CEA, and PGCIL etc) and labs/institutes. This membership class is available for those who wish to participate fully in the Forum activities and contribute their inputs & requirements to enhance the adaptability & acceptability of Interoperability standard. Membership to this category of organisations will be on honorary basis. MIOS forum will soon write to all such organisations, inviting nomination of an authorized official to be a member of the forum.

iii. Associate members-PS (Private Sector)

This membership class would be from any third party software developers, System Integrators, Solution Providers or non IEEMA meter manufacturer those who would like to use & contribute their valuable inputs in getting interoperability standards upgraded as per the demand in the market and also those who are actually interested in developing / enhancing the interoperability concept for the use of Application Program Interface (API's).

9. PRESENT STATUS

In the present scenario nine major players in India are member of this forum. They have written APIs for meter reading & data conversion.

The Forum has defined the specification & made the same public. The specification is being refined regularly. Several utilities have already floated tenders with MIOS as a part of their specification. Many system integrators have shown keen interest to adopt this concept.

a. MIOS Forum member

Following are the members of the MIOS Forum:

i. Capital Meters Ltd.
ii. Easun Reyrolle Ltd.
iii. ECE Industries Limited
iv. Elster Metering (P) Ltd.
v. Genus Power Infrastructures Ltd.
vi. HPL Socomec Ltd.
vii. L&T Limited
viii. Omne Agate Systems Pvt. Ltd.
ix. Secure Meters Limited

b. Involving others

In order to make the standard more robust by including the requirements of the various stakeholders, the MIOS forum has given several demonstrations & presentations to different utilities, system integrators and other standard/certification agencies.

On 25th Feb 2008, MIOS forum organised a half day session for third party system integrators, many of them attended the same as mention below:

i. Analogic Tech (I) Ltd.
ii. HCL
iii. IBM India Pvt. Ltd.
iv. ICSA (India) Ltd.
v. KLG Systel Limited
vi. RF Arrays Systems Pvt. Ltd.
vii. Sands Pvt. Ltd.

They have shown their keen interest in the same and have also given their inputs of improving the solution. The MIOS forum has requested system integrators to become members of MIOS and actively participate in MIOS technical committee. This will help in deciding a clear strategy/technology road map for MIOS interoperable solution. Several System Integrators have agreed to join the MIOS Forum.

On 17th April 2008, MIOS organised a half day session for utilities. Representatives of CEA, BIS and various utilities, mentioned below attended the same:

i. APCPDCL
ii. APSPDCL
iii. CESU
iv. CSEB
v. GRIDCO
vi. KESCO
vii. MGVCL
viii. MPPKVVL
ix. NDPL
x. NPCL

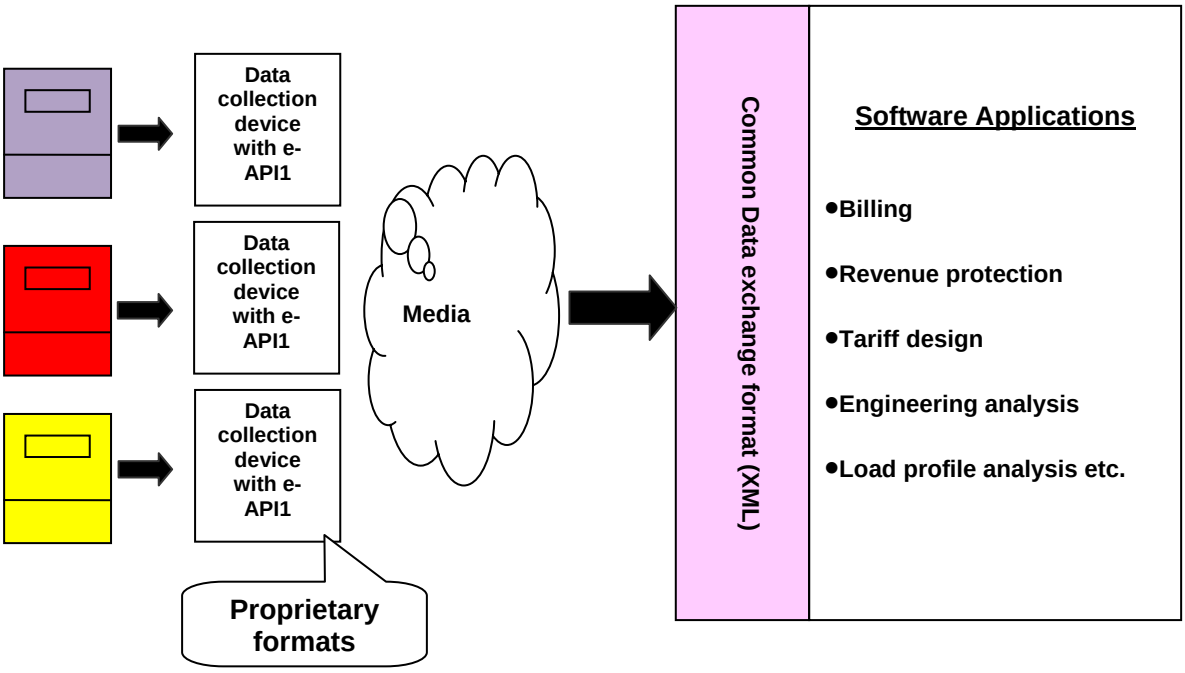
xi. OPTCL
xii. POWERGRID
xiii. RVPNL
xiv. RRVPNL
xv. SPDCL and
xvi. WBSEDCL

Representatives of the Utilities appreciated the concept of MIOS and the way in which it takes care of their present day problems and future requirements. They also shared their inputs for making the solution more robust and useable. Some of them also indicated that they would try to adopt the solution in their future AMR projects. .

10. WAY FORWARD – ROAD MAP

a. Support for Inward (Inbound)dialling

The solution as defined above is suitable for query based / outward (outbound) dialling systems. However in order to support Inward dialling systems / other modes of communication such as GPRS etc, which is required for collection of data from a large number of meters, MIOS proposes to implement a solution based on embedded API (eAPI) ,



e-API1 will reside in a communication device sitting next to the meter as slave program and, based upon the instruction received from the master program, e-API will get invoked and will read the respective meter data. Subsequently, the same shall be forwarded by the communication device to base station PC / server, where API3 shall convert the data into XML format.

The e-API can reside in communication devices provided by a meter manufacturer or any third party. The above solution enables third party system

integrators or any other meter manufacturer to read and convert data from a large volume of meters.

b. API Procurement Process

i. API Availability for utilities

All utilities are being invited to become honorary member of MIOS. Member meter manufacturers will ensure availability of APIs to utilities progressively by December 2008 as per their requirement.

ii. API Availability for System Integrators

Third Party System Integrators can get the APIs from MIOS. In order to get the APIs following is the two step process:

- Step I
  - Become member of MIOS forum
  - Membership ID will be allotted
  - Provide concern person's name & contact details
- Step II
  - Send Authority letter from the concern utility to MIOS forum. In view of data security issues, Authority letter has to be from the person authorized by the concerned utility. After submission of the Authorization letter to MIOS forum, APIs will be made available to that system integrator with in define time line.

MIOS Technical Committee members / member meter manufacturer will provide support from time-to-time, as required.

ANNEXURE – PROVEN CONCEPT

NDPL in Delhi has adopted the MIOS solution; they have developed their meter reading software using Common Frame Work (CFW) specification and are reading around 25000 HT & LT meters through AMR. These meters are of different manufacturer make & model. Meters are installed in remote places at different consumer premises along with the GSM modem. At the central station common software is installed with the GSM / PSTN modem through port multiplier.

API's of all the requisite meter is made available to the utility for reading & converting data in to the common format. These API's works on windows platform and get invoked through the common software (CFW). The common software is independent of communication port/media. Utility is using combination of GSM/PSTN communication media to read meters for AMR as per a pre- prepared schedule which runs from midnight to 6 a.m. every day. The schedule is a common schedule for all meters irrespective of meter make or model.

Read meter data is converted to common format i.e. XML, which is made available to the billing software of the utility to generate bills. Further, the same data is also taken to other data analysis software.

By using the above system utility is able to produce MIS reports, billing & data analysis though the common format having a common interface between all the modules.

Since utility meter reading software is developed as per the CFW specification, hence in order to add new manufacturer make meters or existing manufacturers meter with different model / communication media, no changes will be required in the software developed by them. All that is required is to add the API of the new meter.

The complete system is independent of meter hardware & communication protocol. This doesn't require any specific communication port or protocol to communicate. Hence the complete system is future proof, supports backward compatibility and provides support to installed based meter.

Utility has developed a complete web based system, through which meter could be read from any web client PC. They have developed the complete system on their intranet, hence they can authorize no. of users to login and prepare schedule, execute the schedule view reports, view data, convert data which is to be integrated to other software like billing, data analysis, etc. This takes less time since all the meter data is read from common software through AMR and produce the same common format, hence there is no delay in relation with the earlier process in which data read through different manufacturer specific BCS and then converted into ASCII format (which was different from different BCS), then convert all the data formats into an acceptable format as required by the target software. The MIOS / CFW solution therefore provides a faster way to do the same.

Annex-VIII

Comments of Utilities on White Paper by IEEMA on MIOS

Utility	Protocol being adopted	Difficulties faced because of different makes of meters in achieving interoperability	Views for standardization of Methodology/ Protocol	Opinion about open protocol /API based Integration from the Security and Revenue Management point of view
West Bengal State Electricity Distribution Co. Ltd., Kolkata	Meters are read either through Common Meter Reading Instrument (CMRI) or directly through Base Computer Software (BCS) of Meter manufacturer. Own developed billing software. Meter manufacturers are asked to supply the meter data as per our defined American System Code for Information Interchange (ASCII) format from their BCS. In case of analysis of data for different purpose, the required data available in meters are collected from BCS in Comma separated Value (CSV) format.	It becomes a lengthy process and laborious too.	Standardization helps in giving correct data. Total process should be user friendly, less time taking and capable to store data in secured condition	Under Meter Inter-Operable Solution (MIOS) there is a chance to tamper the data in XML (extensible Markup language), CDF (Common Data Format) at the time of feeding to Application Software. Any development should be open & implementable for meters of any make. Meter interoperable solution must be applicable to all meter manufacturers selling meters in India. NDPL in Delhi has implemented the MIOS in their system, but their experience is not encouraging on its performance as per the feedback received from them. Any developed system should be applicable

Annex-VIII

Comments of Utilities on White Paper by IEEMA on MIOS

Utility	Protocol being adopted	Difficulties faced because of different makes of meters in achieving interoperability	Views for standardization of Methodology/ Protocol	Opinion about open protocol /API based Integration from the Security and Revenue Management point of view
				without going for replacement of the existing meters.
Jaipur Vidyut Vitran Nigam Ltd.	Manufacturers specific protocol are being used and no method is being used for interoperability	Due to lack of standard protocol, it is difficult to have common software	Standardization of methodology will help Discoms and actual implementation of AMI AMR for correct data will be possible	It will be in the larger interest of the Discoms to have a standard open protocol like IEC-62056 for future meters to ensure seamless integration of all the meters. Since the protocols are adopted by IEC, there seems to be no issues with regard to security and undoubtedly the integrated system will be of use and benefit.
DPSC Ltd, West Bengal	No Application software in use. The required data is entered manually in our billing software and accordingly, bills are raised on the basis of manual entry only	Not aware of the difficulties		
TATA power, Mumbai	FOP network is used to collect meter data remotely. The software supplied by the meter manufacturer is used for reading the meter using	a) Some meter manufacturers do not provide APIs b) Meter manufacturers who have agreed to	Standardization of methodology and protocol will help in collection, integration, and analysis of meter data. It will also ensure	API based solution is the preferred option for security and integrity of data than open protocol. Supply of relevant APIs along with meters

Annex-VIII

Comments of Utilities on White Paper by IEEMA on MIOS

Utility	Protocol being adopted	Difficulties faced because of different makes of meters in achieving interoperability	Views for standardization of Methodology/ Protocol	Opinion about open protocol /API based Integration from the Security and Revenue Management point of view
	proprietary protocol. The meter data is obtained in proprietary file format and then converted into ASCII / Excel format for further processing	provide APIs are taking considerable time to develop the same c) we are in the process of developing CFW software through an external agency	direct transfer of data to the billing system and data sharing with consumers, state load dispatch center	should be made mandatory
Central Power Distribution Co. of AP Ltd.	No method / protocol being adopted for interoperability of various makes of electronic meter software The method/procedure followed is, the MRI dumps are converted into ASCII and by invoking the Standard Query Language (SQL) LOADER the data is transferred to ORACLE database Depending on the MRI data (No. of days) available the time for entire process varies			

Annex-VIII

Comments of Utilities on White Paper by IEEMA on MIOS

Utility	Protocol being adopted	Difficulties faced because of different makes of meters in achieving interoperability	Views for standardization of Methodology/ Protocol	Opinion about open protocol /API based Integration from the Security and Revenue Management point of view
	from 30 minutes to 60 minutes			
Meghalaya State Electricity Board	Individual meter vendor software is being used to read individual meter	Application programme interface has not been used.		
APEPDCL, Vishakhapatnam	API to convert Meter data to XML file	To end the protocol blackmail		
BSES Rajdhani Power Ltd., New Delhi	Application Programme Interface (API) to be supplied by each meter manufacturer for converting meter to ASCII or demanding meter with standard common communication protocol, DLMS in the meter itself have been viewed reviewed in past at various level.	Finalized one standard protocol and now asking vendor to follow the same	The final conclusion is that in India there is need to standardize the protocol at the earliest. MIOS-API is an intermediate solution	We request CEA to play an important role in standardization of the common protocol and prevent the problem of vendor own protocol
Madhya Gujarat Vij Co. Ltd.	All the meters procured so far are being operated and handled with the help of Proprietary software supplied by respective supplier. Thus nomethod/protocol could be adopted by our Organisation for ensuring inter-operability of various make of meters.	a. A very strong reluctance from the suppliers. They have main apprehension that if Common International protocol, i.e. IEC-62056 and DLMS would be implemented they might have to face	There would be total transparency among all makes of meters as regards meters service programme, CMRI software as well as BCS software.	The open protocol is better compared to API based integration. There are more than 40 single phase static meters manufacturers in India, hence it will be impossible for users to handle large number of proprietary software supplied by various suppliers. And to expect all single phase static

