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Independent Operator of Measurements as a Virtual Enterprise on the Energy Market

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***Abstract*—The independent Operator of Measurements (IOM) is a new energy market actor that will implement a remote access to the metering data and stores, as well as aggregating and delivering them in real time to all market participants as an independent service-placed "above the market" enterprise.**

In that sense IOM, with an adequate infrastructure of ICT has become a virtual company with real effect - where, thanks to its distributed and virtual activities on the energy market - achieves it, synergizes the whole market and activates the necessary and accurate real-time decisions of other market participants.

IOM is a virtual unit (not necessarily constrained by any single location) from the point of view of the access to the Market.

The Energy market (EM) in Poland, where IOM will be set up, has become closer to the full liberalization, energetic efficiency, enhanced competitiveness and contribute to the smart grids potential.

This article presents the issues of ICT and the creation of new business models for the above-described virtual enterprise, which manages measurement data at the EM in Poland.

I. Introduction

A FUTURE model of EM assumes a development towards to the smart grid together with: an implemented AMR-AMM infrastructure (fig.1), intelligent bi-directional communication power meters for metering load power, many sources of distributed generation using among other renewable energy sources and their settlements with market aggregators on an intra day (real-time) market. The current market design in Poland is presented in some detail in: [7], [12], [13].

An essential element of this market will be the virtual access to the measurement data, collected and aggregated from the bi-directional smart multimeters measuring the media (like electricity, gas, heat, heating), aggregate of any scale, which share any eligible market participant as a service.

Real Smart Utility – a model for the future utilities of any type on the EM — -is an actor trading and marketing on the energy market, which, thanks to virtual technologies manages the flow of information in real time. It can precisely manage and balance its needs as well as the manufacture and sale of energy (prosumers, system manufacturers, small manufacturers or EM traders).

There are some barriers for the development of such market (technical, financial, legal, information technology) that need to be resolved, and that are associated with the following problems:

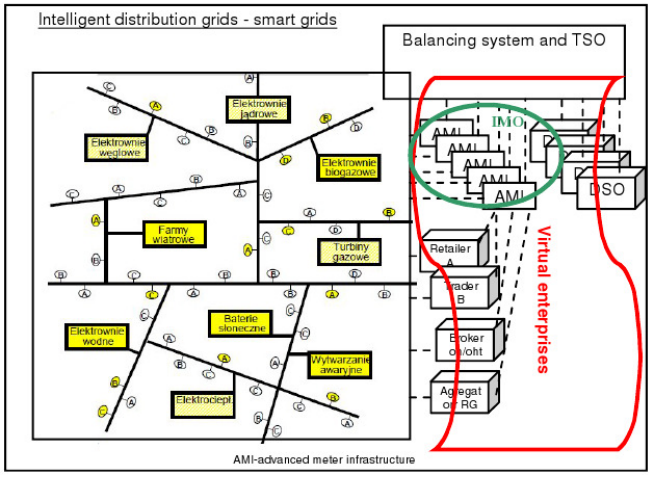

Fig. 1. The technical infrastructure required for the realization of intelligent network-general concept and the location for the IOM. (A, B, C, D: energy consumers), source: the basis on information from: www.ure.gov.pl

- Bi-directional flow of energy and information in real time (demand response) and implementation of the intelligent bi-directional remote power meters.
- Communication between market operators in real time.
- Monitoring network in real time.
- Operating and monitoring systems - operating in real-time and also effective integrating with AMI infrastructure.
- Adequate telecommunication infrastructure for data management systems.
- Power meters data management systems for the independent metering operator (IOM) - as a company with access to market participants and to the high quality, useful measurement data in real time.

Directive EU 2006/32 p. 13 defines the basis for the use and access to smart meters for customers and points out the need for billing based on actual energy consumption.

The main barrier to progress in work on smart metering are investment costs and scale of the complexity of possible solutions and the number of participants as well data obtained for instance every day for each hour (or more) for each end users.

II. Metering Market Model

Currently, the market value of the energy is built around a primary object of manufacturing and trade - that is energy.

The analysis a market value defined in such a way reveals the weaknesses of the current market model. Mainly these arise from the presence of many distributors on the market which are operating on different, often internally regulated basis. This results in poorly organized connections between the other market participants - especially energy traders. Formal and legal rules which are contained in the Comprehensive Distribution Agreements (CDA) as well as in the IRiESDs only require from operators to expose the measurement data at specified times schedule but they are often in different formats, and in practice the timetable is not respected. The companies send the estimate and poor data to fulfill the terms of settlements with clients because of the lack of the adequate data. In addition, current regulations and a system of metering and billing create difficulties, if not actually preventing prosumers activities.

