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SMART METERING IN POLAND - IMPLEMENTATION STUDY

EXECUTIVE SUMMARY OF THE DOCUMENT FROM MAY 6TH, 2010

Commissioner: **Polish Electricity Transmission and Distribution Association (PTPiREE)**
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This document constitutes the executive summary of the elaboration "The study of the implementation of the smart metering in Poland" and should be studied and analyzed alongside with the main document, since conclusions drawn basing on parts of the document may be wrong.

The study does not account for the analysis of the profitability of the implementation of AMI in Poland, which is required by the Directive 2009/72/EU to be completed by September 3rd 2012.

Solutions presented in this study refer to energy consumers from tariff group G and C1 connected to the LV network. The study presents problems of smart metering systems implemented on the DSO level, while issues referring to the metering data exchange on the national level are discussed in another elaboration prepared by PSE Operator.

1. THE AIM OF THE IMPLEMENTATION OF SMART METERING

The basic assumption made for this study is that the main purpose of AMI implementation in Poland **is meeting the EU directives' requirements at the lowest possible social cost.**

According to EU directives each member country is obliged to carry out, by September 3rd, 2012, the economic analysis of the AMI implementation. The analysis should include the evaluation of all long - term costs and benefits concerning both the market and the individual consumer as well as the evaluation presenting the most economically justifiable and profitable form of smart metering and the time, within which the implementation is feasible.

Basing on analysis, the Ministry of Economy in cooperation with Energy Regulatory Office (URE in Polish) should define measurable and precise targets of the implementation of smart metering in Poland.

2. THE CONCEPT OF THE NATIONAL SMART METERING SYSTEM

This study focuses on the problems of the implementation of smart metering systems in Distribution Systems Operators and does not define the organization of metering data exchange on the national level.

The concept of the establishment of the national metering data repository (MDR), as a subject separated from the DSO, being controlled by the Energy Market Regulator, influences exclusively the results of legal analysis presented in this study, and has no influence on other areas.

Under national conditions more concepts of smart metering systems may be formulated. It results from the complexity and multilevel structure of the smart metering implementation project and the number of engaged stakeholders. General SWOT analysis for 4 sample scenarios of smart metering system implementation has been presented in the full version of the study.

The crucial aspect of AMI implementation is the adjustment of the future concept of smart metering system (market model) to the country specific features. Each country implementing AMI has selected a different solution that was the most suitable for its national conditions.

International experience and 2009/72 UE Directive Regulations prove that, while choosing the smart metering system concept, a precise analysis of costs and benefits for various smart metering system concepts should be carried out.

Key issues regarding the national metering system implementation:

- The access to metering data and enabling information and messages to be dispatched to all entitled users (i.e. vendors, TSO, producers, URE, Central Statistical Office (GUS) etc.).
- Integration of central IT systems created within the structures of the DSOs, which are the source of metering data of individual users.
- Providing data security both within data access, data storage and data transfer between entitled parties.
- Implementation of the communication quality requirements referring to AMI systems' and communication subsystems' suppliers.
- Providing standards for data exchange at appropriate levels of national metering system.

Detailed considerations concerning the national metering system have been included in the chapter 3 of the study.

3. BENEFITS AND BENEFICIARIES OF THE SMART METERING IMPLEMENTATION

In chapter 4 a list of potential beneficiaries of AMI implementation in Poland has been presented together with the benefits that they could obtain.

Alongside with the DSOs, retail sales companies, final customers, Transmission System Operator, electricity producers, Energy Regulatory Office, AMI technology suppliers, telecom operators and research & development institutes will also benefit from the implementation of the smart metering.

From the DSO point of view the most important benefits of AMI implementation are:

- The provision of tools to enable the reduction of network losses,
- The reduction of costs of all operations on customers' meters (including meter reading),
- The decrease of the customer service costs,
- The chance to deploy statistical legalization which results in the decrease of costs of electricity meters legalization,
- The higher quality of power supply,
- The optimization of planning of the network repairs and investments,
- The provision of the appropriate system functionality on the customers' side.

AMI implementation benefits for the rest of beneficiaries are mostly indirect and depend on the changes in the energy consumers' behavior. This in turn needs inter alia:

- Changes within energy trading market, including the electricity market liberalization for LV customers (tariff group G),
- The increase of customers' awareness as without proper customers' education they will oppose AMI taking into consideration only higher bills for energy consumption covering the implementation costs.