Annex-VIII				
Comments of Utilities on White Paper by IEEMA on MIOS				
Utility	Protocol being adopted	Difficulties faced because of different makes of meters in achieving interoperability	Views for standardization of Methodology/ Protocol	Opinion about open protocol /API based Integration from the Security and Revenue Management point of view
		competition with international meters suppliers and would lose the business in India. b. The suppliers do not honestly share information of their software with each other. They do not even provide correct API files to purchaser and other supplier also. This makes impossible for any developer or supplier to device common tool c. The supplier sharing information with developer of common software tool always try to evade		meters manufacturers of India to join consortium and share API files for CFW tool is far away from truth

Annex-VIII

Comments of Utilities on White Paper by IEEMA on MIOS

Utility	Protocol being adopted	Difficulties faced because of different makes of meters in achieving interoperability	Views for standardization of Methodology/ Protocol	Opinion about open protocol /API based Integration from the Security and Revenue Management point of view
		responsibility in case if anything goes wring. Thus lack of accountability on suppliers part scare purchasers d. There is no statutory provision and standard prevailing which makes user helpless in implementation		
The Brihan Mumbai Electric Supply & Transport Undertaking	CMRI has been incorporated with meter reading software of various meter manufactures. The meter readings are duly processed in common ASCII format through the in-house software developed by BEST Undertaking for billing purpose. The readings obtained through CMRI are then uploaded into the computer systems. The computer systems are incorporated with	At CMRI level, proliferation of different operating system of different manufacturers cramps operating memory space of CMRI. In some makes of the meter, the meter reading software cannot be incorporated in the existing CMRI and therefore a separate MRI is required to read these meters. Thus, it increases	We would like to add that with the present system the data accuracy is ensured	It is observed that in the MIOS membership categories, meter manufacturers are treated as core member, who would decide the strategies and will take policy decisions whereas Utilities, Govt.agencies are treated as associated members, who will not have any part in policy making which implies that they would not have a decisive say in policy making. However,

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Comments of Utilities on White Paper by IEEMA on MIOS

Utility	Protocol being adopted	Difficulties faced because of different makes of meters in achieving interoperability	Views for standardization of Methodology/ Protocol	Opinion about open protocol /API based Integration from the Security and Revenue Management point of view
	software to convert such downloaded readings into ASCII format	the number of MRI to be carried to the site Proliferation of computer systems both in hardware and software for all base stations for processing of meter reading of different makes. Thus, the both meter reading and meter reading process becomes cumbersome and time consuming		these utilities will be affected by policies decided by the meter manufacturers. This approach in our opinion is not correct. It is felt that all the stake holders should have their say in the policy framing and moreover the regulatory bodies such as CEA who has termed as associated member should lead in the matter. As CEA has framed the metering regulations, it would be an appropriate body to oversee formulation of standards, which could be agreeable by both manufacturers and utilities. We would welcome any system which makes meter reading and subsequent billing process expeditious so that revenue realization will become faster
Government of Mizoram	No	-	Standardization of protocol is welcome	

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Comments of Utilities on White Paper by IEEMA on MIOS

Utility	Protocol being adopted	Difficulties faced because of different makes of meters in achieving interoperability	Views for standardization of Methodology/ Protocol	Opinion about open protocol /API based Integration from the Security and Revenue Management point of view
			including open protocol (API based integration)	
Madhya Pradesh Paschim Kshetra Vidyut Vitaram Co. Ltd.	The data downloaded from the meter is converted into ASCII format and is used for analysis purpose. The company at present do not have any application software of its own and is using the meter manufacturer's software for analysis of the meter data	No comments		
Chamundeshwari Electricity Supply Corpn. Ltd.	No Interoperability of various makes of electronic meters is being adopted. The software for collecting the data from the MRI & down loading the same to PC's is being done with different protocols for different types provided by different meter manufacturers			
Lower Assam Electricity Distribution Co. Ltd.	Not adopted any method		System or attempt at any level in standardization of methodology/protocol would immensely help in getting correct data for	The use of open protocol is welcome if the meter manufacturers can properly take care of the related securities issue that may be

Annex-VIII				
Comments of Utilities on White Paper by IEEMA on MIOS				
Utility	Protocol being adopted	Difficulties faced because of different makes of meters in achieving interoperability	Views for standardization of Methodology/ Protocol	Opinion about open protocol /API based Integration from the Security and Revenue Management point of view
			various analysis	involved with it. Meter inter-operable Solution (MIOS) under IEEMA is a welcome step forward and active participation of this organization would be beneficial
Torrent Power, Ahmedabad	All the manufactures in India use different proprietary protocols and data structures, we do not have common operating software which can read, collect, collate and analyze data from different makes of meters. Hence, after collecting data in supplier specific BCS the same is converted in CSV/ASCII format for using the same for billing and further analysis. It is also to be noted that there is no common standard export format among all the manufactures.	The time taken in reading the meter varies from one manufacturer's make/ models to others. The time varies from 10 minutes to 45 minutes depending upon the volume, communication protocol and hardwares/softwares being used	Since storage capacity, baud rate and data structure of the different makes of the meters are different, it becomes necessary either to customize the each of the BCSs or to develop a comprehensive system to facilitate integration with utility billing and exception reporting system	Maintaining required data security level, standardization of methodology/ communication protocol would always be a welcome step. While evaluating both the methods of meter reading i.e common protocol and Application Program Interface (API), the former would be always instrumental in bringing standardization in meter data formats, its handing and analysis thereof. It also encourages standard and automated processes and reduces dependency on skilled personnel to operate the proprietary systems
Maharahtra State	No			M/s IIT Mumbai and

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Comments of Utilities on White Paper by IEEMA on MIOS

Utility	Protocol being adopted	Difficulties faced because of different makes of meters in achieving interoperability	Views for standardization of Methodology/ Protocol	Opinion about open protocol /API based Integration from the Security and Revenue Management point of view
Electricity Distribution Co. Ltd.				they have recommended to use Open Protocol (IEC 62056)
Transmission Corporation of Andhra Pradesh Ltd.	After conversion of MRI data. The data is being up loaded into Database through separate software developed for each make of meters. After uploading into Database, the data is being utilized for billing analysis etc.	No	Standardization would definitely improve the data quality	No comments.
Hubli Electricity Supply Co. Ltd.	Data down loading is done through optical port to CMRI and each meter manufacturer software is provided at Base Computer for data analysis			The MIOS concept has limitation that the meter manufacturer will provide API for all version meters that are already working in field and for all new meters that are going to be supplied in future
UT Chandigarh	The data of these meters is studied/analysed with the software supplied by the concerned vendors	No integration of meter data has been done with meter software and meters of different makes have been studied/analysed by separate software supplied by different	Methodology and protocols/methods should be standardized so as to overcome the above mentioned problems	The white paper issued by the MIOS is very good move in the standardization of data communication and integration of different software modules like billing, load profile analysis, revenue profile

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Comments of Utilities on White Paper by IEEMA on MIOS

Utility	Protocol being adopted	Difficulties faced because of different makes of meters in achieving interoperability	Views for standardization of Methodology/ Protocol	Opinion about open protocol /API based Integration from the Security and Revenue Management point of view
		vendors		analysis, energy auditing etc.
Central Electricity Supply Utility of Orissa	Application programme interface which would act as a driver to convert the meter data to XML format for use by the application software is the better solution	Presently we do not have any application software integrated with downloaded data		There is a solution developed by IEEMA to eradicate the common problem and can download the data from different makes of meter which have inbuilt API of manufacturers participated in this forum. The programme is yet to be tested. It is not available in open market
Government of Puducherry	No comment			
Gulbarga Electricity Supply Co. Ltd.	Each meter manufacturer uses different Protocols for communication to download the data and convert into XML format for use by Utility	Time taken for downloading varies depending upon meter which may be 15-30 minutes	Open Protocol for use by application software will be better solution for converting meter Data to XML format	
MP Poorva Kshetraa Vidyut Vitarana Company Limited, Jabalpur	MRI/CMRI programme for compatible meter reading software of specific make. Remote meter reading with the help of GSM modem. The received billing data	A very long time is taken in downloading the data.	In the absence of any standard method of reading the data interoperability problem is being faced.	

Annex-VIII				
Comments of Utilities on White Paper by IEEMA on MIOS				
Utility	Protocol being adopted	Difficulties faced because of different makes of meters in achieving interoperability	Views for standardization of Methodology/ Protocol	Opinion about open protocol /API based Integration from the Security and Revenue Management point of view
	is linked with in-house developed billing software to generate bills. The MRI/BCS is provided by respective meter manufacturer.			
POWERGRID	We are specifying Standard IEC interface/ protocols in our specification. Presently, our specifications envisages RS-485 communication port co communicate with Remote Terminal Unit (RTU) over Modbus Protocol. However, for CMRI purposes, optical communication ports as per IEC-101/PACT/ANSI have been specified.	We are experiencing difficulties in getting the APIs (Application Programe Interface) of existing meters while executing AMR (Automatic Meter Reading) in the projects involving Consumer Billing. These APIs by default should have been supplied by meter manufacturers to the utility alongwith the meters. However, the same were not supplied to the utility and when the need arises for interfacing of these meters, undue delay and impediments are being faced due to reluctance shown by the meter manufacturers	Standardisation of methodology/protocol shall make the system transparent, reduce dependency on meter manufacturers (as data storage formats are of proprietary nature) and further ease in retrieving data stored in the meters. This is possible when data storage formats & identifier number are standardized for all manufactures irrespective of the interface they use.	In such a globalised scenario, Standard protocol is the need of the hour. The Indian industry should have open protocol with international acceptability or adopt an international protocol like IEC 62056/DLMS. Keeping this in view, REC have added these protocols in their Standard
NTPC	Electronic meters of	A major hurdle for	As the Utilities are the	For developing a national

Annex-VIII

Comments of Utilities on White Paper by IEEMA on MIOS

Utility	Protocol being adopted	Difficulties faced because of different makes of meters in achieving interoperability	Views for standardization of Methodology/ Protocol	Opinion about open protocol /API based Integration from the Security and Revenue Management point of view
	different make deploying different protocols of data transfer and data structures are installed at various metering nodes.	energy accounting and auditing especially in the areas where different make meters are installed	owners of these energy meters, in our opinion meter manufacturers should provide Meter protocols/ data structure / memory maps for their meters to the Utility who can use it by developing their own software as per their business process requirement which will fetch the meter data directly using meter protocol, thus minimizing the interface points in the form of APIs, may help in reducing response/ communication time besides might save power consumption. One of the alternative solution for interoperability of different made of meters existing presently in various utilities in the country. The solution provided by IEEMA through MIOS forum mat be considered as one of the alternative solution for interoperability of different make of meters existing	standard for energy meter suitable for AMR applications, an endeavor should be made to evolve a common standard with respect to meter data structures/ data storage / protocol issues etc. on a unified basis to be implemented by all meter manufactures in the country in line with the standardization practices being evolved internationally and looking at the demand of the utilities, it should be in a position to accept any of the meters sourced internationally.

Annex-VIII

Comments of Utilities on White Paper by IEEMA on MIOS

Utility	Protocol being adopted	Difficulties faced because of different makes of meters in achieving interoperability	Views for standardization of Methodology/ Protocol	Opinion about open protocol /API based Integration from the Security and Revenue Management point of view
			presently in various utilities in the country. But it should be left to the utilities whether to use meter software to fetch meter data from AMR metering nodes or use a driver software (APIs) with Common Frame Work (CFW) software as master program (MIOS solution by IEEMA)	
MSEDCL, Mumbai	At present not using Automatic reading Programme	Assignment given to IIT Mumbai to suggest protocol for metering application	IIT Mumbai have recommended to use Open Protocol (IEC 62056)	The decision to use suitrable protocol is under process.

Annex-

F.No.6/8/2008-EC/APDRP
Government of India
Ministry of Power

Shram Shakti Bhavan, Rafi Marg,
New Delhi Dated October 8, 2008

Subject: Minutes of the meeting held under the Chairmanship of Joint Secretary (Distribution) on 30th September, 2008 for finalisation of protocol issue of A.M.R.

A copy of the minutes of the above meeting is forwarded herewith for information and necessary action.

(Remesh Chand)
Under Secretary to the Government of India
Tel: 2370 5957

1. Shri Alok Gupta, Chief Engineer, DP&D Division, C.E.A, New Delhi
2. Joint Director (Sh. Arunachalam), Central Power Research Institute, Prof.Sir C.V.Raman Road, Post Box No: 8066, Sadasiva Nagar (p.o),Bangalore- 560 080
3. Shri Sunil Singhvi, Vice Chairman, Meter Division, Indian Electrical & Electronics Manufacturers Association (IEEMA), 804, Surya Kiran, K.G. Marg, New Delhi - 110001
4. Principal Executive Officer, NDPL, New Delhi
5. Managing Director, Dakshin Haryana Bijlee Vitran Nigam Ltd, Vidyut Nagar, Hissar.
6. Shri R.C. Dhup, GM, NTPC Ltd, NOIDA
7. Shri V.K. Sharma, AGM(DMS), PowerGrid Corporation of India Ltd., Gurgaon.
8. CEO, BSES, New Delhi
9. MD, West Bengal State Electricity Distribution Co. Ltd.
10. Director -General, Bureau of Indian Standards, Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002
11. Shri N.Murugesan, Chief Manager, TCE Consulting Engineering Ltd & honorary Secretary I.S.A., 73/1, 3rd Floor, Sherif Chamber, Next to Nandini Hotel, St. Mark Road, Bangalore.

Copy to
PS to Joint Secretary (Distribution)
Director (Distribution)
AGM (RGGVY)/DGM (APDRP), Ministry of Power

F. No. 6/8/2008 – EC/APDRP
Government of India
Ministry of Power

Subject: Minutes of Meeting held under the Chairmanship of Joint Secretary (Distribution) on 30th September 2008 for finalization of protocol issue of A.M.R.

