IMPLEMENTATION OF AMR/AMM SYSTEM: RESULTS AND PLANS – ELEKTROPRIVREDA BIH

Elvisa BEĆIROVIĆ Mustafa MUSIĆ Suada PENAVA

Elektroprivreda BiH – Bosnia and Herzegovina

e.becirovic@elektroprivreda.ba m.music@elektroprivreda.ba s.penava@elektroprivreda.ba

ABSTRACT

Improvement of measurement system of electricity is considered to be extremely important factor in the process of liberalization and deregulation of electricity market and considerable attention in the relevant regulations should be given to this issue accordingly. This paper deals with the issues on introducing of AMR/AMM (Automated Meter Reading/Automated Meter Management) system in Power utility Elektroprivreda of Bosnia and Herzegovina.

This paper deals with the description of organization of measurement activities performed in Elektroprivreda BiH and its regulatory or legal framework. Complete organization of measurement activities in terms of electricity distribution or supply activities performed in power utility, will be influenced by regulatory provision with respect to the complete organization of electricity market.

Current Pilot projects of AMR/AMM implementation in three distribution branch offices are presented briefly and some results are given in second part of this paper.

Finally conclusions and areas for further research are presented.

INTRODUCTION

Since the lack of precise definition of smart metering concept many suppliers and companies use its own interpretation. Basically, three different concepts can be differentiated: Automated Meter Reading - AMR, Automated/Advanced Metering Infrastructure - AMI and Automated Meter Management - AMM. Distribution companies worldwide have introduced smart metering systems due to several different reasons. The three main motives to adopt smart metering are following needs: managing of peak demand, better theft detection and faster and more accurate billing [1]. Bosnia and Herzegovina has started process of liberalization of the electricity market that also includes smart metering related issues.

The term AMR/AMM is used in this paper to represent the system that enables collection, storing and processing of data on electric and other types of energy (heat, gas, water, etc.), and also management at the level of residential metering.

This paper deals with current status and future plans and regulatory framework on AMR/AMM implementation in power utility JP Elektroprivreda BiH (EPBiH), one of three power utilities in Bosnia and Herzegovina (B&H). EPBiH performs the activities of electricity generation, distribution and supply, based on license issued by Regulatory Commission for Electricity in Federation of Bosnia and Herzegovina (FERK) in December 2007.

Commitment to the introduction of AMR/AMM systems as an innovative technology in the area of accounting measurement of electricity is present in EPBiH for over a certain number of years. This is certified with some studies and analysis performed during previous period. Strategic investment plan of EPBiH also includes the plan for full implementation of AMR/AMM system in future.

Nevertheless, there were no significant activities about AMR/AMM implementation despite the affirmative attitude in EPBiH. Main reason for this is the financial aspect of such investment project.

REGULATORY FRAMEWORK FOR ELECTRICITY METERING IN BOSNIA AND HERZEGOVINA

Improvement of electricity metering is considered to be an issue that is relevant for the development of a competitive energy market during liberalization process and thus it represents an important focus of interest in relevant regulatory policy framework.

In Bosnia and Herzegovina, certain regulatory acts that consider metering organization structure in an electricity utility were delievered by policy makers. For example, in [2] it is stated that „Remote reading of electricity meters should commence as soon as possible since it is a precondition for full implementation of the Market Rules as to make the balancing market fully functioning", as one of necessary condition for electricity market establishment. Since it is also stated that "Work out correct load profiles for different customer groups in order to further develop tariff methodologies" [2], this should be performed with modern AMR/AMM system and progressive analysis on electricity data consumption.

Even in case of changes in plan schedule of electricity market opening for B&H [3] these obligations for precondition preparation still remain valid.