Besides, the attention should be paid to the fact that with current methods of defining distribution tariffs, benefits gained by the DSOs will actually be partially transferred to the customer through the distribution fees decrease.

4. FUNCTIONAL AND TECHNICAL REQUIREMENTS FOR AMI SYSTEMS

Certain functions of AMI systems can be executed either on the electricity meters level or on IT systems level. While analyzing functional requirements of AMI systems, meter functions should be defined in such a way that certain AMI system functions could be executed outside the meter, for example within DSO, TSO or electric power producers IT systems. Such functions as grouping the amounts of consumed energy according to the time of use, introducing power limits for consumers or having consumers billed through prepayment may be taken into consideration.

Electricity meter functions required in AMI systems installed all over the country should be defined before widespread implementation of AMI systems is executed. Sets of functions divided into the following groups: basic functions, additional functions, optional functions have been presented in this study.

- **Basic functions** – these are the functions, which thanks to widespread implementation in all electricity meters should guarantee the achievement of the main targets of AMI systems implementation. The basic functions group consists, among others, of: registration of daily energy consumption hourly profiles and maximum, 15-minute daily power consumption, remote consumer switch off or power consumption reduction, event logging enabling quick response to power outages or the attempts of illegal consumption. Another aspect of defining basic functions may be the possibility (necessity) of financing the electricity meters with basic features through tariff solutions (distribution tariff).
- **Additional functions** – these are the functions that are not necessary, but may be considered useful and necessary for the implementation, which expand the electricity meters functionality with the communication modules useful in the implementation of a “smart grid“ concept. Electricity meters would eventually function as a data concentrator for other media meters (gas, water, heat) and would enable household devices operation control. In the future these functions may be compulsory in all meters. The implementation of these functions may depend on the financing possibilities through tariff solutions or by entities other than DSOs (vendors, recipients, other media suppliers).
- **Optional functions –** these are the functions**,** which do not need to be applied in all electricity meters, i.e. reactive energy measurement, bidirectional energy measurement for dispersed generation.

The chapter 5.3 of the study includes detailed analysis of functional requirements.

Conclusions concerning the standardization of technological solutions in AMI systems

1. Both foreign and domestic experiences prove that the dominant communication technology deployed in the relation: electricity meters – data concentrator is PLC transmission technology, using electric power network as a communication medium. The use of MV electric power network for data transmission in relation: data concentrator/rooter – metering data collection system, may make DSOs independent from the cellular operators’ services.
2. Preferable communication solution between metering data collection system and data concentrators (if such data concentrators are incorporated) is using GPRS service available in GSM cellular networks. Such solution is commonly used in AMI system already deployed in

Europe. Incorporation of other wireless and wireline communication solutions based on trunked radio systems, WiFi, WiMax, PSTN, LAN /WAN is also acceptable.

3. Taking cost-effectiveness into consideration, it seems necessary to deploy a solution enabling the creation of free competitiveness for individual suppliers within each DSO area, which can be achieved by the implementation of technical standards. Meeting these standards enables the exchange of system elements (electricity meters, data concentrators) delivered by various suppliers and at the same time contributing to the DSOs being independent from one supplier.

   Present communication standards concerning the exchange of information on various levels (interfaces) of AMI system are described in the chapter 5.5 of the study in general thus in each technical solution a standard of the implementation must always be defined. Interoperability of devices supplied by various producers will be possible provided both solutions correspond with the description of the standard implementation.
4. Application of the DLMS/COSEM standard for data transmission between the meter and the metering data collection system may be an example. Assuming that the communication medium (a power network for example) may enable the method of communication forced by this standard, its implementation will always be connected with the need to develop the implementation description that would be followed by the device suppliers.
5. Solution standardization at certain interface is not always beneficial also from technical point of view. Business dedicated solutions may be much better adjusted to existing information exchange technology and thus cheaper and safer. For example, while using the DLMS/COSEM standard for data transfer between the electricity meter and the metering data collection system each daily reading of load profile is burdened with data relating to the use of the protocol itself, which considerably extends the useful information volume.
6. The necessity of information exchange standardization in AMI system between the metering data collection systems and the MDM system as well as between MDM system and external applications cannot be disputed. The amount of transferred data is determined by the selected standard of recording the information (usually a file). Preliminary analysis of expected communication traffic connected with the exchange of the metering data between computer systems using WAN/LAN network proves that the data transfer will not be disturbed.

