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Analyzing Existing Standards in the Field of Electricity Smart Grids

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Abstract: *in short, smart grid is defined as many elements, all of which has a sameness in one subject, that is bilateral data flow corresponding to electricity energy current. As smart grid is involved in the all parts of the energy transformation cycle, from generation to consumption, the route of electricity current is converted from one-way case (generating electricity in the form of centralized and then transmit it through transmission and distribution networks to the final consumer) to two-way mode (figures 1 and 2). Also power system operation method is changed from hierarchical case (from up to bottom) to distributed control system. One of the main points about the smart grids is the increment in the observability and controllability rate of all of the processes in the grid. It is because the data is shared between different components and subsystems in the grid. Therefore standardizing the aforementioned total process is very vital, since the prerequisite of smart grid is to interact and percept the data reciprocally between all the equipments and devices, systems, software and hardware located in the entire electricity network. In this paper, it is tried to analyze the proposed standards in this field and cite the advantages and disadvantages of them and the route to their evolution.*

Keywords: IEC standards, smart grids, meter smart metering, e-mobility

1. INTRODUCTION

Given that investment in smart grids is in the form of long term and the country Iran is in the first steps of making the electricity grid smart, it is vital to specify the basic and fundamental set of standards in this field brightly, so that investors could rely on these standards with complete confidence.

Among the validated standard codification companies in the entire world, International Electro technical Commission (IEC) and U.S. National Institute of Standard and Technology (NIST) have great validation in the field of standardizing smart grids. These two organs are the leaders of upgrading the international standards of smart grid, each of them having its roadmap in this field. Both groups have multiple ways to prepare standards list and of course has associated in some of them. The trends of NIST and IEC to the applications of smart grid are different somehow. The priority list of NIST in this field includes: response to consumption demand and energy consumption efficiency, energy saving, electrical transportation, the Advanced Metering Infrastructure (AMI) smart measurement ultra-system, electricity distribution management, cyber security of data and communication network; while the priority list of IEC includes: High Voltage DC (HVDC), preventing power interruptions, distribution management and automation, substation automation, distributed energy resources, smart measurement ultra-system, respond to consumers demand, smart homes, electricity saving and e-mobility.

Given that both organs have different organizations, some of participants of NIST in smart grid are members of Strategic Group of smart grid standard codification at IEC's SG3.

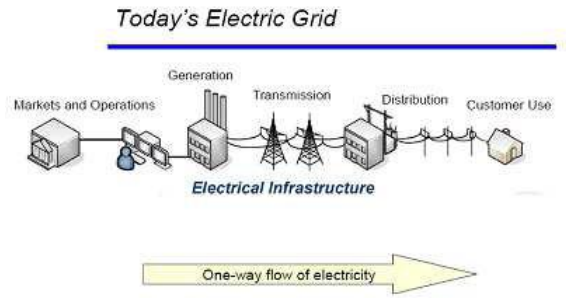

Figure 1- Today's Electric Grid

IEC is an international NGO and non-profit standard organization which sets and publishes global standards in the fields of electric, electronic, and related technologies such as electricity generation, transmission, and distribution, through Technical Committee (TC).

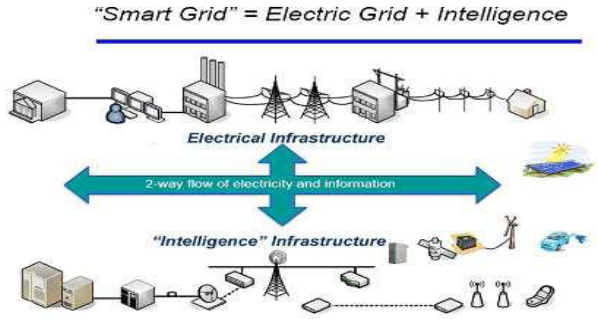

Figure 2- the architecture of electricity smart grid

At the end of 2008, IEC started to make a professional group for setting strategy in the field of smart grid. Its goal

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was producing and developing standard common models and protocols, in order to make an interaction and reciprocal functionality between the equipments in the smart grid and the ones in other systems; so some of technical committees got involved to this. While some of committees as TC8 had a glancing and general view to the system, others such as TC57 played a key role in this problem (figure 3). The aforementioned commission made a group of standards related to smart grid. These standards typically include IEC61850 which is about automation architecture of substations and IEC61970/61968 which is a Common Information Model and, used as a data to information converter.