List of participants enclosed at **Annexure**.

1. Joint Secretary (Distribution) welcomed the participants and apprised about the IT infrastructure to be created under Part-A of the re-structured APDRP for energy accounting / auditing. AMRs on feeders, Distribution Transformers and high load LT consumers shall be the vital and critical source of data required for AT&C loss reduction. He further informed that electronic meters of different make deploying different protocols of data transfer and data structures have been used through out the country. The protocol / memory map of the meters are not disclosed by the meter manufacturers. This has created a major hurdle for energy accounting and auditing especially in the areas where different make meters are installed. Numbers of meetings / discussions / deliberations have already taken place at various levels, but the appropriate solution is yet to be arrived at.

2. He stated that there is a need for open protocol in order to retrieve data from different make of meters. Different make of meters should communicate with the IT system installed for energy accounting /auditing, Billing & collection etc without any difficulty. Tempering with meter data should not be made shield for making the protocol as proprietary. He invited the representatives of CEA, CPRI, NTPC, TCE Consulting Engineering, State Distribution Utilities, BIS one by one to express their views on the issue of open protocol.

3. It emerged from the views expressed by the representatives of the above organizations that:
   (a) Open protocol standard IEC 62056 should be used in future for all new meters.
   (b) For the existing meters, all the manufactures should open the protocol to be used by system integrator. Application Programme Interface software solution developed by different manufactures can also be used by the system integrator.

4. BIS representative also informed that a panel comprising of representatives of Regulatory Bodies, Testing Agencies, Standardization bodies, Utilities and Meter Manufacturers (Overseas & Indian) has already been constituted to address the issue of open protocol but the response from the Distribution utilities are very poor. Joint Secretary (Distribution) advised BIS to take the help of his office for improving the participation of State power utilities the panel.

5. L&T gave the brief presentation on the **MIOS (Meters Inter operable Solution)** and informed that the proposed MIOS by meter manufacturers is meeting the

requirements of the Indian Power Utilities. Meter manufacture also informed that the Test Case Document on MOIS has been already been created and any independent third party can test and certify the same.

6. Joint Secretary (Distribution) concluded the meeting with following observation:
   a) CPRI shall continue to be convener of the panel constituted by BIS to address the protocol issue.
   b) Experts suggested by CPRI should be included in the panel or invited as special invitee.
   c) Panel should arrive at the solution and final recommendations on the meter protocol issue latest by end of Nov. 08 without fail, so that MOP can take a final view in the matter for incorporating the same in implementation of revamped APDRP. The recommendations should clearly suggest solution for
      (i) Communication among existing (installed) static meters.
      (j) Open protocol for meters yet to be installed.

The meeting ended with thanks to the chair.

Annexure

List of participants

Ministry of Power

1. Shri Devender Singh, Joint Secretary (Distribution)
2. Shri Kapil Mohan, Director (Distribution)
3. Shri Ramesh Chand, Under Secretary (APDRP)
4. Shri A Trivedi, AGM (RGGVY)
5. Shri Kamlakar Singh, DGM (APDRP-Cell)
6. Shri S.K. Jhamb, Sr Manager (APDRP-Cell)

Central Electricity Authority (CEA)

1. Shri Alok Gupta, Chief Engineer (DP&D)
2. Ms. Anjuli Chandra, Director (Dist.)

CPRI

1. Shri V. Arunachalam, Joint Director

BIS

1. Ms. Manju Gupta

NTPC Ltd.

1. Shri S Rudra, AGM (APDRP)

Power Grid Corporation of India Ltd. (PGCIL)

1. Shri V K Sharma, AGM (DMS)

State Power Utilities

1. Shri M.K. Goyal, Director Operation, DHBVNL
2. Shri S.K. Jindal, GM (IT), DHBVNL
3. Shri Randeep Singh, DGM (IT), DHBVNL
4. Shri S.K. Das, ACE, WBSEDCL
5. Shri Rajesh Bansal, AVP, BSES
6. Shri A.S.Gujral, AVP, BSES
7. Shri R.K.Singh, Manager, NDPL
8. Shri B.N.Prasanna, Manager, NDPL

TCE Consulting Engineering Ltd

1. Shri N. Murugesan

IEEMA

1. Shri S.C. Sarkar, Chairman (Metering Division)
2. Shri S.K. Singhvi, Co-Chairman (Metering Division)
3. Shri J. Pande
4. Shri R.R.Marathe, DGM (Sales), L&T
5. Shri S. Ahuja, DGM (Marketing), L&T
6. Shri Surendra Jhalova, DGM, Secure Meters ltd.
7. Shri Rajesh Kohli, Secure Meters ltd.
8. Shri Dinesh Chandra Gupta, DGM (R&D), ISCA (India) Ltd.
9. Ms. Manjushri, Elster Metering
10. Shri C.P. Jain, DGM, MPL SOCOMEC
11. Shri G. Vinaya Kumar, ICSA (India) Ltd.

Annex-X

MINUTES OF FIRST MEETING OF THE HIGH LEVEL COMMITTEE ON STANDARDISATION OF METER PROTOCOL HELD ON 11.11.08 AT CEA

First meeting of the High Level Committee on Standardisation of Meter Protocol chaired by Member (GO&D), CEA was held on 11th November, 2008 in the conference hall of CEA at 6th floor, Sewa Bhawan, New Delhi. The list of participants is enclosed at Annex-A.

Chairman while welcoming the members/participants stated that High Level Committee has been constituted by the Ministry of Power (MoP) for Standardisation of Meter Protocol to enforce interoperability of different makes of meters, both existing and to be installed in the Power Sector. He expressed that the Committee needs to deliberate on the interoperability issue and come out with recommendations for adoption of interoperability solution to cover different makes of meters in the light of ensuing re-structured APDRP likely to commence shortly. The Committee needs to finalise its report by 30-11-2008. He requested the Director General, CPRI to initiate deliberations followed by members making suggestion on the subject matter.

Director General, CPRI the Convener of the Committee cited reference to the meeting held in MoP on 30-09-2008 on this issue and stated that the there is a need for open protocol in order to retrieve data from different make of meters. CPRI suggested that the requirement of different utilities be consolidated for assessing the long term needs from the meter applications.

CPRI made a presentation covering, mandate of Committee, the challenges, the virtue of OPEN protocol, Interoperability, relative merits and demerits of open protocols (IEC 62056, MODBUS, ANSI), provisions of IEC 62056 and the suggested approach. CPRI mentioned that the MODBUS protocol is for mainly for process industry and may not be suitable for current and future metering applications. ANSI C12 (in 5 parts) is being followed by USA and Canada for metering applications. CPRI informed that the conformance tool for IEC 62056 is available with CPRI, and the additional features as and when required can be incorporated by them in consultation with dlms group. CPRI emphasized the need for a designated authority for assigning new 'objects identification system' (OBIS) codes and the same was concurred by all. It was suggested that a Committee comprising of members form CEA, CPRI, PGCIL, NTPC, BIS and utilities could be formed for this purpose or BIS may take the lead for finalization of Indian Standards in line with relevant IEC.

NTPC expressed that system requirement specification (SRS) has been prepared keeping in mind open protocol approach for meters and huge investment is likely to be incurred under R-APDRP in this segment. NTPC suggested that keeping the time line in mind it is appropriate to proceed with available communication technology and have an open approach for adopting the new or alternative technologies for communication in future. The solution should be plug and play type. NTPC

emphasized that since the utilities are the owners of the metering infrastructure they should have their final say in deciding the communication system for the meters. The industry should follow transparency in suggesting/offering the solution to the utilities. NTPC pointed out that if an open system approach is followed in the metering industry the Indian Meter Manufacturers' would be the gainers. NTPC stated that all the communication options have been kept open in SRS. GM, NTPC intimated that roll out plan of restructured APDRP is fixed at 10th December and we have to find a solution before this. The investment in the meter is huge and there is a diverse requirement. Technology is ahead of us and smart metering may also be covered in APDRP. As such the solution offering plug and play type arrangement needs to be insisted upon by the utilities.

Shri De, CMD, West Bengal suggested that we must select a technology which does not inhibit competition. Further he intimated that hardware and software restricted practices must be avoided and once the meter is supplied to the utility, ownership of protocol must be with utility. The solution of meter reading should be based on option which is cost effective.

IEEMA opined that MODBUS and ANSI are not suitable for metering applications. Though the approach of an open system protocol is good, communication technology, compatibility with back end systems and obsolescence are to be considered before adopting IEC 62056 protocol. IEEMA also suggested that the overall system requirements like the data for each type/category of energy meter, tamper conditions and other related issues are to be finalized. IEEMA also suggested that before implementation we must chalk out an implementation plan for next five years so as to accommodate communication technologies and meter technologies which are fast changing. He further stated that whatever protocol is chosen should be selected keeping in view of inter-operability and compatibility with the back-end system and devices. The plug and play type of system may not be possible directly because of continuous innovations in metering technology, configuration of the meter for the utility requirement. IEEMA suggested that MIOS has been developed keeping India scenario in mind and will provide solution for existing meters and future meter base. IEEMA suggested that we should map all the common requirements of utilities and the additional tags could be identified for mapping with OBIS Code or new OBIS Code could be allotted. IEEMA stated that the utilities should not face problem with the proprietary protocol and shall be free to use any integrator for achieving energy accounting, auditing and other applications as envisaged in R-APDRP. IEEMA desired that MIOS be still considered for legacy meters.

Shri Alok Gupta, CE(DP&D) intimated that in the transition period from API based solution to open protocol there could be some difficulty during implementation which could be resolved with the help of manufacturer. The meter reading specification (MIOS) must be available in public domain. It may not be necessary for a manufacturer who wants to adopt MIOS for him to become a member of MIOS Group. This may result in restrictive trade practices and must be avoided.

The Committee requested IEEMA to send within 2/3 days the parameters required to be recoded for various types of meters by various utilities to CEA for enlisting category wise data including tamper conditions.

it was decided that based on information furnished by IEEMA,CEA and NTPC shall consolidate and finalize the parameters required from energy meter including tamper conditions and will take a feed back from DISCOMs for standardizing the data list for each category of meters. It was also considered that parameters in particular transmission requirements be obtained from PGCIL.

a) Representative from MAHADISCOM intimated that as per the consultant report for AMR Protocol received from IIT Mumbai, they are developing Common Frame Work (CFW) for implementing AMR by using Meter Manufacturer's APIs as they have already installed about 2.5 lakh meters of Secure, L&T and Elster. Elster's meters are IEC62056 compliant. In the AMR Pilot Project 2 vendors are using protocols of Meter Manufactures and one is using APIs. For near future we will procure the meters with Standard Protocol as finalised by CEA. Shri Mane, MSEDCL intimated that they had entrusted a study of Standard Protocols for AMR Compatible Energy Meters to IIT, Mumbai. The consultants have carried out a study of the options available in consultations with the stakeholders and recommended the use of IEC 62056 protocol for energy meters.

The Committee decided to hold its next meeting on 27-11-2008 at 2.00 PM in CEA.

Annex-A

MINUTES OF FIRST MEETING OF THE HIGH LEVEL COMMITTEE ON STANDARDISATION OF METER PROTOCOL HELD ON 11.11.08 AT CEA

List pf Participants

Sl. No.	Name	Designation	Company Name
1	Mr. S.M.Dhiman	Member (GO&D)	CEA
2	Mr. M.K.De	CMD	WBSEDCL
3	Mr. P.K.Kognolkar	DG	CPRI
4	Mr. V.L Sonawane	Director Operation I/C	MSEDCL
5	Mr. S.C Sarkar	V P Chairman Metering	IEEMA
6	Mr. R.C Dhup	GM (APDRP)	NTPC
7	Mr.V Arunachalam	JD	CPRI
8	Mr. Alok Gupta	Chief Engineer	CEA
9	Mr. R.K.Verma	Director	CEA
10	Smt. Anjuli Chandra	Director	CEA
11	Mr.U.S Mane	GM(IT)	MSEDCL
12	Mr. A.K.Rajput	Dy.Director	CEA
13	Mr. S Rudra	DGM	NTPC
14	Mr. S Jhalora	DGM	IEEMA
15	Mr. R.R Marathe	DGM Sales	L&T
12	Mr. J Pande	AD	IEEMA

Annex-XI

Minutes of the Second Meeting of the High Level Committee Held in CEA on 27-11-2008

Welcoming the participants, Member (GO&D) stated that issues relating to the Communication Protocol for energy meter to achieve interoperability had been deliberated in detail during the first meeting of the Committee held on 11th of November, 2008. The MIOS and DLMS/COSEM (IEC-62056) were considered. The issues in respect of DLMS requiring clarifications were identified. CEA/CPRI had examined the matter in detail with DLMS UA Members. He expressed that discussions may be confined to understanding and evolving solutions to specific issues to enable submission of the report in the time frame given to the Committee.

DG, CPRI in his introductory remarks stated that the meter had a large amount of information stored in it and it is important in today's era to have a solution which is inter-operable and independent of the make of the meter.

The Chairman, WBSEDCL stressed upon the need to find a solution which is efficient, cost effective and ensures that the Distribution Company is not tied up to any of the meter manufacturers to implement its applications. He stressed upon that the system requirement specification (SRS) needs to be frozen so that implementation works of RAPDRP can start as per schedule.

Member (GO&D), CEA informed that the DLMS User Association had made significant advancement towards incorporating the requirements of tamper events and as many as 55 parameters have been incorporated in their proposal circulated to be incorporated in IEC 62056 standard.

IEEMA members gave a presentation on MIOS system of down loading the data/providing communication solution to AMR services. They indicated the following:

- MIOS take care of end to end solution. It is backward and future compatible and gives data in XML format. DLMS compliant meters would require high end controller, more RAM and non-volatile memory (NVM) requirements resulting in the increase in cost.

- About certification of application programme interfaces (APIs) MIOS group is in the process of making the test tool for the same.