5. LEGAL ASPECTS OF THE AMI IMPLEMENTATION

- With current legal status basic regulations referring to the implementation of AMI system are defined in Directive 2009/72/EU and Directive 2006/32/EU connecting the implementation program of AMI directly with the power efficiency promotion, the power consumption optimization and the enhancement of the electricity retail market.
- These regulations **do not introduce the obligation of the AMI implementation with respect to all consumer categories.** Firstly, the decision to implement AMI should depend on the results of economic analysis and existing technical possibilities. According to Directive 2009/72EU such analysis should be carried out by the member states of EU **by September 3rd 2012**. Secondly, Directive 2009/72/EU introduces guaranties exclusively with respect to consumers, which in general means individual household consumers.
- The regulations of both directives have not been implemented in national legal regulations. The work on the delayed implementation of Directive 2006/32/EU is in progress. Directive 2009/72/EU should be implemented before March 3rd 2011.

- The only document, dealing with AMI implementation in Poland is Energy Policy, though it does not impose any mandatory law.

Complete analysis of legal aspects of AMI implementation is included in the Chapter 6 of the study.

6. IMPLEMENTATION OF SMART METERING SYSTEMS AND POWER INDUSTRY REGULATIONS

To provide effective implementation of AMI systems it is necessary to solve a number of regulatory issues. Detailed analysis of these issues has been presented in the Chapter 7 of the study. The following issues should be considered as the most essential.

- The provision of stable rules of the DSO tariff valuation with the need to incur significant expenditure connected with the AMI implementation by these operators,
- Methods of including the AMI implementation expenditures in the development plans, along with the verification method of the level of expenditure incurred by the DSOs and the benchmark calculation method for development plans verification,
- The necessity to develop the guidelines for AMI depreciation method, which is to be prepared by the Regulator in order to provide accounting consistency relating to the capital expenditures across the country,
- Defining the method of the gradual elimination of the costs of traditional readings, which are currently included in the DSO tariff and will be eliminated after the AMI implementation has been completed,
- The development of the AMI operational costs efficiency evaluation mechanism, that will be incurred after the implementation of these systems has been completed,
- The change of the way of billing the network charges and the identification of the connection power with the contractual power, which aims at providing the DSOs with the possibility to connect the new consumers without any necessary investments after the reduction of contractual power by the existing consumers,
- The change in the excess power capacity accounting and reactive power consumption accounting above the levels agreed within the contract (extension of the calculation of excess consumption to the whole C1 group and when justified G group),
- The development and implementation of stimulus control system based on power supply quality indicators after the AMI systems implementation,
- The solution of the problem of traditional electricity meters' stranded costs.

The risk of "pushing out" the expenditure on modernization and reconstruction of the distribution network from the development plan by the planned expenditure on the implementation of the AMI system poses a significant problem. Taking into consideration this risk, as well as the minimization of one-off (single) increase of rates of distribution fees for customers, a longer schedule of implementation or an amendment to the regulations (separation of cash flow resulting from tariff rates from the rate of return on investment – IRR or NPV) seem to be the recommended solution.

7. ARRANGEMENTS DURING THE TRANSITIONAL PERIOD

A transitional period is a period in which not all customers will be equipped with smart metering devices.

The most significant legal-regulatory problem that must be solved within transitional period is the distribution tariff valuation algorithm.

The recommended solution is that all consumers participate equally in costs connected with the smart metering, regardless of the type of metering system they use. This will help avoid rapid increase of network tariffs. Detailed analysis of this issue is presented in the chapter 8.1 of the study.

Assumed condition of the aim of implementing the AMI system, i.e. a minimization of the social costs of implementation, will be possible, provided the consumers start to gain profit of the implementation as soon as possible. The consumers will be able to take the advantage of modern fare (price lists) that will be offered by retail sales companies to customers using smart meters. To provide the above, the DSOs must implement IT system equipped with an interface appropriate for vendors' software systems or for metering data collection systems.

The most important issues from AMI implementation organization and logistics point of view has been presented in the chapter 8.2.