NIST standard organization is a non-governmental body either and the majority of its activities is in the field of Transmission and Distribution (T&D) workgroups, Building to Grid (B2G), Home to Grid (H2G), and Industrial to Grid (I2G) connection and Cyber Security issues. Also NIST has signed a contract with EPRI for organization development and bilateral collaboration in order to set the smart grid architecture and roadmap and standardizing it [2].

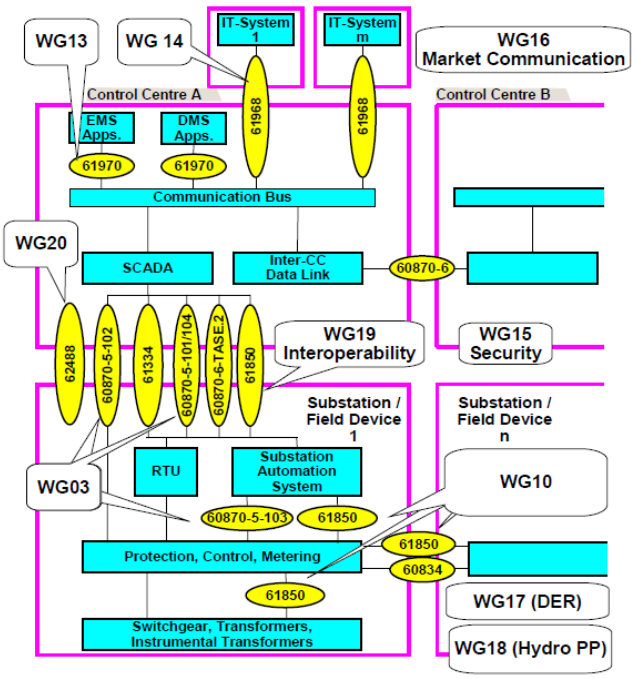

Figure 3- the relations between workgroups of TC57

Since the operations accomplished in the field of electrical measurement smart ultra-system and smart grid infrastructure are substantial priorities in both organizations, in this paper it is tried to analyze the existing standards in the above fields and eventually the future challenges of researches in order to modify and optimize them is cited.

2. SMART GRID INFRASTRUCTURE

Given that the AMI meter reader smart ultra-system is in fact an integration of meter reader and smart grid infrastructure, AMI suggests a system in which measurement, gathering, analyzing, and controlling the energy distribution and consumption is accomplished in a predetermined schedule or any time needed, with the help of advanced distribution automation equipments such as distribution network monitoring and controlling equipments, switching systems, generation/load cut off devices, electricity, gas or water meters or by several telecommunication medias.

This infrastructure includes hardware, communication, energy distribution systems, systems related to consumer, and Meter Data Management (MDM) applications.

The bilateral communication network between smart grid and measurement and reading equipments in one hand and financial-economical systems in the other hand make it possible to gather, distribute and broadcast information from/to consumers, suppliers, DisCos, service providers, electricity companies, etc., and this needs the cooperation between the beneficiary parties and offering appropriate solutions about demand response, appropriate services securement and/or additional generation (figure 4). [4]

Given that AMI has the responsibility to integrate the metering process and distribution networks management in a sole system, distribution network operators are capable of optimizing the network processes, so that smart grids as completely appropriate solution, gather information in the level of consumers, whom are electricity suppliers sometimes, by distribution network infrastructure and under specified contract profiles, and transmit them to the control center. This allows the distribution network operators to optimize key processes and provides new data and services for customers in both supplier and consumer sides, such as supplying electricity energy with higher quality for consumers increasing day by day. [5]

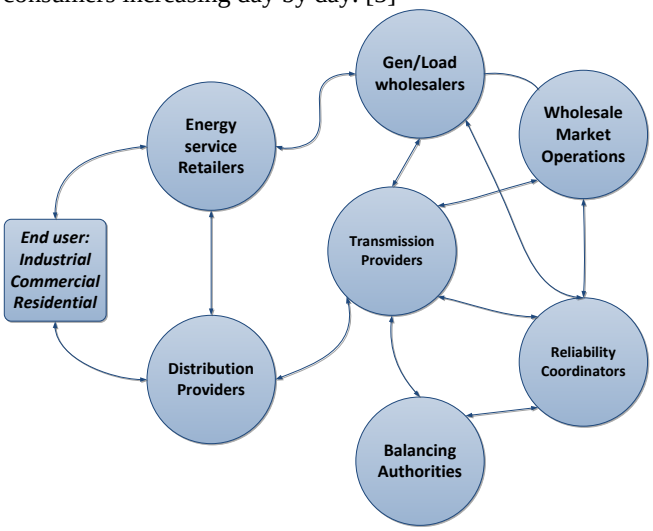

Figure 4- beneficiary parties in smart grid

2.1. Smart grid infrastructure requirements

Smart grid infrastructure has a special position, because as an interface system is placed between distribution network in one side and smart measurement systems, house automation, industrial automation, e-mobility and distributed energy resources in another side.