- MIOS group stated that in IEC 62056 the stack implementation and profile implementation is with meter manufacturers.

Nine Indian Meter manufacturers have got together under the MIOS forum and one more was becoming a Member of the group under the aegis of IEEMA. The MIOS group has conducted 30 meetings of the Technical Committee so far. Total number of 805 parameters had been incorporated in the MIOS.

M/S L&T stated that the memory map inside the meters, even from the same manufacturer is different for different generation/type of meters.

NTPC stated that a large number of parameters for different meters are being specified by the utilities. It should be analyzed whether all such parameters are really useful. Only necessary parameters should be specified so that overheads are the minimum. NTPC opined that the open system would prove to be advantageous with third party integrators providing an open solution to the utilities.

CPRI corroborated the view of NTPC that large number of parameters has arisen because of non-standardization of meter related data/information. They also stated that once the requirement is standardized the cost of communication for IEC 62056 compliant meters would not be high.

The participants also gave a suggestion that an agency may be designated for standardizing the parameters and the agency should take the responsibility of getting the parameters incorporated in IEC.

CBIP informed that it had carried out a lot of work on standardization of ac static meters. However, more work would need to be carried out for incorporating Protocol Communication related issues in their technical publication. They opined that standardization of parameters and adoption of open protocol for interoperability need to be implemented at the earliest.

Mr. N. Murugesan from TCE gave a presentation on the need for standardization of protocol and details about IEC 62056. He intimated that France is going in for AMR/ Smart Meters for 33 million meters in a phased meter. A pilot project for 3 lakh meters is being undertaken in the first phase with DLMS compliant meters. He intimated that the additional cost per meter for DMLS compliant meter indicated in the past was about $ 3-4 per meter and with advancement in communication technology and large scale requirement the cost may be about $1 per meter.

He informed in respect of the apprehensions expressed regarding tamper conditions as experienced under Indian conditions that the CPRI, who are one of the members of DLMS-UA had identified 55 tamper conditions in consultation with stake holders. These have been communicated to the DLMS UA. These have already been circulated by DLMS-UA to its members and are expected to be incorporated in the IEC 62056 standards shortly. It is learnt that OBIS code for fraud related activities are identified. Detail of Specific tamper could be made country specific.

Representative from DHBVN indicated that they were also facing problem in inter-operability due to non standardization of the data format/communication from the meters.

After discussions, IEEMA indicated that the following issues need to be addressed before implementation of IEC – 62056 for the meters:

- Standardization of parameters, both consumer category wise and application wise;
- List of tamper parameters to be recorded by the meter;
- Compare the standard list of parameters with the OBIS code already available in IEC 62056, identification of gaps and evolve object identification system (OBIS) code for the same;
- The compatibility of common meter reading instrument (CMRI) with IEC - 62056;
- The timeframe for implementation of IEC - 62056 protocol by the manufacturers.

It was also agreed that CPRI who is one of the members of DLMS-UA, and also the convener of BIS panel on standardization of metering protocol may pursue and finalize incorporation of India specific requirements in the IEC 62056 and corresponding Indian Standards on the subject. CEA would circulate the parameters to the utilities for their comments and finalization of the list of parameters. CPRI would take necessary action for assigning OBIS codes for parameters where such codes do not exist. It was decided to set out a time frame for the various activities.

Second Meeting of the High Level Committee held in CEA on 27-11-2008

List of Participants

Sl. No.	Name	Designation	Organisation with Address
1	S/Shri S.M.Dhiman	Member (GO&D)	CEA
2	Alok Gupta	Chief Engineer	CEA
3	Mrs Anjuli Chandra	Director	CEA
4	A.K.Rajput	DD	CEA
5	Vivek Goel	DD	CEA
6	Praveen Kamal	AD	CEA
7	P.K.Kognolkar	DG	CPRI
8	V.Arunachalam	JD	CPRI
9	S Rudra	DGM	NTPC
10	R.C Dhup	GM	NTPC
11	M.K.De	CMD	WBSEDCL
12	R.K. Taneja	CE / EP	UHBVN Rohtak
13	Naresh Sardana	SE/MCP	UHBVN Delhi
14	P.P.Wahi	Director	CBIP
15	S.K.Batra	Manager (Tech)	Central Board of Irrigation and Power
16	G.V Shah	GM	Secure Meters Ltd.
17	S Jhalora	DGM	Secure Meters Ltd.
18	C P Jain	ED	HPL Socomec
19	M.K.Srivastava	Manager	IEEMA
20	J.Pande	AD	IEEMA
21	S.Ahuja	DGM	Larsen & Toubro Ltd.
22	M.Shah	Sr.Manager	Elster Metering
23	N. Murugesan	CM	Tata Consulting Engineer

6. FINDINGS AND RECOMMENDATIONS

a. Findings

Aligning with international standard bodies helps the customers to safeguard their investments in the long run as the standard bodies make provision for backward compatibility when they migrate to other technology.

Without any standard adoption of communication Protocol for Energy meters in India, Electric utilities are resorting to purchase of Energy meters specifying different protocols and outdated standards. If this trend is not arrested all the investment made on this particular area would go as waste. The need of the hour is the standardization of Metering Protocol in India without much loss of time.

DLMS/COSEM is a standardized protocol, which enables utilities to use common and structured means of modelling their meter and reading the data as required by the utilities various requirements. This also enables the Utilities to adapt unique AMR applications with very operational costs, since DLMS/COSEM based AMR will enable retrieving selective data and exception reporting, making AMR viable, compared to manual reading.

From the interoperability view point, IEC 62056 scores over the proprietary protocols. Utilities should specify this as the important requirement and challenge the metering vendors to provide the solution.

b. Recommendations

PAL team did a detailed evaluation of the two options which are as follows:

1. Meter Inter-Operable Solution (MIOS) promoted by a group of Indian Meter Manufacturers
2. IEC 62056 or DLMS/COSEM standards

It is our considered opinion that IEC 62056 series of standards are comprehensive open international standards which meet requirements of AMR solution for MSEDCL. On the other hand, adopting MIOS restricts alternatives of the distribution company and binds it to a group of vendors. This may also restrict promotion of good international practices in the distribution company. Therefore, we recommend IEC 62056 for adoption in AMR in MSEDCL.

List of Parameters furnished by IEEMA

SL. No.	Parameters	HT Meters	LT Meters	DT Meters	Feeder / Grid Meters	WC Meters	OBIS Code
A	General Parameters						
1	Meter Serial Number	Yes	Yes	Yes	Yes	Yes	
2	Meter Type - 3P4W/3P3W	Yes			Yes	Yes	
3	Meter Accuracy					Yes	
4	Meter CT ratio	Yes	Yes	Yes	Yes	Yes	
5	Meter PT ratio	Yes			Yes	Yes	
6	Meter reading count	Yes	Yes	Yes	Yes	Yes	
7	MD reset count	Yes	Yes	Yes	Yes	Yes	
8	MD Reset Date	Yes	Yes	Yes	Yes	Yes	
9	Mode of MD reset for last 12 bill point	Yes	Yes			Yes	
10	MD date for last 12 bill point	Yes	Yes			Yes	
11	MD time for last 12 bill point	Yes	Yes	Yes		Yes	
12	R Phase Line Current	Yes	Yes	Yes	Yes	Yes	
13	Y Phase Line Current	Yes	Yes	Yes	Yes	Yes	
14	B Phase Line Current	Yes	Yes	Yes	Yes	Yes	
15	Phase to Neutral Voltage (R)	Yes	Yes	Yes	Yes	Yes	
16	Phase to Neutral Voltage (Y)	Yes	Yes	Yes	Yes	Yes	
17	Phase to Neutral Voltage (B)	Yes	Yes	Yes	Yes	Yes	
18	Phase to Phase Voltage RY	Yes					
19	Phase to Phase Voltage RB	Yes					
20	Phase to Phase Voltage BY	Yes					
21	R Phase voltage angle	Yes	Yes	Yes	Yes	Yes	
22	Y Phase voltage angle	Yes	Yes	Yes	Yes	Yes	
23	B Phase voltage angle	Yes	Yes	Yes	Yes	Yes	
24	Line current angle R pahse	Yes	Yes	Yes	Yes	Yes	
25	Line current angle Y pahse	Yes	Yes	Yes	Yes	Yes	
26	Line current angle B pahse	Yes	Yes	Yes	Yes	Yes	
27	Active current R	Yes	Yes	Yes	Yes	Yes	
28	Active current y	Yes	Yes	Yes	Yes	Yes	
29	Active current B	Yes	Yes	Yes	Yes	Yes	
30	Reactive current R	Yes	Yes	Yes	Yes	Yes	
31	Reactive current Y	Yes	Yes	Yes	Yes	Yes	
32	Reactive current B	Yes	Yes	Yes	Yes	Yes	
33	Current tariff name	Yes	Yes	Yes	Yes	Yes	
34	Active Power/Load	Yes	Yes	Yes	Yes		
35	Reactive Power/Load	Yes	Yes	Yes	Yes		
36	Apparent Power/load	Yes	Yes	Yes	Yes		
37	Cumulative tamper counts	Yes	Yes	Yes	Yes	Yes	
38	Cumulative transaction counts	Yes	Yes	Yes	Yes	Yes	
39	Timeset counts	Yes	Yes	Yes	Yes	Yes	
40	Phase angles of voltage & current				Yes		
41	Quadrant operation				Yes		
42	Program Name	Yes	Yes	Yes	Yes	Yes	
43	Time set date	Yes	Yes	Yes	Yes	Yes	
44	Time set time	Yes	Yes	Yes	Yes	Yes	
B	Energy Registers						
1	Active Forwarded (kWh)	Yes	Yes	Yes		Yes	
2	Apparent Forwarded (kVA)	Yes	Yes	Yes		Yes	
3	Reactive lag forwarded	Yes	Yes	Yes		Yes	
4	Reactive lead forwarded	Yes	Yes	Yes		Yes	
5	Active Forwarded - History-1	Yes	Yes	Yes		Yes	
6	Active Forwarded - History-2	Yes	Yes	Yes		Yes	
7	Active Forwarded - History-3	Yes	Yes	Yes		Yes	
8	Active Forwarded - History-4	Yes	Yes	Yes		Yes	
9	Active Forwarded - History-5	Yes	Yes	Yes		Yes	
10	Active Forwarded - History-6	Yes	Yes	Yes		Yes	
11	Active Forwarded - History-7	Yes	Yes	Yes		Yes	
12	Active Forwarded - History-8	Yes	Yes	Yes		Yes	
13	Active Forwarded - History-9	Yes	Yes	Yes		Yes	
14	Active Forwarded - History-10	Yes	Yes	Yes		Yes	
15	Active Forwarded - History-11	Yes	Yes	Yes		Yes	
16	Active Forwarded - History-12	Yes	Yes	Yes		Yes	
17	Apparent Forwarded-History-1	Yes	Yes	Yes		Yes	
18	Apparent Forwarded-History-2	Yes	Yes	Yes		Yes	
19	Apparent Forwarded-History-3	Yes	Yes	Yes		Yes	
20	Apparent Forwarded-History-4	Yes	Yes	Yes		Yes	
21	Apparent Forwarded-History-5	Yes	Yes	Yes		Yes	

SL. No.	Parameters	HT Meters	LT Meters	DT Meters	Feeder / Grid Meters	WC Meters	OBIS Code
22	Apparent Forwarded-History-6	Yes	Yes	Yes		Yes	
23	Apparent Forwarded-History-7	Yes	Yes	Yes		Yes	
24	Apparent Forwarded-History-8	Yes	Yes	Yes		Yes	
25	Apparent Forwarded-History-9	Yes	Yes	Yes		Yes	
26	Apparent Forwarded-History-10	Yes	Yes	Yes		Yes	
27	Apparent Forwarded-History-11	Yes	Yes	Yes		Yes	
28	Apparent Forwarded-History-12	Yes	Yes	Yes		Yes	
29	Reactive lag-History-1	Yes	Yes	Yes		Yes	
30	Reactive lag-History-2	Yes	Yes	Yes		Yes	
31	Reactive lag-History-3	Yes	Yes	Yes		Yes	
32	Reactive lag-History-4	Yes	Yes	Yes		Yes	
33	Reactive lag-History-5	Yes	Yes	Yes		Yes	
34	Reactive lag-History-6	Yes	Yes	Yes		Yes	
35	Reactive lag-History-7	Yes	Yes	Yes		Yes	
36	Reactive lag-History-8	Yes	Yes	Yes		Yes	
37	Reactive lag-History-9	Yes	Yes	Yes		Yes	
38	Reactive lag-History-10	Yes	Yes	Yes		Yes	
39	Reactive lag-History-11	Yes	Yes	Yes		Yes	
40	Reactive lag-History-12	Yes	Yes	Yes		Yes	
41	Reactive lead-History-1	Yes	Yes	Yes		Yes	
42	Reactive lead-History-2	Yes	Yes	Yes		Yes	
43	Reactive lead-History-3	Yes	Yes	Yes		Yes	
44	Reactive lead-History-4	Yes	Yes	Yes		Yes	
45	Reactive lead-History-5	Yes	Yes	Yes		Yes	
46	Reactive lead-History-6	Yes	Yes	Yes		Yes	
47	Reactive lead-History-7	Yes	Yes	Yes		Yes	
48	Reactive lead-History-8	Yes	Yes	Yes		Yes	
49	Reactive lead-History-9	Yes	Yes	Yes		Yes	
50	Reactive lead-History-10	Yes	Yes	Yes		Yes	
51	Reactive lead-History-11	Yes	Yes	Yes		Yes	
52	Reactive lead-History-12	Yes	Yes	Yes		Yes	
53	Active Import total	Yes	Yes	Yes		Yes	
54	Active Export total	Yes	Yes	Yes		Yes	
55	Active Import fundamental	Yes	Yes	Yes	Yes		
56	Active Export fundamental	Yes	Yes	Yes	Yes		
57	Apparent while Active Import	Yes			Yes		
58	Apparent while Active Export	Yes			Yes		
59	Reactive lag while active Import	Yes			Yes		
60	Reactive lag while active Export	Yes			Yes		
61	Reactive lead while active import	Yes			Yes		
62	Reactive lead while active export	Yes			Yes		
63	Reactive lag(Q1+Q4)	Yes					
64	Reactive lead(Q2+Q3)	Yes					
65	Active Import total - History -1	Yes			Yes		
66	Active Import total - History -2	Yes			Yes		
67	Active Import total - History -3	Yes			Yes		
68	Active Import total - History -4	Yes			Yes		
69	Active Import total - History -5	Yes			Yes		
70	Active Import total - History -6	Yes			Yes		
71	Active Import total - History -7	Yes			Yes		
72	Active Import total - History -8	Yes			Yes		
73	Active Import total - History -9	Yes			Yes		
74	Active Import total - History -10	Yes			Yes		
75	Active Import total - History -11	Yes			Yes		
76	Active Import total - History -12	Yes			Yes		
77	Active Export total - History -1	Yes			Yes		
78	Active Export total - History -2	Yes			Yes		
79	Active Export total - History -3	Yes			Yes		
80	Active Export total - History -4	Yes			Yes		
81	Active Export total - History -5	Yes			Yes		
82	Active Export total - History -6	Yes			Yes		
83	Active Export total - History -7	Yes			Yes		
84	Active Export total - History -8	Yes			Yes		
85	Active Export total - History -9	Yes			Yes		
86	Active Export total - History -10	Yes			Yes		
87	Active Export total - History -11	Yes			Yes		
88	Active Export total - History -12	Yes			Yes		
89	Active Import fundamental - History-1	Yes			Yes		
90	Active Import fundamental - History-2	Yes			Yes		
91	Active Import fundamental - History-3	Yes			Yes		
92	Active Import fundamental - History-4	Yes			Yes		
93	Active Import fundamental - History-5	Yes			Yes		
94	Active Import fundamental - History-6	Yes			Yes		
95	Active Import fundamental - History-7	Yes			Yes		
96	Active Import fundamental - History-8	Yes			Yes		
97	Active Import fundamental - History-9	Yes			Yes		