- The necessity of optimization of DSO business processes for future use of AMI systems and coordination of this optimization with AMI implementation. This is a precondition for gaining any profits from the AMI implementation executed by the DSOs.
- Accurate planning of human resources. Within the period of the smart metering system implementation, average number of meters installed annually will be by 1,3 mln meters higher than it is done presently, which means about 500 electricians and about 100 administration workers more in comparison to current employment. Besides, new qualifications will be necessary due to the increased demand for software programmers and the decreased demand for electricians and metering data collectors. Each DSO, within the smart metering implementation planning, is recommended to carry out the inventory of present human resources and their qualifications, to plan any necessary professional trainings.
- Planning the method of utilization of the unnecessary meters (during the years of the implementation about 23 000 meters will have to be scrapped throughout the country on a weekly basis).

8. ESTIMATION OF THE SMART METERING IMPLEMENTATION INVESTMENT IN POLAND AND ITS PROPOSED ALLOCATION

Pricing assumptions for this study have been defined basing on the budget offers received from the AMI systems suppliers. Actual prices, established as a result of the auctions, may differ significantly from prices assumed for this analysis. These differences may result from the fact that the budget offer was not binding for the suppliers and various meters' functionality or the increased demand for AMI systems resulting from numerous parallel implementations in EU countries.

Table1 Expenditure on AMI systems per unit

Investment on AMI - Prices 2010	unit	Optimistic scenario	Pessimistic scenario
Meter price	[PLN/metering point]	288	338
Installation of meters & auxiliary devices	[PLN/metering point]	60	100
Routers/concentrators	[PLN/unit]	800	1 200
Metering data collection system	[k PLN/m metering points]	2 000	4 000
MDM system	[k PLN/system]	30 000	60 000

Three model schedules of smart metering system implementation have been considered in the analysis.

- Basic Schedule – 8 years
- Shortened Schedule – 6 years
- Extended Schedule – 10 years

Global investment in constant prices for the year 2010 were estimated to be about 7,8 billion PLN in an optimistic scenario and about 10,2 billion PLN in a pessimistic scenario.

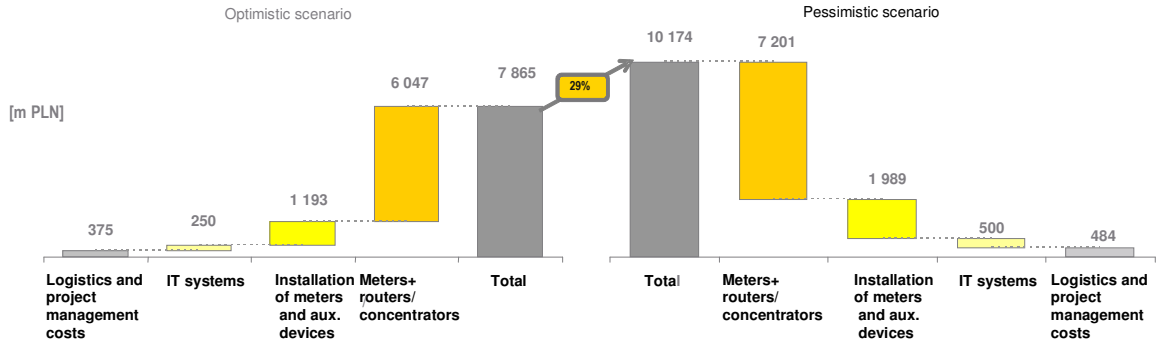

Figure1 Global investment on AMI implementation divided into most important cost categories [m PLN]

Global investment on one metering point is estimated to vary from **about 400 PLN in an optimistic scenario to about 520 PLN in a pessimistic one.**

Compared to other European countries, where the investment on one metering point amounts to 280 PLN in Italy, 660 PLN in Portugal or 740 PLN in Great Britain, 852 PLN in the USA and finally 872 PLN in Sweden, estimated expenditure on one metering point in Poland is lower, which results from a different range of AMI system functionality, a different communication technology and lower labor costs in Poland.

Cost estimation presented in this study should be verified by the implementation of a pilot system covering the appropriate number of consumers, minimum 30-50 thousand metering points.

Figure 2 presents the simulation of the influence of the smart metering implementation on the development plan. As mentioned before, such significant increase of expenditure is connected with the risk of "pushing out" investments in the distribution network.

Paradoxically, random, unconsidered way of the AMI implementation may result in the decrease of the supply quality instead of its increase.