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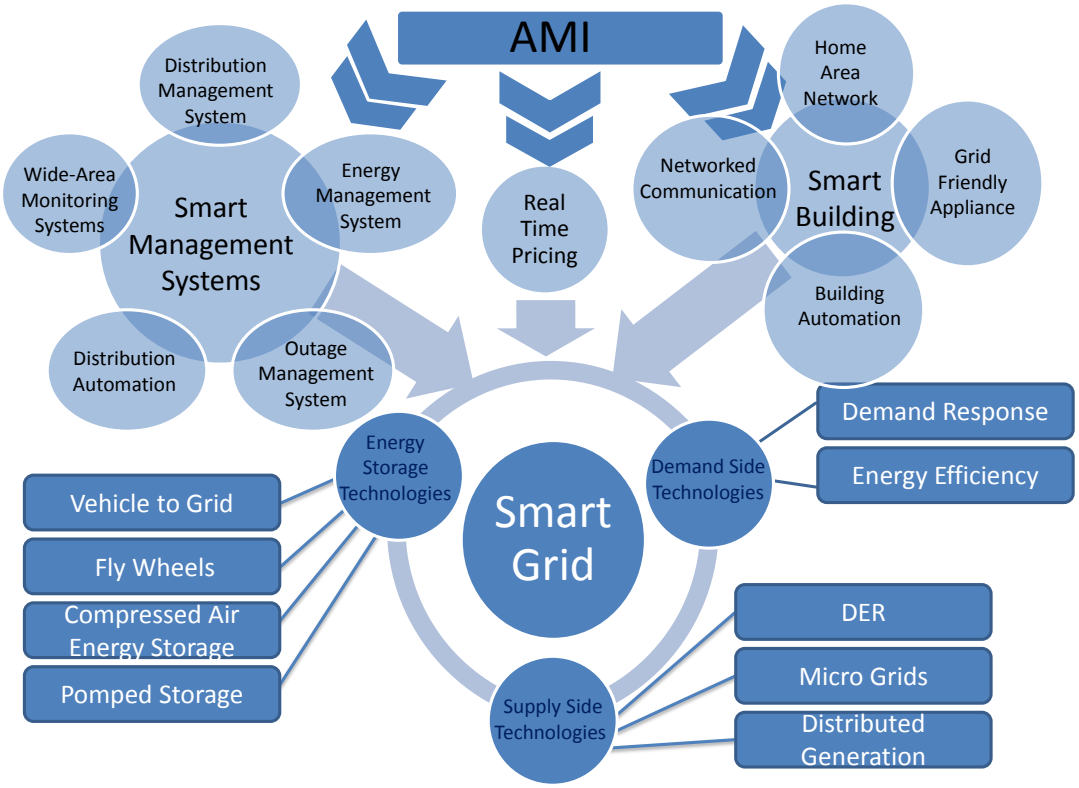

Figure 5- relationships in smart grid

It is crucial to consider following requirements in order to establish such a system: [6]

2.1.1. System requirements

Smart grid infrastructure has to own following functionalities:

- Distribution network monitoring,
- Power quality monitoring,
- Fraud detection,
- Load balancing,
- Response to demand functions,
- New financial-economical models,
- The capability to record and specify the available capacity,
- Minimizing electricity cut off time,
- Load/supply cut off,
- Energy resources control and management,
- Remote switching,
- Informing customers,
- Capital management.

Also it is crucial to consider electricity quality and security.

2.1.2. Generation requirements

The AMI system equipments and devices are required to have specified considerations such as accuracy, security, and reliability. They are noticed in the following.

✓ *Security [12]*

Cyber security implies to the issues related to observing information security and protecting private policies of customers and is a fundamental requirement of such systems.

✓ *Telecommunication requirements*

Telecommunication connection between different areas is one of crucial parts of smart grid infrastructure. The inputs and outputs of smart grid equipments are considered as interface between different areas of automation (such as commercial automation model, building automation, etc.).