SL. No.	Parameters	HT Meters	LT Meters	DT Meters	Feeder / Grid Meters	WC Meters	OBIS Code
98	Active Import fundamental - History-10	Yes			Yes		
99	Active Import fundamental - History-11	Yes			Yes		
100	Active Import fundamental - History-12	Yes			Yes		
101	Active Export fundamental - History-1	Yes			Yes		
102	Active Export fundamental - History-2	Yes			Yes		
103	Active Export fundamental - History-3	Yes			Yes		
104	Active Export fundamental - History-4	Yes			Yes		
105	Active Export fundamental - History-5	Yes			Yes		
106	Active Export fundamental - History-6	Yes			Yes		
107	Active Export fundamental - History-7	Yes			Yes		
108	Active Export fundamental - History-8	Yes			Yes		
109	Active Export fundamental - History-9	Yes			Yes		
110	Active Export fundamental - History-10	Yes			Yes		
111	Active Export fundamental - History-11	Yes			Yes		
112	Active Export fundamental - History-12	Yes			Yes		
113	Apparent Import-History-1	Yes			Yes		
114	Apparent Import-History-2	Yes			Yes		
115	Apparent Import-History-3	Yes			Yes		
116	Apparent Import-History-4	Yes			Yes		
117	Apparent Import-History-5	Yes			Yes		
118	Apparent Import-History-6	Yes			Yes		
119	Apparent Import-History-7	Yes			Yes		
120	Apparent Import-History-8	Yes			Yes		
121	Apparent Import-History-9	Yes			Yes		
122	Apparent Import-History-10	Yes			Yes		
123	Apparent Import-History-11	Yes			Yes		
124	Apparent Import-History-12	Yes			Yes		
125	Apparent Export-History-1	Yes			Yes		
126	Apparent Export-History-2	Yes			Yes		
127	Apparent Export-History-3	Yes			Yes		
128	Apparent Export-History-4	Yes			Yes		
129	Apparent Export-History-5	Yes			Yes		
130	Apparent Export-History-6	Yes			Yes		
131	Apparent Export-History-7	Yes			Yes		
132	Apparent Export-History-8	Yes			Yes		
133	Apparent Export-History-9	Yes			Yes		
134	Apparent Export-History-10	Yes			Yes		
135	Apparent Export-History-11	Yes			Yes		
136	Apparent Export-History-12	Yes			Yes		
137	Reactive lag while active import-History-1	Yes			Yes		
138	Reactive lag while active import-History-2	Yes			Yes		
139	Reactive lag while active import-History-3	Yes			Yes		
140	Reactive lag while active import-History-4	Yes			Yes		
141	Reactive lag while active import-History-5	Yes			Yes		
142	Reactive lag while active import-History-6	Yes			Yes		
143	Reactive lag while active import-History-7	Yes			Yes		
144	Reactive lag while active import-History-8	Yes			Yes		
145	Reactive lag while active import-History-9	Yes			Yes		
146	Reactive lag while active import-History-10	Yes			Yes		
147	Reactive lag while active import-History-11	Yes			Yes		
148	Reactive lag while active import-History-12	Yes			Yes		
149	Reactive lag while active export-History-1	Yes			Yes		
150	Reactive lag while active export-History-2	Yes			Yes		
151	Reactive lag while active export-History-3	Yes			Yes		
152	Reactive lag while active export-History-4	Yes			Yes		
153	Reactive lag while active export-History-5	Yes			Yes		
154	Reactive lag while active export-History-6	Yes			Yes		
155	Reactive lag while active export-History-7	Yes			Yes		
156	Reactive lag while active export-History-8	Yes			Yes		
157	Reactive lag while active export-History-9	Yes			Yes		
158	Reactive lag while active export-History-10	Yes			Yes		
159	Reactive lag while active export-History-11	Yes			Yes		
160	Reactive lag while active export-History-12	Yes			Yes		
161	Reactive lead while active import-History-1	Yes			Yes		
162	Reactive lead while active import-History-2	Yes			Yes		
163	Reactive lead while active import-History-3	Yes			Yes		
164	Reactive lead while active import- History-4	Yes			Yes		
165	Reactive lead while active import-History-5	Yes			Yes		
166	Reactive lead while active import-History-6	Yes			Yes		
167	Reactive lead while active import-History-7	Yes			Yes		
168	Reactive lead while active import-History-8	Yes			Yes		
169	Reactive lead while active import-History-9	Yes			Yes		
170	Reactive lead while active import-History-10	Yes			Yes		
171	Reactive lead while active import-History-11	Yes			Yes		
172	Reactive lead while active import-History-12	Yes			Yes		
173	Reactive lead while active export-History-1	Yes			Yes		

SL. No.	Parameters	HT Meters	LT Meters	DT Meters	Feeder / Grid Meters	WC Meters	OBIS Code
174	Reactive lead while active export-History-2	Yes			Yes		
175	Reactive lead while active export-History-3	Yes			Yes		
176	Reactive lead while active export-History-4	Yes			Yes		
177	Reactive lead while active export-History-5	Yes			Yes		
178	Reactive lead while active export-History-6	Yes			Yes		
179	Reactive lead while active export-History-7	Yes			Yes		
180	Reactive lead while active export-History-8	Yes			Yes		
181	Reactive lead while active export-History-9	Yes			Yes		
182	Reactive lead while active export-History-10	Yes			Yes		
183	Reactive lead while active export-History-11	Yes			Yes		
184	Reactive lead while active export-History-12	Yes			Yes		
185	Reactive lag Q1+Q4 - History1	Yes					
186	Reactive lag Q1+Q4 - History2	Yes					
187	Reactive lag Q1+Q4 - History3	Yes					
188	Reactive lag Q1+Q4 - History4	Yes					
189	Reactive lag Q1+Q4 - History5	Yes					
190	Reactive lag Q1+Q4 - History6	Yes					
191	Reactive lag Q1+Q4 - History7	Yes					
192	Reactive lag Q1+Q4 - History8	Yes					
193	Reactive lag Q1+Q4 - History9	Yes					
194	Reactive lag Q1+Q4 - History10	Yes					
195	Reactive lag Q1+Q4 - History11	Yes					
196	Reactive lag Q1+Q4 - History12	Yes					
197	Reactive lead Q2+Q3 - History1	Yes					
198	Reactive lead Q2+Q3 - History2	Yes					
199	Reactive lead Q2+Q3 - History3	Yes					
200	Reactive lead Q2+Q3 - History4	Yes					
201	Reactive lead Q2+Q3 - History5	Yes					
202	Reactive lead Q2+Q3 - History6	Yes					
203	Reactive lead Q2+Q3 - History7	Yes					
204	Reactive lead Q2+Q3 - History8	Yes					
205	Reactive lead Q2+Q3 - History9	Yes					
206	Reactive lead Q2+Q3 - History10	Yes					
207	Reactive lead Q2+Q3 - History11	Yes					
208	Reactive lead Q2+Q3 - History12	Yes					
209	Reactive lag kVArh high				Yes		
210	Reactive lag kVArh low				Yes		
211	Reactive lead kVArh high				Yes		
212	Reactive lead kVArh low				Yes		
213	Reactive High net				Yes		
214	Reactive Low net				Yes		
215	Active Energy net				Yes		
216	Active Energy Fwd R Phase		Yes			Yes	
217	Active Energy Fwd Y Phase		Yes			Yes	
218	Active Energy Fwd B Phase		Yes			Yes	
219	Active Energy Export R Phase		Yes			Yes	
220	Active Energy Export Y Phase		Yes			Yes	
221	Active Energy Export B Phase		Yes			Yes	
222	Defrauded Active Energy Register	Yes	Yes	Yes	Yes	Yes	
223	Defrauded Apparent Energy Register	Yes	Yes	Yes	Yes	Yes	
224	kWh (I-E) Total				Yes		
225	kWh (E-I) Total				Yes		
226	kWh (I-E)				Yes		
227	kWh (E-I)				Yes		
228	kVArh (I-E)				Yes		
229	kVArh (E-I)				Yes		
230	Apparent while kWh (I-E)				Yes		
231	Apparent while kWh (E-I)				Yes		
232	Wheel Active Energy				Yes		
233	Wheel Reactive Energy				Yes		
234	PF -History-1	Yes	Yes	Yes	Yes	Yes	
235	PF -History-2	Yes	Yes	Yes	Yes	Yes	
236	PF -History-3	Yes	Yes	Yes	Yes	Yes	
237	PF -History-4	Yes	Yes	Yes	Yes	Yes	
238	PF -History-5	Yes	Yes	Yes	Yes	Yes	
239	PF -History-6	Yes	Yes	Yes	Yes	Yes	
240	PF -History-7	Yes	Yes	Yes	Yes	Yes	
241	PF -History-8	Yes	Yes	Yes	Yes	Yes	
242	PF -History-9	Yes	Yes	Yes	Yes	Yes	
243	PF -History-10	Yes	Yes	Yes	Yes	Yes	
244	PF -History-11	Yes	Yes	Yes	Yes	Yes	
245	PF -History-12	Yes	Yes	Yes	Yes	Yes	
C	Load Survey						

SL. No.	Parameters	HT Meters	LT Meters	DT Meters	Feeder / Grid Meters	WC Meters	OBIS Code
1	Active Forwarded (kWh)	Yes	Yes	Yes	Yes	Yes	
2	Apparent Forwarded (kVA)	Yes	Yes	Yes	Yes	Yes	
3	Reactive lag fwd	Yes	Yes	Yes	Yes	Yes	
4	Reactive lead fwd	Yes	Yes	Yes	Yes	Yes	
5	Active Import total	Yes			Yes		
6	Active Export total	Yes			Yes		
7	Active Import fundamental	Yes			Yes		
8	Active Export fundamental	Yes			Yes		
9	Apparent while Active Import	Yes			Yes		
10	Apparent while Active Export	Yes			Yes		
11	Reactive lag while active Import	Yes			Yes		
12	Reactive lag while active Export	Yes			Yes		
13	Reactive lead while active import	Yes			Yes		
14	Reactive lead while active export	Yes			Yes		
15	Reactive lag Q1+Q4	Yes					
16	Reactive lead Q2+Q3	Yes					
17	Phase voltage (R)	Yes	Yes	Yes	Yes	Yes	
18	Phase voltage (Y)	Yes	Yes	Yes	Yes	Yes	
19	Phase voltage (B)	Yes	Yes	Yes	Yes	Yes	
20	Three phase average voltage	Yes	Yes	Yes	Yes	Yes	
21	R-Phase Line Current	Yes	Yes	Yes	Yes	Yes	
22	Y-Phase Line Current	Yes	Yes	Yes	Yes	Yes	
23	B-Phase Line Current	Yes	Yes	Yes	Yes	Yes	
24	Three phase average current	Yes	Yes	Yes	Yes	Yes	
25	Frequency	Yes	Yes	Yes	Yes	Yes	
26	Supply in hours-Availibility - all three phases		Yes	Yes			
27	Supply in hours-Availibility - Partial supply (one or two phases)		Yes	Yes			
28	Supply in hours-Non- availibility in any phase for each day.		Yes	Yes			
29	Phase wise active power at peak kVA			Yes			
30	Phase wise reactive power at peak kVA			Yes			
31	Phase Wise voltage at peak kVA			Yes			
32	Power Down time in minutes in IP			Yes			
D	TOD Registers						
1	Active Energy Forwarded - Register 1	Yes	Yes	Yes		Yes	
2	Active Energy Forwarded - Register 2	Yes	Yes	Yes		Yes	
3	Active Energy Forwarded - Register 3	Yes	Yes	Yes		Yes	
4	Active Energy Forwarded - Register 4	Yes	Yes	Yes		Yes	
5	Active Energy Forwarded - Register 5	Yes	Yes	Yes		Yes	
6	Active Energy Forwarded - Register 6	Yes	Yes	Yes		Yes	
7	Active Energy Forwarded - Register 7	Yes	Yes	Yes		Yes	
8	Active Energy Forwarded - Register 8	Yes	Yes	Yes		Yes	
9	Apparent Energy Forwarded- Register 1	Yes	Yes	Yes		Yes	
10	Apparent Energy Forwarded- Register 2	Yes	Yes	Yes		Yes	
11	Apparent Energy Forwarded- Register 3	Yes	Yes	Yes		Yes	
12	Apparent Energy Forwarded- Register 4	Yes	Yes	Yes		Yes	
13	Apparent Energy Forwarded- Register 5	Yes	Yes	Yes		Yes	
14	Apparent Energy Forwarded- Register 6	Yes	Yes	Yes		Yes	
15	Apparent Energy Forwarded- Register 7	Yes	Yes	Yes		Yes	
16	Apparent Energy Forwarded- Register 8	Yes	Yes	Yes		Yes	
17	Reactive Lag Energy Forwarded Register 1	Yes	Yes	Yes		Yes	
18	Reactive Lag Energy Forwarded Register 2	Yes	Yes	Yes		Yes	
19	Reactive Lag Energy Forwarded Register 3	Yes	Yes	Yes		Yes	
20	Reactive Lag Energy Forwarded Register 4	Yes	Yes	Yes		Yes	
21	Reactive Lag Energy Forwarded Register 5	Yes	Yes	Yes		Yes	
22	Reactive Lag Energy Forwarded Register 6	Yes	Yes	Yes		Yes	
23	Reactive Lag Energy Forwarded Register 7	Yes	Yes	Yes		Yes	
24	Reactive Lag Energy Forwarded Register 8	Yes	Yes	Yes		Yes	
25	Reactive Lead Energy Forwarded Register 1	Yes	Yes	Yes		Yes	
26	Reactive Lead Energy Forwarded Register 2	Yes	Yes	Yes		Yes	
27	Reactive Lead Energy Forwarded Register 3	Yes	Yes	Yes		Yes	
28	Reactive Lead Energy Forwarded Register 4	Yes	Yes	Yes		Yes	
29	Reactive Lead Energy Forwarded Register 5	Yes	Yes	Yes		Yes	
30	Reactive Lead Energy Forwarded Register 6	Yes	Yes	Yes		Yes	
31	Reactive Lead Energy Forwarded Register 7	Yes	Yes	Yes		Yes	
32	Reactive Lead Energy Forwarded Register 8	Yes	Yes	Yes		Yes	
33	History-1 Active Energy Forwarded - Register 1	Yes	Yes	Yes		Yes	
34	History-1 Active Energy Forwarded - Register 2	Yes	Yes	Yes		Yes	
35	History-1 Active Energy Forwarded - Register 3	Yes	Yes	Yes		Yes	
36	History-1 Active Energy Forwarded - Register 4	Yes	Yes	Yes		Yes	
37	History-1 Active Energy Forwarded - Register 5	Yes	Yes	Yes		Yes	
38	History-1 Active Energy Forwarded - Register 6	Yes	Yes	Yes		Yes	