As far as regulatory policy of European Union, new rules strengthening the internal energy market are the most recent documet published in June 2009 as a package of rules and directives. This package also contains new Electricity Directive *2009/72/EC* replacing Directive 2003/54/EC that relates to common rules on energy markets. In [2] in part that relates to measures on consumer protection it is stated: „ Member States shall ensure the implementation of intelligent metering systems that shall assist the active participation of consumers in the electricity supply market. "In this document it is

stated that the introduction of intelligent metering systems should be based on an economic assessment and that the results of economic assessment should be used in order to make further decisions.
As it is stated, where roll-out of smart meters is assessed positively, at least 80 % of consumers shall be equipped with intelligent metering systems by 2020 in EU Member States.
Since overall efforts to adopt the best practice from EU and to fulfil the commitments undertaken by BiH by signing international agreements (Energy Community Treaty, Stabilization and Association Agreement, etc.) the obvious and official attitude in EPBiH is that certain strategic regulatory documents are needed.
The role of Regulatory Commission for Electricity in Federation of Bosnia and Herzegovina (FERK) as relevant authority is very important in process of introduction of AMR/AMM systems. This is due to the fact that regulatory agency has possibility to accelerate this process in a whole by applying certain incentives or by defining the obligation of so-called "smart metering".
In EPBiH the organization model of metering activitiy holds the basics in regulated model of metering with the ownership of meters and data collection and analysis on network opreator's side and with regulated prices for customers. Due to this fact, it is necessary to initiate cooperation activities on AMR/AMM system introduction between FERK, EPBiH and other interested parties in future.

CURRENT STATUS OF AMR/AMM SYSTEM IN ELEKTROPRIVREDA B&H

In principle, a commitment to AMR/AMM system introduction as an innovative technology is present in EPBiH already for a certain number of years. On behalf of this, certain reserach activities were undertaken i.e study research [4] was performed during 2004. Recommendations and conclusions from this Study celarly indicated the need to continue the activities on AMR/AMM system introduction.
Sveral internal company analysis were performed regarding the metering issues in EPBiH. Figure 1. shows the age structure for meters in EPBiH. Unfavourable age structure of the electricity meters is constant problem that is solved by purchasing and installing a new meters.

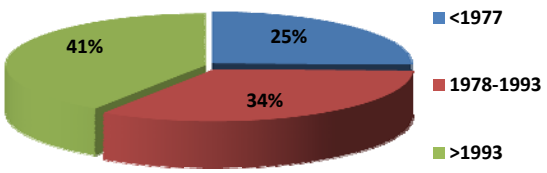

Figure 1. Current age structure for electricity meters in EPBiH

Affirmative attitude on AMR/AMM system introduction was clearly stated in General Conditions of Electricity Supply [5] and following documents i.e Rule on Metering Point of End Customer [6]. In [6] it is stated the obligatory function for all customers except residential customers but for them this is not a mandatory decision and also can be an option. Also, an internal document of EPBiH „Technical recommendation for electricity meters in EPBiH – TP 22"[7] clearly defined the recommendation of usage of electronic meters with possiblity of AMR/AMM integration. All meters that are being installed now in EPBiH distribution network are electronic meters ready for AMR/AMM integration.
Typical structure of AMR/AMM systems that is planned in EPBiH is shown on Figure 2.

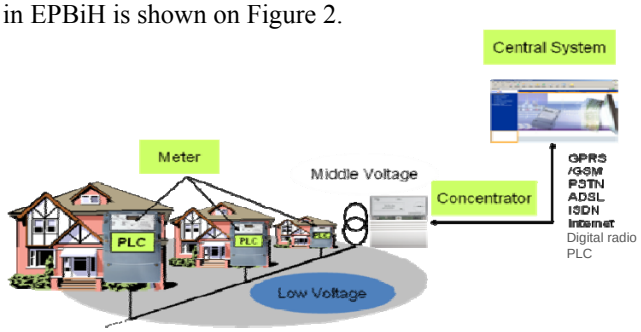

Figure 2. Typical planned structure of AMR/AMM in EPBiH

Despite the obvious positive attitude towards the introduction of this advanced technology to the intensive introduction of AMR/AMM systems in EPBiH to this date this has not yet occurred. The reasons for this are various and one of them is certainly the lack of relevant decisions from the management level that would generally confirmed the commitment of EPBiH to enter into a complex and long-term project like this.