The data models and protocols capable of supporting the functions of smart grid/metering in any area should be developed. [7]

2.2. Existing standards in the field of smart grid infrastructure

Existing standards in the field of smart grid infrastructure is as follows:

2.2.1. Generation standards

The generation standard list is as followed, description of each is cited in the quotation marks:

IEC/TR62051 "electrical measurement – terminology index"

IEC 61968-9 "integrating applications in electricity companies – system interfaces for distribution management – section 9: interfaces for meter reading and control"

2.2.2. Remote communication standards [8]

Each of remote communication methods has its own adherents and opponents. There is no specified solution which may be used in any condition, but some of its well-known methods are:

- Public Switched Telephone Network (PSTN),
- IEC/TR61334; distribution automation by PLC system,
- General Packet Radio Service (GPRS),
- Circuit Switched Data (CSD)/GSM

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- WiMAX according to the standard IEEE802.11
- IP

2.2.3. In-house telecommunication standards [9]

Considering many differences existing in various areas, some standards are utilized in relation to in-house telecommunication, which are as follows; description of each is cited in the quotation marks:

- ISO16484-5 "building automation and control system – section 5: data telecommunication protocol"
- ISO/IEC 14543-3 "information technology – Home Electronic System (HES) architecture"
- EN 13321 "data telecommunication in building automation in the open source format, building management and control, house systems and electronic buildings"
- EN50090 "Home and Building Electronic System (HBES)"
- EN50428 "home switches and installing similar electronic equipments – related peripheral equipments and switches for utilize in HBES"
- EN50491 "requirements and general conditions for HBES and Building Automation and Control System (BACS)"
- Chinese standard GB/Z 20965 "information technology – HES architecture"
- American standard ANSI/ASHRAE 134, BACnet "data telecommunication protocol for BACS"

2.2.4. Information security standards

Security in the electricity network level is explained comprehensively in the standard IEC62351.

2.2.5. Information related to price

The information related to the price should be available in any market levels (including DMS, EMS, and smart metering). The standard United Nations Electronic Data Interchange for Administration, Commerce and Transport (UN/EDIFACT) is mainly used for measurement and metering. UN/EDIFACT is an international standard for exchanging financial data. On this basis, related messages in the form of Metered Services Consumption Report Message (MSCONS) are defined in the form of information packets so that meter bill information could be exchanged.

EDIFACT/MSCONS focuses on automatic meter reading at present and it needs pricing information in wide scale and from other canals either in order to reach more elastic tariffs. A list of related standards is as follows, description of each cited in quotation marks:

- IEC/TR62325 "energy market telecommunication framework"
- IEC/TR62325-501 "energy market telecommunication framework – section 501: general guidance for using ebXML"

While the diversity of protocols and standards used in this section is much, the focus of using UML is on modeling; therefore implementation roadmap of pricing models is resulted by combining and integrating the common information model of IEC61970 and IEC61968.

2.2.6. Electromagnetic compatibility (EMC)

The list of related standards is as follows, description of each cited in quotation marks:

- IEC60870-2-1 "tele-control equipments and systems – section 2: operation conditions – part 1: electricity supply and electromagnetic compatibility"
- IEC61000-3-8 "EMC – section 3: scopes – part 8: signaling in low voltage electrical installation – rate of diffusion – frequency bands and rate of electromagnetic disruptions"
- CISPR22 "information technology devices – characteristics of radio disruption – measurement methods and scopes"

In producing European meters, the rate and amount of scopes are defined for many standard information transmission methods which include EMC, i.e. EN50470-1 "AC electrical measurement equipments – section 1: general requirements, test and its conditions – measurement equipments (classes A, B, and C)"

2.2.7. General standards

IEC61000-4-30 "EMC – section 4 – part 30: measurement techniques and test – power quality measurement methods"

2.2.8. Other standards

The list of related standards is as follows, description of each cited in quotation marks:

- EN1375-7 "telecommunication systems for remote reading of meters, physical layer and Metering-Bus (M-Bus) link"; It is a European standard for reading meter data and represents a bus system with serial communication. Nowadays M-Bus is developed to wireless case and can operate in 900 MHz frequency band, although it could be implemented in other information transmission Medias too. If M-Bus develops and expands in Europe, this standard could undertake the automatic reading of meter and telecommunicating between the meters of a residential complex.
- E-DIN43863-4IP "IP telemetric protocol"
- ANSI C 12.18 is an American comprehensive standard and used for automatic reading of meters. This standard cites the specifications of optically information transmission in local level, while C12.21 and ANSI C12.21 determine data transmission through modem and to telecommunication networks respectively.
- ANSI C12.19-1997 "the table about information of final industrial equipments of electricity suppliers"
- ANSI C12.21-2006 "protocol characteristics for telecommunication through telephone modem"
- ANSI C12.22 "protocol characteristics for an interface mediating to telecommunication networks"

2.3. Disadvantages of smart grid standards

The main flaw of AMI systems is presence of many parallel and even sometimes conflicting standards. If just considering IEC standards, existing protocols and Distribution Line Message Specification (DLMS)/COSEM information transmission standard focus on exchanging