SL. No.	Parameters	HT Meters	LT Meters	DT Meters	Feeder / Grid Meters	WC Meters	OBIS Code
39	History-1 Active Energy Forwarded - Register 7	Yes	Yes	Yes		Yes	
40	History-1 Active Energy Forwarded - Register 8	Yes	Yes	Yes		Yes	
41	History-1Apparent Energy Forwarded- Register 1	Yes	Yes	Yes		Yes	
42	History-1Apparent Energy Forwarded- Register 2	Yes	Yes	Yes		Yes	
43	History-1Apparent Energy Forwarded- Register 3	Yes	Yes	Yes		Yes	
44	History-1Apparent Energy Forwarded- Register 4	Yes	Yes	Yes		Yes	
45	History-1Apparent Energy Forwarded- Register 5	Yes	Yes	Yes		Yes	
46	History-1Apparent Energy Forwarded- Register 6	Yes	Yes	Yes		Yes	
47	History-1Apparent Energy Forwarded- Register 7	Yes	Yes	Yes		Yes	
48	History-1Apparent Energy Forwarded- Register 8	Yes	Yes	Yes		Yes	
49	History-1 Reactive Lag Energy Forwarded Register	Yes	Yes	Yes		Yes	
50	History-1 Reactive Lag Energy Forwarded Register	Yes	Yes	Yes		Yes	
51	History-1 Reactive Lag Energy Forwarded Register	Yes	Yes	Yes		Yes	
52	History-1 Reactive Lag Energy Forwarded Register	Yes	Yes	Yes		Yes	
53	History-1 Reactive Lag Energy Forwarded Register	Yes	Yes	Yes		Yes	
54	History-1 Reactive Lag Energy Forwarded Register	Yes	Yes	Yes		Yes	
55	History-1 Reactive Lag Energy Forwarded Register	Yes	Yes	Yes		Yes	
56	History-1 Reactive Lag Energy Forwarded Register	Yes	Yes	Yes		Yes	
57	History-1 Reactive Lead Energy Forwarded Registe	Yes	Yes	Yes		Yes	
58	History-1 Reactive Lead Energy Forwarded Registe	Yes	Yes	Yes		Yes	
59	History-1 Reactive Lead Energy Forwarded Registe	Yes	Yes	Yes		Yes	
60	History-1 Reactive Lead Energy Forwarded Registe	Yes	Yes	Yes		Yes	
61	History-1 Reactive Lead Energy Forwarded Registe	Yes	Yes	Yes		Yes	
62	History-1 Reactive Lead Energy Forwarded Registe	Yes	Yes	Yes		Yes	
63	History-1 Reactive Lead Energy Forwarded Registe	Yes	Yes	Yes		Yes	
64	History-1 Reactive Lead Energy Forwarded Registe	Yes	Yes	Yes		Yes	
65	History-2 Active Energy Forwarded - Register 1	Yes	Yes	Yes		Yes	
66	History-2 Active Energy Forwarded - Register 2	Yes	Yes	Yes		Yes	
67	History-2 Active Energy Forwarded - Register 3	Yes	Yes	Yes		Yes	
68	History-2 Active Energy Forwarded - Register 4	Yes	Yes	Yes		Yes	
69	History-2 Active Energy Forwarded - Register 5	Yes	Yes	Yes		Yes	
70	History-2 Active Energy Forwarded - Register 6	Yes	Yes	Yes		Yes	
71	History-2 Active Energy Forwarded - Register 7	Yes	Yes	Yes		Yes	
72	History-2 Active Energy Forwarded - Register 8	Yes	Yes	Yes		Yes	
73	History-2 Apparent Energy- Register 1	Yes	Yes	Yes		Yes	
74	History-2 Apparent Energy- Register 2	Yes	Yes	Yes		Yes	
75	History-2 Apparent Energy- Register 3	Yes	Yes	Yes		Yes	
76	History-2 Apparent Energy- Register 4	Yes	Yes	Yes		Yes	
77	History-2 Apparent Energy- Register 5	Yes	Yes	Yes		Yes	
78	History-2 Apparent Energy- Register 6	Yes	Yes	Yes		Yes	
79	History-2 Apparent Energy- Register 7	Yes	Yes	Yes		Yes	
80	History-2 Apparent Energy- Register 8	Yes	Yes	Yes		Yes	
81	History-2 Reactive Lag Energy Register 1	Yes	Yes	Yes		Yes	
82	History-2 Reactive Lag Energy Register 2	Yes	Yes	Yes		Yes	
83	History-2 Reactive Lag Energy Register 3	Yes	Yes	Yes		Yes	
84	History-2 Reactive Lag Energy Register 4	Yes	Yes	Yes		Yes	
85	History-2 Reactive Lag Energy Register 5	Yes	Yes	Yes		Yes	
86	History-2 Reactive Lag Energy Register 6	Yes	Yes	Yes		Yes	
87	History-2 Reactive Lag Energy Register 7	Yes	Yes	Yes		Yes	
88	History-2 Reactive Lag Energy Register 8	Yes	Yes	Yes		Yes	
89	History-2 Reactive Lead Energy Register 1	Yes	Yes	Yes		Yes	
90	History-2 Reactive Lead Energy Register 2	Yes	Yes	Yes		Yes	
91	History-2 Reactive Lead Energy Register 3	Yes	Yes	Yes		Yes	
92	History-2 Reactive Lead Energy Register 4	Yes	Yes	Yes		Yes	
93	History-2 Reactive Lead Energy Register 5	Yes	Yes	Yes		Yes	
94	History-2 Reactive Lead Energy Register 6	Yes	Yes	Yes		Yes	
95	History-2 Reactive Lead Energy Register 7	Yes	Yes	Yes		Yes	
96	History-2 Reactive Lead Energy Register 8	Yes	Yes	Yes		Yes	
97	Active Import Fundamental - Register 1	Yes			Yes		
98	Active Import Fundamental - Register 2	Yes			Yes		
99	Active Import Fundamental - Register 3	Yes			Yes		
100	Active Import Fundamental - Register 4	Yes			Yes		
101	Active Import Fundamental - Register 5	Yes			Yes		
102	Active Import Fundamental - Register 6	Yes			Yes		
103	Active Import Fundamental - Register 7	Yes			Yes		
104	Active Import Fundamental - Register 8	Yes			Yes		
105	Active Export Fundamental - Register 1	Yes			Yes		
106	Active Export Fundamental - Register 2	Yes			Yes		
107	Active Export Fundamental - Register 3	Yes			Yes		
108	Active Export Fundamental - Register 4	Yes			Yes		
109	Active Export Fundamental - Register 5	Yes			Yes		
110	Active Export Fundamental - Register 6	Yes			Yes		
111	Active Export Fundamental - Register 7	Yes			Yes		
112	Active Export Fundamental - Register 8	Yes			Yes		
113	Apparent Import Energy- Register 1	Yes			Yes		
114	Apparent Import Energy- Register 2	Yes			Yes		

SL. No.	Parameters	HT Meters	LT Meters	DT Meters	Feeder / Grid Meters	WC Meters	OBIS Code
115	Apparent Import Energy- Register 3	Yes			Yes		
116	Apparent Import Energy- Register 4	Yes			Yes		
117	Apparent Import Energy- Register 5	Yes			Yes		
118	Apparent Import Energy- Register 6	Yes			Yes		
119	Apparent Import Energy- Register 7	Yes			Yes		
120	Apparent Import Energy- Register 8	Yes			Yes		
121	Apparent Export Energy- Register 1	Yes			Yes		
122	Apparent Export Energy- Register 2	Yes			Yes		
123	Apparent Export Energy- Register 3	Yes			Yes		
124	Apparent Export Energy- Register 4	Yes			Yes		
125	Apparent Export Energy- Register 5	Yes			Yes		
126	Apparent Export Energy- Register 6	Yes			Yes		
127	Apparent Export Energy- Register 7	Yes			Yes		
128	Apparent Export Energy- Register 8	Yes			Yes		
129	History-1 Active Import - Register 1	Yes			Yes		
130	History-1 Active Import - Register 2	Yes			Yes		
131	History-1 Active Import - Register 3	Yes			Yes		
132	History-1 Active Import - Register 4	Yes			Yes		
133	History-1 Active Import - Register 5	Yes			Yes		
134	History-1 Active Import - Register 6	Yes			Yes		
135	History-1 Active Import - Register 7	Yes			Yes		
136	History-1 Active Import - Register 8	Yes			Yes		
137	History-1 Active Export - Register 1	Yes			Yes		
138	History-1 Active Export - Register 2	Yes			Yes		
139	History-1 Active Export - Register 3	Yes			Yes		
140	History-1 Active Export - Register 4	Yes			Yes		
141	History-1 Active Export - Register 5	Yes			Yes		
142	History-1 Active Export - Register 6	Yes			Yes		
143	History-1 Active Export - Register 7	Yes			Yes		
144	History-1 Active Export - Register 8	Yes			Yes		
145	History-1Apparent while active import- Register 1	Yes			Yes		
146	History-1Apparent while active import- Register 2	Yes			Yes		
147	History-1Apparent while active import- Register 3	Yes			Yes		
148	History-1Apparent while active import- Register 4	Yes			Yes		
149	History-1Apparent while active import- Register 5	Yes			Yes		
150	History-1Apparent while active import- Register 6	Yes			Yes		
151	History-1Apparent while active import- Register 7	Yes			Yes		
152	History-1Apparent while active import- Register 8	Yes			Yes		
153	History-1Apparent while active export- Register 1	Yes			Yes		
154	History-1Apparent while active export- Register 2	Yes			Yes		
155	History-1Apparent while active export- Register 3	Yes			Yes		
156	History-1Apparent while active export- Register 4	Yes			Yes		
157	History-1Apparent while active export- Register 5	Yes			Yes		
158	History-1Apparent while active export- Register 6	Yes			Yes		
159	History-1Apparent while active export- Register 7	Yes			Yes		
160	History-1Apparent while active export- Register 8	Yes			Yes		
161	History-2 Active Import Fundamental - Register 1	Yes			Yes		
162	History-2 Active Import Fundamental - Register 2	Yes			Yes		
163	History-2 Active Import Fundamental - Register 3	Yes			Yes		
164	History-2 Active Import Fundamental - Register 4	Yes			Yes		
165	History-2 Active Import Fundamental - Register 5	Yes			Yes		
166	History-2 Active Import Fundamental - Register 6	Yes			Yes		
167	History-2 Active Import Fundamental - Register 7	Yes			Yes		