Pilot projects: Implementation of AMR/AMM system in EPBiH

In EPBiH, few pilot projects were performed and some are still enrolling [8].
In 2006, a first pilot project for remote reading of electricity meters was started in distribution branch office Sarajevo – ED Sarajevo. The scope of this project was 41 meters for residential customers. This project is realized with Iskraemeco. In spite of positive results, but due to financial reasons, this project was continued in 2009. The scope of this project in total was 839 meters (single-phase and poly-phase meters, and control meters in substations) and 16 meters on exchange points between distribution branch offices or other utilities, and 3 industrial customers.
Depending on communication channel from data concentrator DC to AMM centre, four different groups can be identified (Figure 3), sorted from largest to smallest share:

- Digital radio

- GSM
- PSTN
- Fibre-optic

This share is the result of geographical position and bad connection possibilities of chosen locations for implementation of AMR/AMM.

In this project, periodical readings of meters are performed. Billing data and load profile data are read periodically. Reading frequency depending on communication channel was different for different data and locations.

Main result of this pilot project was the confirmation for usage of digital radio modems for AMR/AMM system purposes. Current digital radio system in ED Sarajevo is primarily used for remote monitoring and controlling of transformer substations and switch disconnectors. According to the results on communication performances, no type of communication can be stated as the most favourable.

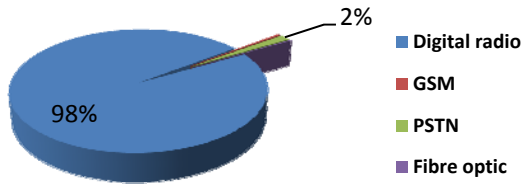

Figure 3. Meter structure according to communication channel – pilot project ED Sarajevo

Second pilot project was implemented in distribution branch office ED Zenica, during 2009. The scope of this project was the implementation of Landis+Gyr meters with total 106 meters installed on five different locations for different categories of customers. PLC is used for communication between meters and data concentrators and GSM communication channel is used for communication between DC's and AMR/AMM centre.

Characteristic aims of this pilot project were to analyze the performances of these meters and performances of GSM communication.

Preliminary report of this pilot project showed very good performances of this AMR/AMM system based on Landis+Gyr meters. Metering data were also used for certain analysis i.e. distribution losses analysis and also for the outage statistic analysis. Since in EPBiH, the SCADA system is not in used in all parts of distribution network and outage statistic is made based on network operator report – so called "Book of events", this system was used to analyze the possible benefits for the total network operation process.

Results of active energy distribution loss analysis are presented in Table 1 for one location in Zenica - a residential building with 50 meters (26.09.-28.10.2010.).

Table 1. Example of results for distribution losses analysis with AMR/AMM data

Item	Description	Total active energy (kWh)
1	Sum of total active energy by meters	7.314,51
2	Total active energy by control meters in substation	7.395,85
3	Active energy losses (kWh)	81,34
4	Active energy losses (%)	1,1

Third pilot project that is still enrolling in final stage is a small pilot project with Echelon meters in distribution branch office ED Tuzla. The scope of this project was the usage of only 20 meters for residential customers. Communication link between electricity meters and data concentrator is narrowband PLC (via LV distribution network) and communication link between the data concentrator and the AMM center is GPRS that is used in EPBiH for the first time for such purposes. There were certain problems regarding the implementation of this pilot project because of telecom provider and the possibility to use the GPRS for such purposes. Our telecom operator had some problems about this type of service for power utility, but first problems were successfully solved during this project.

Final report on this pilot project will also be prepared consequently.

Current project is the project with the largest scope so far in EPBiH in both geography and quantity manner. It is a project that covers all five distribution branch offices with total number of 1.747 meters. Partner of this project is Iskraemeco B&H and also meters from Landis+Gyr will also be used in one part. Communication from meters to DC's will be a broadband PLC and digital radio modems and EPBiH WAN will be used for connection between DCs and AMM centre.

In this project, the AMR/AMM system will be fully integrated with our billing application. Also, the system will be used to analyze the performances of DC when two different types of meters are connected to the same DC.

Installation phase is finished on all locations until now and currently the complete system is in a trial operation phase, until March 2011.

Further term plans for AMR/AMM system implementation in Elektroprivreda B&H

According to current metering organization, a classification of metering categories is defined in order to prepare the proposal of term plan for AMR/AMM system implementation in EPBiH. This classification is presented in Table 2.