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meters' information with AMR units and so the entire requirements presented by smart grid is not covered. This problem also includes functions such as supporting electricity quality, fraud detection, and load/supply cut off. Since these functions are in the scope of electricity automation therefore, a compatibility with DLMS/COSEM standards should be reached, which is not done yet. Moreover if various areas such as energy market, transmission and distribution, distributed energy resources, building, industry, and e-mobility are considered, a definition of common interface is needed, which is not supported by existing standards; and serious works have to be done in this field. [3]

3. SMART READING OF METER

Smart meters are a concrete and visible approach of ICT new infrastructure, developed recently by many countries around the world in order to promote the efficiency and quality of electrical energy.

Smart reading systems allow consumers and distribution network operators to play actively in electricity market and electrical systems respectively, sum of which forms electricity smart grid in fact.

Smart reading systems are in fact the lifeline of reaching customers to a new network and simultaneously more valuable services which has a sensitive and positive effect on electricity and energy demand, demand response/load management, and distributed energy resources combination and integration. These systems have many advantages for all the parties involved, which are as follows:

- For final consumers of energy: more appropriate bill, reduction in consumption and energy price through better information and informing enhancement, ease of change in electricity supplier.
- For meter reader companies and Distribution System Operators (DSO): reducing the cost of meter reading through remote information transmission.
- For electricity network operators: preparing the network for future through more appropriate information and controlling exercises.
- For energy suppliers: introducing new and customer-oriented services and decreasing customers' concerns.
- For governments: reaching the goals of energy saving and increasing the efficiency of free market operation.
- And society in general benefits from the efficient consume of energy and integration of distributed and renewable energy resources.

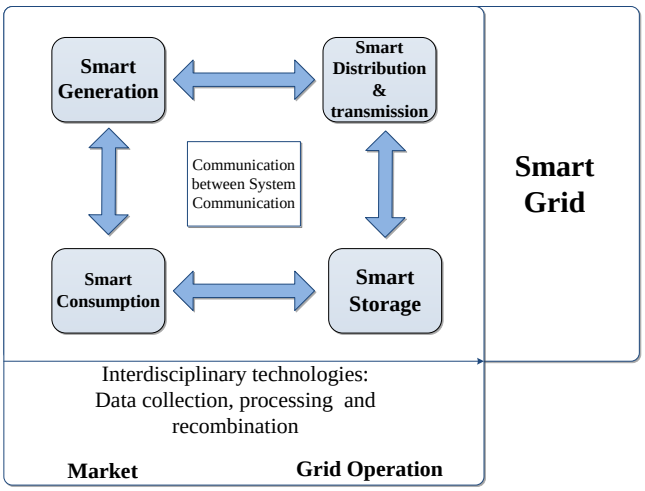

Figure 6- the communication between the players on the stage of smart grid.

Smart reading was a revolutionary development which changed power market methods and generation and distribution management dramatically. The concept of Automatic Meter Reading (AMR) has moved to multipurpose/multifunctional reading and AMI smart measurement ultra-system rapidly. Some of applications of the smart reading systems are as follows:

- Receiving information for issuing bill and other goals related to measurement and financial issues in the field of energy consumption and if any, energy generation;
- Gathering additional information about the operation of meter and network, including power quality and electricity cut off information;
- Sending the information about configuration to the final consumer of energy, including the parameters of the contract concluded, tariffs scheduling, information about price and operation, time synchronization, etc.;
- Supporting various options of payment and advanced tariffs;
- Remote electricity turn on/off, constraining load in a completely elastic manner in place and time mandated by system conditions.
- Communicating with in-house systems including home appliances and local electricity generation units, in order to reach the goals of load management, cost control, etc.

3.1. Requirements and considerations about smart reading systems [10]

Smart reading systems have to cover a complex set of below requirements:

- User-friendliness,
- Legal requirements about weights and amounts,
- Information security,
- Private policy observation,
- Capability of being open source and its elasticity,
- Economically efficiency,
- Interaction with other systems,
- Reliability.

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3.1.1. User-friendliness

Making the final energy consumer involved is in fact the basis of making practical the advantages of smart metering successfully. Therefore the above systems should deliver the accurate and related information to the consumer on time.

3.1.2. Legal requirements about weights and amounts

Smart metering, among all functions in the working area of smart grids, is the only issue being under control of the weights and amounts organization. The set of strict rules and regulations legislated by this organization about allowed level of errors, repetition capability, reliability, and protection against failure has to be observed.