SL. No.	Parameters	HT Meters	LT Meters	DT Meters	Feeder / Grid Meters	WC Meters	OBIS Code
168	History-2 Active Import Fundamental - Register 8	Yes			Yes		
169	History-2 Active Export Fundamental - Register 1	Yes			Yes		
170	History-2 Active Export Fundamental - Register 2	Yes			Yes		
171	History-2 Active Export Fundamental - Register 3	Yes			Yes		
172	History-2 Active Export Fundamental - Register 4	Yes			Yes		
173	History-2 Active Export Fundamental - Register 5	Yes			Yes		
174	History-2 Active Export Fundamental - Register 6	Yes			Yes		
175	History-2 Active Export Fundamental - Register 7	Yes			Yes		
176	History-2 Active Export Fundamental - Register 8	Yes			Yes		
177	Apparent Forwarded TOD Energy (Register 1)					Yes	
178	Apparent Forwarded TOD Energy (Register 2)					Yes	
179	Apparent Forwarded TOD Energy (Register 3)					Yes	
180	Current TOD KVAh Forwarded (0-24 hrs.)					Yes	
181	Current TOD KWh Forwarded (0-24 hrs.)					Yes	
182	History 1: Current TOD KWh Forwarded (0-24 hrs.)					Yes	
183	History 2: Current TOD KWh Forwarded (0-24 hrs.)					Yes	
184	History 3: Current TOD KWh Forwarded (0-24 hrs.)					Yes	
	All defined energy types as in energy type section applicable						
E	MD Register						
			Yes	Yes			
1	Apparent Energy (0-24)hrs		Yes	Yes			
2	Apparent Energy Occurrence date (0-24)hrs		Yes	Yes			
3	Apparent Energy Occurrence time (0-24)hrs		Yes	Yes			
4	History 1: Apparent Energy (0-24)hrs		Yes	Yes			
5	History 1: Apparent Energy Occurrence date (0-24)hrs		Yes	Yes			
6	History 1: Apparent Energy Occurrence time (0-24)hrs		Yes	Yes			
7	History 2: Apparent Energy (0-24)hrs		Yes	Yes			
8	History 2: Apparent Energy Occurrence date (0-24)hrs		Yes	Yes			
9	History 2: Apparent Energy Occurrence time (0-24)hrs		Yes	Yes			
10	History 3: Apparent Energy (0-24)hrs		Yes	Yes			
11	History 3: Apparent Energy Occurrence date (0-24)hrs		Yes	Yes			
12	History 3: Apparent Energy Occurrence time (0-24)hrs		Yes	Yes			
13	History 4: Apparent Energy (0-24)hrs		Yes	Yes			
14	History 4: Apparent Energy Occurrence date (0-24)hrs		Yes	Yes			
15	History 4: Apparent Energy Occurrence time (0-24)hrs		Yes	Yes			
16	History 5: Apparent Energy (0-24)hrs		Yes	Yes			
17	History 5: Apparent Energy Occurrence date (0-24)hrs		Yes	Yes			
18	History 5: Apparent Energy Occurrence time (0-24)hrs		Yes	Yes			
19	History 6: Apparent Energy (0-24)hrs		Yes	Yes			
20	History 6: Apparent Energy Occurrence date (0-24)hrs		Yes	Yes			
21	History 6: Apparent Energy Occurrence time (0-24)hrs		Yes	Yes			
22	History 7: Apparent Energy (0-24)hrs		Yes	Yes			
23	History 7: Apparent Energy Occurrence date (0-24)hrs		Yes	Yes			
24	History 7: Apparent Energy Occurrence time (0-24)hrs		Yes	Yes			
25	History 8: Apparent Energy (0-24)hrs		Yes	Yes			

SL. No.	Parameters	HT Meters	LT Meters	DT Meters	Feeder / Grid Meters	WC Meters	OBIS Code
26	History 8: Apparent Energy Occurrence date (0-24)hrs		Yes	Yes			
27	History 8: Apparent Energy Occurrence time (0-24)hrs		Yes	Yes			
28	History 9: Apparent Energy (0-24)hrs		Yes	Yes			
29	History 9: Apparent Energy Occurrence date (0-24)hrs		Yes	Yes			
30	History 9: Apparent Energy Occurrence time (0-24)hrs		Yes	Yes			
31	History 10: Apparent Energy (0-24)hrs		Yes	Yes			
32	History 10: Apparent Energy Occurrence date (0-24)hrs		Yes	Yes			
33	History 10: Apparent Energy Occurrence time (0-24)hrs		Yes	Yes			
34	History 11: Apparent Energy (0-24)hrs		Yes	Yes			
35	History 11: Apparent Energy Occurrence date (0-24)hrs		Yes	Yes			
36	History 11: Apparent Energy Occurrence time (0-24)hrs		Yes	Yes			
37	History 12: Apparent Energy (0-24)hrs		Yes	Yes			
38	History 12: Apparent Energy Occurrence date (0-24)hrs		Yes	Yes			
39	History 12: Apparent Energy Occurrence time (0-24)hrs		Yes	Yes			
40	Apparent while Active Import (0-24)hrs				Yes		
41	Apparent while active import Occurrence date (0-24)hrs				Yes		
42	Apparent while active import Occurrence time (0-24)hrs				Yes		
43	Apparent while Active Export (0-24)hrs				Yes		
44	Apparent while active Export Occurrence date (0-24)hrs				Yes		
45	Apparent while active Export Occurrence time (0-24)hrs				Yes		
46	History 1: Apparent While active import (0-24)hrs				Yes		
47	History 1: Apparent While active import Occurrence date (0-24)hrs				Yes		
48	History 1: Apparent While active import Occurrence time (0-24)hrs				Yes		
49	History 1: Apparent While active export (0-24)hrs				Yes		
50	History 1: Apparent While active export Occurrence date (0-24)hrs				Yes		
51	History 1: Apparent While active export Occurrence time (0-24)hrs				Yes		
52	Rising Demand with Elasped Time in KVA	Yes	Yes	Yes	Yes	Yes	
	All defined energy types as in energy type section applicable						
F	TOD MD Registers						
			Yes	Yes		Yes	
1	Apparent MD register-Register-1		Yes	Yes		Yes	
2	Apparent MD register-Register-2		Yes	Yes		Yes	
3	Apparent MD register-Register-3		Yes	Yes		Yes	
4	Apparent MD register-Register-4		Yes	Yes		Yes	
5	Apparent MD register-Register-5		Yes	Yes		Yes	
6	Apparent MD register-Register-6		Yes	Yes		Yes	
7	Apparent MD register-Register-7		Yes	Yes		Yes	
8	Apparent MD register-Register-8		Yes	Yes		Yes	
9	History 1: Apparent MD register-Register-1		Yes	Yes		Yes	
10	History 1: Apparent MD register-Register-2		Yes	Yes		Yes	
11	History 1: Apparent MD register-Register-3		Yes	Yes		Yes	
12	History 1: Apparent MD register-Register-4		Yes	Yes		Yes	
13	History 1: Apparent MD register-Register-5		Yes	Yes		Yes	
14	History 1: Apparent MD register-Register-6		Yes	Yes		Yes	
15	History 1: Apparent MD register-Register-7		Yes	Yes		Yes	
16	History 1: Apparent MD register-Register-8		Yes	Yes		Yes	
17	History 2: Apparent MD register-Register-1		Yes	Yes		Yes	
18	History 2: Apparent MD register-Register-2		Yes	Yes		Yes	
19	History 2: Apparent MD register-Register-3		Yes	Yes		Yes	
20	History 2: Apparent MD register-Register-4		Yes	Yes		Yes	
21	History 2: Apparent MD register-Register-5		Yes	Yes		Yes	
22	History 2: Apparent MD register-Register-6		Yes	Yes		Yes	
23	History 2: Apparent MD register-Register-7		Yes	Yes		Yes	
24	History 2: Apparent MD register-Register-8		Yes	Yes		Yes	

SL. No.	Parameters	HT Meters	LT Meters	DT Meters	Feeder / Grid Meters	WC Meters	OBIS Code
25	History 3: Apparent MD register-Register-1		Yes	Yes		Yes	
26	History 3: Apparent MD register-Register-2		Yes	Yes		Yes	
27	History 3: Apparent MD register-Register-3		Yes	Yes		Yes	
28	History 3: Apparent MD register-Register-4		Yes	Yes		Yes	
29	History 3: Apparent MD register-Register-5		Yes	Yes		Yes	
30	History 3: Apparent MD register-Register-6		Yes	Yes		Yes	
31	History 3: Apparent MD register-Register-7		Yes	Yes		Yes	
32	History 3: Apparent MD register-Register-8		Yes	Yes		Yes	
33	History 4: Apparent MD register-Register-1		Yes	Yes		Yes	
34	History 4: Apparent MD register-Register-2		Yes	Yes		Yes	
35	History 4: Apparent MD register-Register-3		Yes	Yes		Yes	
36	History 4: Apparent MD register-Register-4		Yes	Yes		Yes	
37	History 4: Apparent MD register-Register-5		Yes	Yes		Yes	
38	History 4: Apparent MD register-Register-6		Yes	Yes		Yes	
39	History 4: Apparent MD register-Register-7		Yes	Yes		Yes	
40	History 4: Apparent MD register-Register-8		Yes	Yes		Yes	
41	History 5: Apparent MD register-Register-1		Yes	Yes		Yes	
42	History 5: Apparent MD register-Register-2		Yes	Yes		Yes	
43	History 5: Apparent MD register-Register-3		Yes	Yes		Yes	
44	History 5: Apparent MD register-Register-4		Yes	Yes		Yes	
45	History 5: Apparent MD register-Register-5		Yes	Yes		Yes	
46	History 5: Apparent MD register-Register-6		Yes	Yes		Yes	
47	History 5: Apparent MD register-Register-7		Yes	Yes		Yes	
48	History 5: Apparent MD register-Register-8		Yes	Yes		Yes	
49	History 6: Apparent MD register-Register-1		Yes	Yes		Yes	
50	History 6: Apparent MD register-Register-2		Yes	Yes		Yes	
51	History 6: Apparent MD register-Register-3		Yes	Yes		Yes	
52	History 6: Apparent MD register-Register-4		Yes	Yes		Yes	
53	History 6: Apparent MD register-Register-5		Yes	Yes		Yes	
54	History 6: Apparent MD register-Register-6		Yes	Yes		Yes	
55	History 6: Apparent MD register-Register-7		Yes	Yes		Yes	
56	History 6: Apparent MD register-Register-8		Yes	Yes		Yes	
57	History 7 Apparent MD register-Register-1		Yes	Yes		Yes	
58	History 7 Apparent MD register-Register-2		Yes	Yes		Yes	
59	History 7 Apparent MD register-Register-3		Yes	Yes		Yes	
60	History 7 Apparent MD register-Register-4		Yes	Yes		Yes	
61	History 7 Apparent MD register-Register-5		Yes	Yes		Yes	
62	History 7 Apparent MD register-Register-6		Yes	Yes		Yes	
63	History 7 Apparent MD register-Register-7		Yes	Yes		Yes	
64	History 7 Apparent MD register-Register-8		Yes	Yes		Yes	
65	History 8 Apparent MD register-Register-1		Yes	Yes		Yes	
66	History 8 Apparent MD register-Register-2		Yes	Yes		Yes	
67	History 8 Apparent MD register-Register-3		Yes	Yes		Yes	
68	History 8 Apparent MD register-Register-4		Yes	Yes		Yes	
69	History 8 Apparent MD register-Register-5		Yes	Yes		Yes	
70	History 8 Apparent MD register-Register-6		Yes	Yes		Yes	
71	History 8 Apparent MD register-Register-7		Yes	Yes		Yes	
72	History 8 Apparent MD register-Register-8		Yes	Yes		Yes	
73	History 9 Apparent MD register-Register-1		Yes	Yes		Yes	
74	History 9 Apparent MD register-Register-2		Yes	Yes		Yes	
75	History 9 Apparent MD register-Register-3		Yes	Yes		Yes	
76	History 9 Apparent MD register-Register-4		Yes	Yes		Yes	
77	History 9 Apparent MD register-Register-5		Yes	Yes		Yes	
78	History 9 Apparent MD register-Register-6		Yes	Yes		Yes	
79	History 9 Apparent MD register-Register-7		Yes	Yes		Yes	
80	History 9 Apparent MD register-Register-8		Yes	Yes		Yes	
81	History 10 Apparent MD register-Register-1		Yes	Yes		Yes	
82	History 10 Apparent MD register-Register-2		Yes	Yes		Yes	
83	History 10 Apparent MD register-Register-3		Yes	Yes		Yes	
84	History 10 Apparent MD register-Register-4		Yes	Yes		Yes	
85	History 10 Apparent MD register-Register-5		Yes	Yes		Yes	
86	History 10 Apparent MD register-Register-6		Yes	Yes		Yes	
87	History 10 Apparent MD register-Register-7		Yes	Yes		Yes	
88	History 10 Apparent MD register-Register-8		Yes	Yes		Yes	
89	History 11 Apparent MD register-Register-1		Yes	Yes		Yes	
90	History 11 Apparent MD register-Register-2		Yes	Yes		Yes	
91	History 11 Apparent MD register-Register-3		Yes	Yes		Yes	
92	History 11 Apparent MD register-Register-4		Yes	Yes		Yes	
93	History 11 Apparent MD register-Register-5		Yes	Yes		Yes	
94	History 11 Apparent MD register-Register-6		Yes	Yes		Yes	
95	History 11 Apparent MD register-Register-7		Yes	Yes		Yes	
96	History 11 Apparent MD register-Register-8		Yes	Yes		Yes	
97	History 12 Apparent MD register-Register-1		Yes	Yes		Yes	
98	History 12 Apparent MD register-Register-2		Yes	Yes		Yes	
99	History 12 Apparent MD register-Register-3		Yes	Yes		Yes	
100	History 12 Apparent MD register-Register-4		Yes	Yes		Yes	