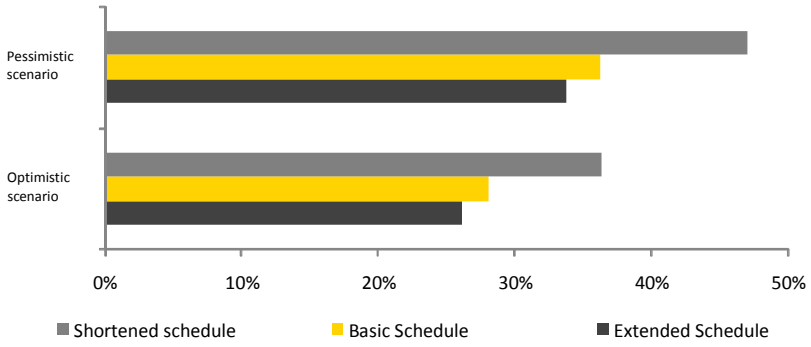

Figure 2 The implementation of AMI impact on annual expenditure in the development plan (percents)

Distribution service fees for consumer connected to LV network after completing AMI implementation may increase from about 12% (optimistic scenario) to about 16% (pessimistic scenario) compared to present value.

If estimated regulated revenue growth caused by the implementation of AMI was compared to total regulated revenue, the increase would amount to **about 8%** (optimistic scenario) and **10,5%** (pessimistic scenario).

Eight year period of electronic meters legalization is assumed. Furthermore, additional, potential DSO revenues achieved after AMI implementation, which will be reducing the valuation of distribution rates, and the possibility of financing the part of AMI investments from EU support funds were not considered.

Taking into consideration the limits of the distribution fees increase, it is recommended to extend the legalization period of electronic meters, implement statistical legalization, partially finance the implementation with support funds and create the regulatory framework enabling additional DSO services, which they will be able to provide after the smart metering system implementation.

The extension of the legalization period of electronic meters up to 15 years will result in the mitigation of the distribution prices increase by about 20% compared to the price level given above (i.e., down to 9,5% in optimistic scenario and down to about 12% in pessimistic scenario).

Distribution of increases in fees for distribution services in subsequent years of AMI implementation will depend on the duration of the implementation (Figure 3).

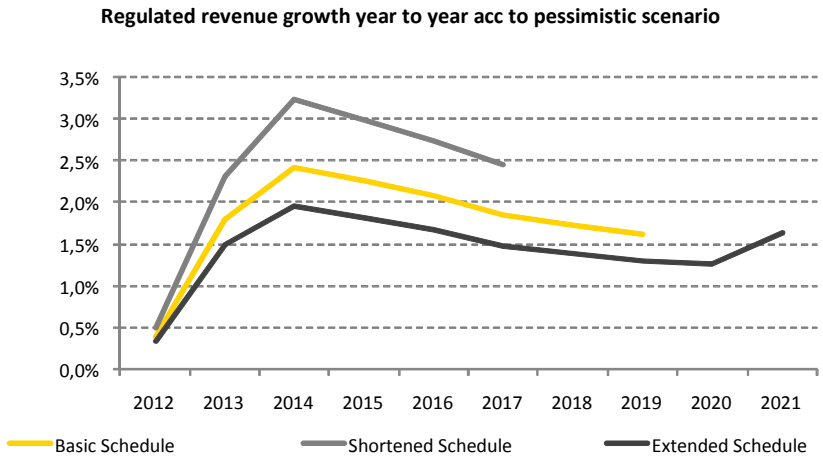

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Figure 3 The increase of the level of distribution fees for the customers (at LV) year to year according to pessimistic scenario

In case of an optimistic scenario the above increases are lower by about 0.5% per year.

Taking into consideration the role of the DSOs as the public utilities, the implementation of AMI should be beneficial for the consumers and should provide the possibility of improving the efficiency of the DSOs performance, which as a consequence will lead to lower tariff fees for the consumers. Simultaneously, DSOs should obtain full return on capital employed in smart metering system, as it is the case with other network assets.

As estimated above, the implementation of smart metering systems will result in a considerable increase of financial burden on final consumers within distribution tariff. Before deciding on the implementation, this burden should be confronted with actual customers' benefits resulting from: consumption profile optimization and more aware energy consumption.

If the current low awareness of end-consumers is not increased, benefits achieved by the consumers will be rather small, and the AMI implementation may seem not justified from the consumer's point of view.