3.1.3. Information security

Given that smart grids and their subsystems are implemented in general infrastructure and also open standards are very sensitive to security attacks, sufficient security policy and standard mechanism and algorithms should be adopted and implemented; because in the area of smart metering, manipulating meters, unauthorized access or falsifying bill, general data or validation data, unauthorized change in system configuration, illegal electricity connection or disconnection is much prevalent in the field of information security.

3.1.4. Private policy observation [12]

Now that each and any information gathered from meters could be useful, protecting the private policy of energy consumer should be given the utmost priority and uttermost attention, since if consumer believes that his/her private policy is in danger, smart metering will certainly fail.

3.1.5. Capability of being open source and its elasticity [14]

Although some of basic functions may remain unchanged trough years, a number of new needs will certainly emerge and telecommunication technologies will rapidly change and grow. Therefore smart metering systems should be based on standards that are compatible with open systems and architectures, so that these systems could support new needs and modern technologies.

3.1.6. Economically efficiency

Economical equations have direct relationship with purchasing price, installation and operation of smart metering systems. Therefore costs should be economic from the perspective of product price and the cost of installation and operation. In order to remain the price of the product low, giving more than enough capability to system should be avoided and using standard components, observing economic issues and utilizing various producers must be considered. Installation costs may be minimized by creating Plug & Play capability. For decreasing the costs related to operation of the system, some issues have great importance, such as lowering power consumption, structuring and transmitting information efficiently, remote updating and fault detecting and high reliability.

3.1.7. Interaction with other systems[13]

Data provided by smart metering systems is used in the entire smart grid and by all beneficiary parties; therefore these information should be presented so that they could be used in the entire system and be translated easily in the systems' boundaries.

Also smart metering systems should cooperate with each other and other systems in the smart grid. The best example of such systems could be local electricity generation systems associated with house automation.

3.1.8. Reliability

Reliability is a key factor in operation costs. The costs related to installing and inspecting the metering site could be as much as the cost of buying a new system. Therefore unreliable equipments could lead to failure of any economic or commercial system.

3.2. Existing standards in smart reading systems

The standards related to electrical measurement and load and tariff control is under the responsibility of IEC TC13 which will be mentioned in the following. [9]

3.2.1. Products' standards TC13/WG11

The list of related standards is as follows, description of each cited in quotation marks:

- IEC62052 sections 11, 21, and 31 (under codification), "(AC) electrical measurement equipments – general requirements, determining test characteristics and the conditions of mechanical and electrical test, weather, EMC, safety requirements and methods for testing meters, load and tariff control"

Note: section 11 covers electromechanical meters and has no relationship with smart metering.

- IEC62053 sections 21, 11, 52, 31, 24, 23, 22, and 61 "(AC) electrical measurement equipments – appropriative requirements which determines the requirements of typical test, testing methods for AC meters and also interface considerations for procuring power and pulse"
- IEC62054 sections 11 and 21 "(AC) electrical measurement – traffic and load control, determining the requirements for typical test and testing methods for load and tariff control equipments (timing switches and ripple control receivers)" These functions usually are integrated inside of meters.
- IEC62058 sections 21, 11, and 31 "(AC) electrical measurement equipments – inspection reception – determiner of requirements related to inspection reception, a crucial tool for guaranteeing quality in purchase process"

3.2.2. Payment systems' standards WG15

The series of standard IEC62055 (electrical measurement of payment systems) determines the functions, processes, information elements, unique characteristics of system and typical test interface, payment interface and the protocol of physical and applicable layers for one-way and two-way Token systems.

3.2.3. Reliability standards WG13

The series of standard IEC62059 "electrical measurement equipments – reliability"

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3.2.4. Standards related to information transmitting WG14

The series of standard IEC62056 "load and tariff electrical measurement" representative and determiner of information transmitting and also includes data model, messaging methods and protocols specialized for telecommunication medias.

This standard is as far as possible on the basis of internationally recognized telecommunication standards such as HDLC, ASN.1, OSI, FIPS, NIST, and Internet RFCs model. Some of these standards are on the basis of IEC61334 series i.e. "distribution automation systems using DLC". [11]

Although working areas of these standards are limited to electrical measurement, principles, and related solutions, they could be used for reading the meters of non-electrical companies too. For this reason they should be accepted by CEN TC294 and EN1375-1 standard references "telecommunication systems for meters and remote reading of meters, section 1: information transmitting"

3.2.5. DLMS/COSEM

The list of related standards is as follows, description of each cited in quotation marks:

DLMS/COSEM including data model, standard protocols for messaging and telecommunicating in order to transmit data on local ports, PSTN, GPRS, GSM, Internet and recently narrowband PLC.