SL. No.	Parameters	HT Meters	LT Meters	DT Meters	Feeder / Grid Meters	WC Meters	OBIS Code
101	History 12 Apparent MD register-Register-5		Yes	Yes		Yes	
102	History 12 Apparent MD register-Register-6		Yes	Yes		Yes	
103	History 12 Apparent MD register-Register-7		Yes	Yes		Yes	
104	History 12 Apparent MD register-Register-8		Yes	Yes		Yes	
105	Apparent MD while active import-Register-1				Yes		
106	Apparent MD while active import-Register-2				Yes		
107	Apparent MD while active import-Register-3				Yes		
108	Apparent MD while active import-Register-4				Yes		
109	Apparent MD while active import-Register-5				Yes		
110	Apparent MD while active import-Register-6				Yes		
111	Apparent MD while active import-Register-7				Yes		
112	Apparent MD while active import-Register-8				Yes		
113	Apparent MD while active export-Register-1				Yes		
114	Apparent MD while active export-Register-2				Yes		
115	Apparent MD while active export-Register-3				Yes		
116	Apparent MD while active export-Register-4				Yes		
117	Apparent MD while active export-Register-5				Yes		
118	Apparent MD while active export-Register-6				Yes		
119	Apparent MD while active export-Register-7				Yes		
120	Apparent MD while active export-Register-8				Yes		
121	History 1: Apparent MD while active import-Register-1				Yes		
122	History 1: Apparent MD while active import-Register-2				Yes		
123	History 1: Apparent MD while active import-Register-3				Yes		
124	History 1: Apparent MD while active import-Register-4				Yes		
125	History 1: Apparent MD while active import-Register-5				Yes		
126	History 1: Apparent MD while active import-Register-6				Yes		
127	History 1: Apparent MD while active import-Register-7				Yes		
128	History 1: Apparent MD while active import-Register-8				Yes		
129	History 1: Apparent MD while active export-Register-1				Yes		
130	History 1: Apparent MD while active export-Register-2				Yes		
131	History 1: Apparent MD while active export-Register-3				Yes		
132	History 1: Apparent MD while active export-Register-4				Yes		
133	History 1: Apparent MD while active export-Register-5				Yes		
134	History 1: Apparent MD while active export-Register-6				Yes		
135	History 1: Apparent MD while active export-Register-7				Yes		
136	History 1: Apparent MD while active export-Register-8				Yes		
	All defined energy types as in energy type section applicable						
G	Tamper Events						
1	R Phase CT Open	Yes	Yes	Yes	Yes	Yes	
2	Y Phase CT Open	Yes	Yes	Yes	Yes	Yes	
3	B Phase CT Open	Yes	Yes	Yes	Yes	Yes	
4	R Phase CT Miss	Yes	Yes	Yes	Yes	Yes	
5	Y Phase CT Miss	Yes	Yes	Yes	Yes	Yes	
6	B Phase CT Miss	Yes	Yes	Yes	Yes	Yes	
7	Magnetic Tamper	Yes	Yes	Yes	Yes	Yes	
8	Tamper ID	Yes	Yes	Yes	Yes	Yes	
9	Restoration Date	Yes	Yes	Yes	Yes	Yes	
10	Restoration Time	Yes	Yes	Yes	Yes	Yes	
11	R- Phase PT Miss	Yes	Yes	Yes	Yes	Yes	
12	Y- Phase PT Miss	Yes	Yes	Yes	Yes	Yes	
13	B- Phase PT Miss	Yes	Yes	Yes	Yes	Yes	
14	R- Phase CT Bypass	Yes	Yes	Yes	Yes	Yes	
15	Y- Phase CT Bypass	Yes	Yes	Yes	Yes	Yes	
16	B- Phase CT Bypass	Yes	Yes	Yes	Yes	Yes	
17	R- Phase CT reversal (Forward logging)	Yes	Yes	Yes		Yes	

SL. No.	Parameters	HT Meters	LT Meters	DT Meters	Feeder / Grid Meters	WC Meters	OBIS Code
18	Y- Phase CT reversal (Forward logging)	Yes	Yes	Yes		Yes	
19	B- Phase CT reversal (Forward logging)	Yes	Yes	Yes		Yes	
20	Neutral Disturbance	Yes	Yes	Yes		Yes	
21	First Occurrence Tamper ID	Yes	Yes	Yes	Yes	Yes	
22	Date of first tamper Occurrence	Yes	Yes	Yes	Yes	Yes	
23	Time of first tamper Occurrence	Yes	Yes	Yes	Yes	Yes	
24	Last Occurrence Tamper ID	Yes	Yes	Yes	Yes	Yes	
25	Date of last tamper Occurrence	Yes	Yes	Yes	Yes	Yes	
26	Time of last tamper Occurrence	Yes	Yes	Yes	Yes	Yes	
27	Last Restoration Tamper ID	Yes	Yes	Yes	Yes	Yes	
28	Date of last tamper Restoration	Yes	Yes	Yes	Yes	Yes	
29	Time of last tamper Restoration	Yes	Yes	Yes	Yes	Yes	
30	Current Imbalance	Yes	Yes	Yes	Yes	Yes	
31	Voltage Imbalance	Yes	Yes	Yes	Yes	Yes	
32	Power On/OFF	Yes	Yes	Yes	Yes	Yes	
33	Over Load Phase wise	Yes	Yes	Yes	Yes	Yes	
34	Low Load Phase wise			Yes			
35	Voltage High Phase wise			Yes			
36	Voltage low Phase wise			Yes			
37	High Neutral current		Yes	Yes		Yes	
38	Low Powerfactor	Yes	Yes	Yes			
39	over current phase			Yes			
40	under current phase wise			Yes			
41	Short term over load phase wise			Yes			
42	Snapshot of voltage R	Yes	Yes	Yes	Yes	Yes	Yes
43	Snapshot of voltage Y	Yes	Yes	Yes	Yes	Yes	Yes
44	Snapshot of voltage B	Yes	Yes	Yes	Yes	Yes	Yes
45	Snapshot of Line current R	Yes	Yes	Yes	Yes	Yes	Yes
46	Snapshot of Line current Y	Yes	Yes	Yes	Yes	Yes	Yes
47	Snapshot of Line current B	Yes	Yes	Yes	Yes	Yes	Yes
48	Snapshot of R phase PF	Yes	Yes	Yes	Yes	Yes	Yes
49	Snapshot of Y phase PF	Yes	Yes	Yes	Yes	Yes	Yes
50	Snapshot of B phase PF	Yes	Yes	Yes	Yes	Yes	Yes
51	Snapshot of Active current R	Yes	Yes	Yes	Yes	Yes	Yes
52	Snapshot of Active current Y	Yes	Yes	Yes	Yes	Yes	Yes
53	Snapshot of Active current B	Yes	Yes	Yes	Yes	Yes	Yes
54	Snapshot of cumulative Active Forwarded energy	Yes	Yes	Yes	Yes	Yes	Yes
55	Snapshot of cumulative Active Import	Yes	Yes	Yes	Yes	Yes	Yes
56	Snapshot of cumulative Active Export	Yes	Yes	Yes	Yes	Yes	Yes
57	Snapshot of cumulative Apparent Forwarded energy	Yes	Yes	Yes	Yes	Yes	Yes
58	Single wire operation Occour/Restore					Yes	
59	Abnormal Power down					Yes	
60	Abnormal Interference					Yes	
61	Cover Open	Yes	Yes			Yes	
62	Low voltage with current missing in one element					Yes	
63	Invalid voltage					Yes	
64	Invalid phase association	Yes	Yes				
65	Bad Battery					Yes	
66	RTC Fail					Yes	
H	Tamper Event Count						
1	R Phase CT Open	Yes	Yes	Yes	Yes	Yes	
2	Y Phase CT Open	Yes	Yes	Yes	Yes	Yes	
3	B Phase CT Open	Yes	Yes	Yes	Yes	Yes	
4	R Phase CT Miss	Yes	Yes	Yes	Yes	Yes	
5	Y Phase CT Miss	Yes	Yes	Yes	Yes	Yes	
6	B Phase CT Miss	Yes	Yes	Yes	Yes	Yes	
7	Magnetic Tamper	Yes	Yes	Yes	Yes	Yes	
8	R- Phase PT Miss	Yes	Yes	Yes	Yes	Yes	
9	Y- Phase PT Miss	Yes	Yes	Yes	Yes	Yes	
10	B- Phase PT Miss	Yes	Yes	Yes	Yes	Yes	
11	R- Phase CT Bypass	Yes	Yes	Yes	Yes	Yes	
12	Y- Phase CT Bypass	Yes	Yes	Yes	Yes	Yes	
13	B- Phase CT Bypass	Yes	Yes	Yes	Yes	Yes	
14	R- Phase CT reversal (Forward logging)	Yes	Yes	Yes		Yes	
15	Y- Phase CT reversal (Forward logging)	Yes	Yes	Yes		Yes	
16	B- Phase CT reversal (Forward logging)	Yes	Yes	Yes		Yes	
17	Neutral Disturbance	Yes	Yes	Yes		Yes	
18	Current Imbalance	Yes	Yes	Yes	Yes	Yes	
19	Voltage Imbalance	Yes	Yes	Yes	Yes	Yes	
20	Power On/OFF bill point	Yes	Yes	Yes	Yes	Yes	

SL. No.	Parameters	HT Meters	LT Meters	DT Meters	Feeder / Grid Meters	WC Meters	OBIS Code
21	Over Load Phase wise	Yes	Yes	Yes	Yes	Yes	
22	Low Load Phase wise			Yes			
23	Voltage High Phase wise			Yes			
24	Voltage low Phase wise			Yes			
25	High Neutral current		Yes	Yes		Yes	
26	Low Powerfactor	Yes	Yes	Yes			
27	over current phase			Yes			
28	under current phase wise			Yes			
29	Short term over load phase wise			Yes			
30	Billing point wise tamper counts	Yes	Yes			Yes	
I	Mid Energy Snap Shot						
1	Active Import total	Yes	Yes	Yes		Yes	
2	Active Export total	Yes	Yes	Yes		Yes	
3	Active Import	Yes	Yes	Yes	Yes		
4	Active Export	Yes	Yes	Yes	Yes		
5	Apparent while Active Import	Yes			Yes		
6	Apparent while Active Export	Yes			Yes		
7	Reactive lag while active Import	Yes			Yes		
8	Reactive lag while active Export	Yes			Yes		
9	Reactive lead while active import	Yes			Yes		
10	Reactive lead while active export	Yes			Yes		
11	Reactive lag(Q1+Q4)	Yes					
12	Reactive lead(Q2+Q3)	Yes					
13	Active Energy Forwarded (kWh)	Yes	Yes	Yes		Yes	
14	Apparent Energy Forwarded (kVA)	Yes	Yes	Yes		Yes	
15	Reactive lag forwarded	Yes	Yes	Yes		Yes	
16	Reactive lead forwarded	Yes	Yes	Yes		Yes	

Annex-XIV

Common list of parameters compiled by CEA based on the available tender specifications of utilities

Sl No	Parameter	unit	Type	Small consumers	3 phase LT/HV consumers	Energy accounting and audit meters	Interface meters	Remark
1	Active Power	KW/MW	I	Y	Y	Y	Y	For each phase in case of poly phase meter
2	Reactive Power	KVAr/MVAr	I	Y	Y	Y	Y	
3	Apparent Power	KVA	I	Y	Y	Y	Y	
4	Active Energy	KWh/MWh	C	Y	Y	Y	Y (15 minutes interval)	Interval to be decided by user for other meters and may vary from utility to utility
5	Reactive Energy	KVArh/MVArh	C	Y	Y	Y	Y (15 minutes cumulative at lower threshold/upper threshold value)	Interval to be decided for other meters and may vary from utility to utility (value for each month for last 12 months be available)
6	Apparent Energy	KVAh/MVAh	C	Y	Y	Y	Y (15 minutes cumulative at lower threshold/upper threshold value)	Interval to be decided for other meters and may vary from utility to utility (value for each month for last 12 months be available)
7.	Monthly Maximum Demand	KW/MW	I	Y	Y	Y	N	MD every 30 minutes, compared with previous MD and store which ever is higher. Date and time to be recorded and indicated
8.	Phase-wise Current	Amp	I	N	Y	Y	Y	-
9.	Phase-wise Voltage	KV	I	N	Y	Y	Y	-
10	Average Voltage	KV	A	N	Y	Y	Y (15 Minutes Interval)	
10	Meter Sl No	Ne	P	Y	Y	Y	Y	

11	Historical KWH and max Demand	-	-	Y	Y	Y	Y	This must be available for last six/twelve months depending upon utility practice
12	Frequency	Hz	I	Y	Y	Y	Y	
13	Average Frequency	Hz	A	N	Y	Y	Y (15 Minutes Interval)	Interval to be decided for other meters and may vary from utility to utility
14	Auto reset MD	Facility	-	Y	Y	Y	N	Date of auto reset to be recorded and must be changeable from remote
15	Disconnect	-	I	Y	Y	Y	Y	Date and time to be recorded
16.	Power factor	Ne	I	Y	Y	Y	N	For each phase in case of polyphase meter
17.	Average Power factor	A	A	N	Y	Y	N (15 minutes interval)	Interval to be decided for other meters and may vary from utility to utility
18.	Tamper counts	Ne	C	Y	Y	Y	N	
19.	Temperature	Degree Celcius	Max	Y	Y	N	N	For last 12 months
20.	Tariff Zones	-	-	Y	Y	Y	Y	Number of zones to be decided by utility.
21.	Power availability time	Hrs/units	C	Y	Y	Y	N	For each phase
22.	Daily Load Profile	-	-	Y	Y	Y	N	This will comprise of cumulative kwh and average power factor for the last minimum 35 days
23.	CT ratio	Ratio	P	N	Y	Y	Y	
24.	Time synchronization	Date & Time	I	N	Y	Y	Y	

Legend: I-instantaneous, C-Cumulative, A-average, N –Numeral, Y-Yes, N-No, P – Permanent (one time)

Note: 1. Protocol must be suitable for the above parameters .
2. These parameters have been proposed keeping present and future requirement
3. Protocol must be capable for TOD metering with downloading tariff rates .
4. Protocol must be capable of bidirectional exchange of messages and par ameters
5. Meters for rural consumers can only be mad for cumulative energy meter reading

Annex-XV

Schedule for finalization of parameters

Sl No	Action	Target
1	Finalization of parameters by CEA along with CPRI and NTPC	20th Dec. 08
2	Circulation of the above parameters to utilities by CEA for their comments	30th Dec. 08
3	Compilation of OBIS codes as per IEC 62056 for above parameters and identification of the parameters for which codes are not available and evolving codes for the same. CPRI to take necessary action in this regard.	28th Feb. 09
4	Submission to DLMS group for incorporation in IEC, if required	First week of March 09