Table 2. Metering categories for AMR/AMM implementation

Metering category	Description
I	Metering points between EPBiH and other utilities and distributed generation metering
II	Metering of MV customers
III	Metering of LV customers > 23 kW (Non-residential customers)
IV	Metering of LV customers ≤ 23 kW (Residential and non-residential customers)

These categories are sorted by ascending order that is defined in accordance with priority list in proposed term plan for AMR/AMM system implementation. Priority list was made based on the importance of metering point in distribution network, actually based on benefits that could be obtained by preparing implementing the AMR/AMM meters on metering points.

On the basis of the expected increase in the number of customers and the assumptions for electricity meters to be in AMR/AMM system until 2020 - 100% of metering categories I, II and III and 80% of metering category IV, the evaluation of the number of existing meters that need to be replaced by electronic meters is made. Results are shown graphically on Figure 4.

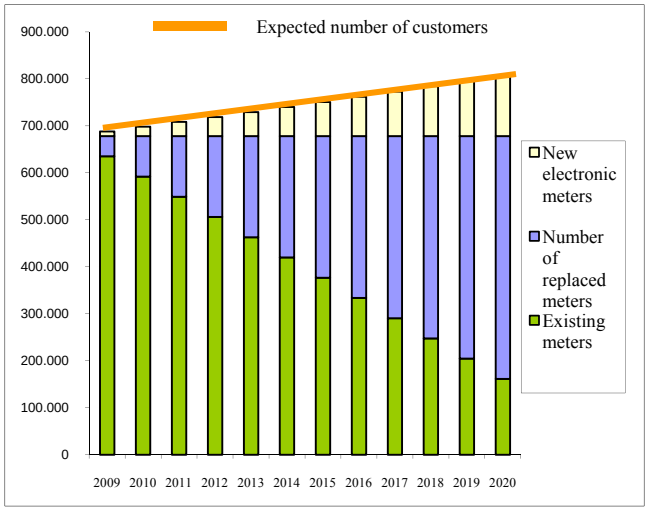

Figure 4. Results of assessment for implementation of AMR/AMM system with specified targets until 2020

Final decision on dynamics of AMR/AMM implementation is still not made by relevant management structure in EPBiH, since it requires large portion of own financial investments and thus requires a full cooperation with relevant structures in total energy sector i.e FERK.

CONCLUSION

Application of intelligent systems for electricity metering is one of the most important prerequisites for improving the efficiency of electricity usage and also for the liberalization of energy markets. Such leaves no alternative to B&H, actually to EPBiH, in terms of general orientations for AMR/AMM system. Final decisions about priorities and the dynamics of the realization must be made as soon as possible from the relevant management level of the company. In addition to roles in setting any requirements for mandatory application of AMR/AMM system for some categories of customers and giving incentives to customers through flexible tariff system, the importance of engagement of FERK for EPBiH would be adequate regarding the financial aspect which is inevitably the most important fact in such project. This is the reason for the authors' finding that the role of mandatory regulatory agency is very important and for the invitation for active cooperation in this field.

The fact that is also very interesting in EPBiH is that the future AMR/AMM system will be a first step towards smart network concept, prior to SCADA/DMS system. Alongside this project, SCADA/DMS project will be implemented also in distribution network of EPBiH until 2013. This would make significant changes on distribution network operating concept in future in EPBiH.

REFERENCES

[1] L. Keränen, *"Usefulness of AMR data in the network operation"*, Master thesis - Tampere University of technology Finland, 5-20

[2] Official Journal of the European Union, 2009, *Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC,* L211/55-93

[3] Decision on scope, conditions and time schedule of electricity market opening in B&H, 2009, State electricity regulatory commission SERC

[4] Group of authors, 2004, *Possiblity for application of automatized reading of meters and optimal solution selection – in Bosnian,* Faculty of Electrical Engineering, Sarajevo, Bosnia and Herzegovina (in Bosnian)

[5] General Conditions of Electricity Supply, 2009, Regulatory Commission for Electricity in Federation of Bosnia and Herzegovina (in Bosnian)

[6] Rule on Metering Point of End Customer, 2010, Elektroprivreda BiH, Sarajevo (in Bosnian)

[7] Technical recommendation for electricity meters in EPBiH – TP 22, 2009, Elektroprivreda BiH, Sarajevo (in Bosnian)

[8] Documentation of EPBiH on Pilot projects for AMR/AMM systems, 2008 – 2010 (in Bosnian)