DLMS/COSEM has a close relationship with IEC T13 WG14.

3.2.6. Data model and determining and identifying data identity

The standards related to this series are very vital, since they are in fact the master key to reach an interaction between the metering system (regardless of the type of the energy supplier, messaging method, or telecommunication media) and other systems. In this way, the same data of each meter could be resulted with same method, using DLMS services specified in IEC62056-53 standard.

The list of related standards is as follows, description of each cited in quotation marks:

- IEC62056-61 "electrical measurement – data exchange for meter reading, load and tariff control – section 61: Object Identification System (OBIS)" This standard provides an identification system for identifying clear data in any type including summary data, data related to the company or organization providing energy and etc. OBIS codes are to identify interface identity of COSEM and data on the meter screen and could be used in the entire system even until bill issuing step.
- IEC62056-62 "electrical measurement – data exchange for meter reading, load and tariff control – section 62: interface classes" This standard determines COSEM interface classes for modeling various functions of meter.

Nowadays these standards are supported by DLMS UA for use in smart metering and includes cases such as information security, load constraint, connect/disconnect, and exchanging information with other equipments which uses M-Bus (EN 13757 Part 2-5) and S-FSK PLC.

3.2.7. Messaging standards

The list of related standards is as follows, description of each cited in quotation marks:

IEC62056-53 "electrical measurement – data exchange for meter reading, load and tariff control – section 53: COSEM applicable layers". This standard determines the way in which DLMS messaging services reach the data modeled by COSEM components.

DLMS services are common for any interface classes and are independent of the lower layers (related to media).

Messaging services are on the basis of IEC61334-41 standard i.e. "distribution automation using DLC systems – section 41: applicable protocols for information transmission – messaging characteristics of distribution line", approved by TC57 group. COSEM applicable layers are the layers which are above any DLMS/COSEM protocol.

3.2.8. Protocols of network layers for PSTN/GSM

The list of related standards is as follows, description of each cited in quotation marks:

- IEC62056-42 "electrical measurement – data exchange for meter reading, load and tariff control – section 42: the services for physical layer and procedures for exchanging asynchronous information related to connection"
- IEC62056-46 "electrical measurement – data exchange for meter reading, load and tariff control – section 46: the layer for linking data using HDLC protocol"

3.2.9. Protocols of network layers for internet/GPRS

The list of related standards is as follows, description of each cited in quotation marks:

- IEC62056-47 "electrical measurement – data exchange for meter reading, load and tariff control – section 47: layers for COSEM transport". This standard leads to connection between COSEM applicable layer and UDP-IP Internet protocol.

3.2.10. Narrowband PLC

This protocol is based on bellow standards which are approved by IEC TC57 group. The list of related standards is as follows, description of each cited in quotation marks:

- IEC61334-4-32 "distribution automation using DLC systems – section 4: data exchange protocols – part 32: the layer for linking data – Logical Link Control (LLC)"
- IEC61334-4-511 "distribution automation using DLC systems – section 4-511: data exchange protocols – systems management, CIASE protocol". This standard has been recently developed by DLMS UA so that it could support Plug & Play installations.
- IEC61334-4-512 "distribution automation using DLC systems – section 4-511: data exchange protocols – systems management using 61334-5-1 protocol – Management Information Base (MIB) to DLMS/COSEM which has mapped by DLMS UA."

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- IEC61334-5-1 “distribution automation using DLC systems – section 5-1: the profiles of lower layers – S-FSK profile”. This standard determines physical layers and MAC.

3.2.11. Standards related to transmitting local information

The list of related standards is as follows, description of each cited in quotation marks:

- IEC62056-21 “electrical measurement – data exchange for meter reading, load and tariff control – section 21: direct exchange of local information (former IEC61107 standard)”. This standard determines information exchange by local optical and electrical ports, in which a new mode has been added for DLMS/COSEM switch.
- IEC62056-31 “electrical measurement – data exchange for meter reading, load and tariff control – section 31: using local networks on the pair of twisted wires”. This standard is modified now so that it could work with DLMS/COSEM.

3.2.12. Other standards based on DLMS IEC61334-4-41

These standards were the first ones in the area of information exchange according to DLMS, and still are utilized in some countries. The list of related standards is as follows, description of each cited in quotation marks:

- IEC/TS62056-41 “electrical measurement – data exchange for meter reading, load and tariff control – section 41: information exchange using Wide Area Networks (WAN): PSTN with LINK+ protocol”
- IEC/TS62056-51 “electrical measurement – data exchange for meter reading, load and tariff control – section 51: the protocols for applicable layers”
- IEC/TS62056-52 “electrical measurement – data exchange for meter reading, load and tariff control – section 52: DLMS telecommunication protocols”

3.3. The weaknesses of existing standards related to automatic reading

Currently, the IEC TC13 scope of operation is AC measurement of most applications in the field of commercial, industrial, and residential uses, but it has to develop so that it could support DC measurement and reading meters in mobile places such as trains and Pluggable Hybrid Electrical Vehicles (PEHVs) in participation of other related IEC TCs.

This development should cover all the aspects such as issues related to weights and amounts, protection, payment, reliability and information exchange.

Although WG11 standards cover bilateral measurement, they should be reanalyzed to assure that all the aspects related to local generation and their control are supported completely.

As mentioned above, IEC62056 DLMS/COSEM protocols of network layers have now been developed recently by DLMS UA in a close cooperation with IEC TCWG14 for smart metering. Therefore new cases should be added to the IEC contents related to standards either.

As a result of analyzing existing needs and with consideration of Open Meter Project and similar activities, new needs and requirements are identified. At this time, some of them are as follows:

- Prepaid metering,
- Information of customers,
- Pricing information,
- Controlling DGs,
- Linking to house automation.

Also modeling these functions should be added to COSEM model and OBIS.

In the field of telecommunication media, new telecommunication profiles that are suitable and useful for smart metering should be covered, such as PLC and wireless media.

The protocols should be optimized more in order to increase the operational power and decrease the telecommunication costs. This includes data compression algorithm, possibility and probability of involving serial reading and writing in a sole list of demands and etc.

Exchanging information between meters and measurement centers directly or by using concentrators (applicable for PLC and LP) is determined by DLCM/COSEM currently. Although these methods also could operate between concentrators and metering center, stronger technologies based on internet (such as XML and Web services) could be considered too. DLMS/COSEM specifies the message which is sent between the meter and metering center, but does not determine the way in which data is saved in metering center and the way data passes through the systems of other energy supplier companies and market systems. Moreover, the interface to in-house systems and to automation systems of house should be determined. [10]

4. CONCLUSION

Given the incremental development of smart grids in all over the world and considering the many advantages implementing of such systems comprises, our dear country Iran may not be an exception and we will observe implementation of such systems in country.

Since investment in this industry is long term and costly, producers, designers, and engineers who come to this area should comply with all the standards related.

Given that smart measurement ultra-system is an infrastructure and typically a prerequisite of smart grid, in this paper it is tried to cite and analyze prevalent standards in aforementioned fields and to describe the advantages and disadvantages of each and their route to evolution is stated. Two validated organization known as IEC and NIST are the leaders of this way, having made common workgroups in this issue. Considering that IEC has presented its activities in form of classification and with a familiar format in this filed, in this paper it is tried to base the work on IEC standards, and other references are mentioned where seemed necessary or activities to complete them have come in scene of the author. Eventually, the following results are gained:

PLC telecommunication is generally used in low voltage distribution network for supporting applications of smart

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metering. PLC network is usually managed by concentrators located in MV/LV transformer substations. Introducing smart grid topic, these concentrators may also operate as RTU for the automations in MV/LV substations. In this case it is crucial to make an interface between IEC61850 (substation automation) and IEC62056 (metering, tariff and load management), which unfortunately has not come to reality yet. Another important interface between smart grids and smart metering is the one that is on the basis of IEC61968-9 standard. Therefore it is also vital to forecast synchronization with other international standards as ZigBee.

Given that existing a simultaneous application of meters and smart grid is crucial, IEC61850 standard should develop so that it covers DLMS/COSEM components.

Various automation functions, meter automated reading and telecommunication systems should be integrated together in one of equipment interfaces of network (including meter and other AMI equipments).

In order to determine the share of commercial partners (for example share of smart home appliances and building automation systems and etc.), it is necessary to explain the amount of partnership in total system clearly.

It seems necessary to develop COSEM components model and DLMS-based protocol architecture in order to be compatible with new expectations and telecommunication modern technologies, while considering multipurpose measurement capability of energy.

Determining the way in which OBIS operates in the entire smart grid system and beyond any beneficiary party from the so-called meter-to-bill, should be completely clear.

PLC (or DLC) telecommunication is recognized as a main telecommunication technology for supporting smart grids. The IEC61334 existing standards on PLC should develop with the latest achievements in smart metering, as reflected in IEC62056 series of standards.

It is crucial to optimize the data volume of protocol in order for maximizing throughput (in any telecommunication media) and minimizing cost (general media), and more study and research is needed in this area.

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