In the proposed target market model, where the value chain on the EM has been defined there is space for the market integrator and operator of measurement data - IOM company, which is separated from transmission and distribution operators (TSO and DSOs). A key role here is, however, the implementation of smart metering and data management system for all EM. The value chain on the EM is presented in Fig 2.

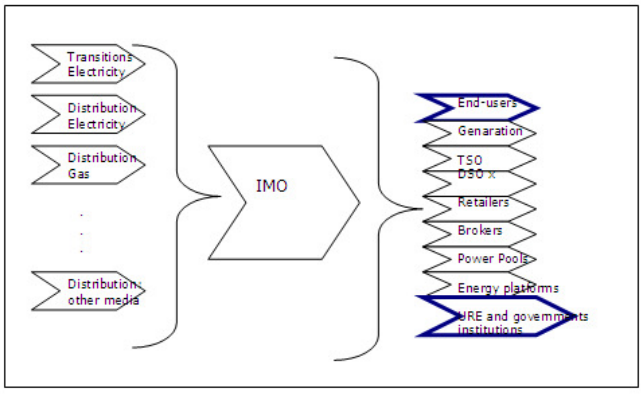

Fig 2. Metering market value chain (with IMO) in the target model of energy market. Development on the basis of [2],[3].

The role of the Independent Operator of Measurements will be: [1], [2]:

- Conducting regulated business activities centered around the acquisition and data processing devices (all tariff groups and data from the station medium / low voltage) obtained from the DSOs and the TSO and forwarding to the relevant players, empowered by law now and for future market players.
- Keeping the central repository of data measuring on the energy market.
- Measurement data processing and aggregating for those who needs the data from the IOM.
- Provision of services in information sharing on the energy market.
- Support competitiveness within the energy market through the actual separation and maintenance of the independent flow of information from the DSOs to the retailers.
- Providing a unified communication channel and standards, providing a base of information to the seller, regardless of his area of operation.
- Keeping archives of the measurement data, thus relieving DSOs from the necessity of maintaining a measurement data store other than necessary for their own needs.

III. Business Model for IOM

In Fig. 3 the main business processes for IOM are presented and described.

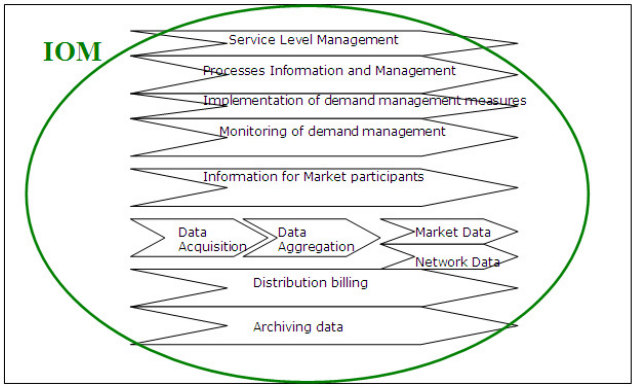

Fig 3. IOM- Main Business Processes. Development on the basis of [2], [3].

The most important business process, however, for the IOM is providing the highest quality and accuracy of the measurement data to all stakeholders of the market.

IV. ICT for Advanced meters infrastructure

ICT needs to be considered in specific areas of innovative technology solutions: the measurement data terminals for market participants, technical infrastructure for data transmission, information systems management measurements, users tools for measurement data and their household appliances etc.

Focusing only on the functionality of the data transmission system (excluding technology and communication standards, measuring meters the same: for all client household appliances, data reading and MDMS system) should be taken into account in following technological solution [5]:
Matching transition capacity to telecommunications traffic expected at different levels and using different technologies and network (LV and MV Network, plc, GPRS, LAN, wireless SDR, dedicated wired network, etc.):

- Respect traffic at one MDMS - up to 1 million meters - the reading of load profiles once a day every 5 hours,

Standards: EDIFACT standard, IEC 61986, XML (plain) PTPiREE standards.

- Respect traffic at a hub of data - for 1000 meters. Standard Communications: DLMS / COSEM.

MDMS requirements:

- Scalability up to several million customers.
- Response time to an event with the counter <1min.
- The possibility of transmission of the command "off" in time <5min.
- The precise specification of the interfaces at the design stage to the meter reading systems, billing systems, SCADA and / or EMS systems, asset management systems.
- An Ease of publication / access data.
- MDM Systems towards to Architecture Service Oriented - SOA (Service Oriented Architecture)
- Corporate Bus Services (eng. Enterprise Service Bus) - adds a layer of a multilayer of information systems architecture that enables the use of the concept of SOA in a corporate environment. Its task is to join and disconnect services for the corporate information system.

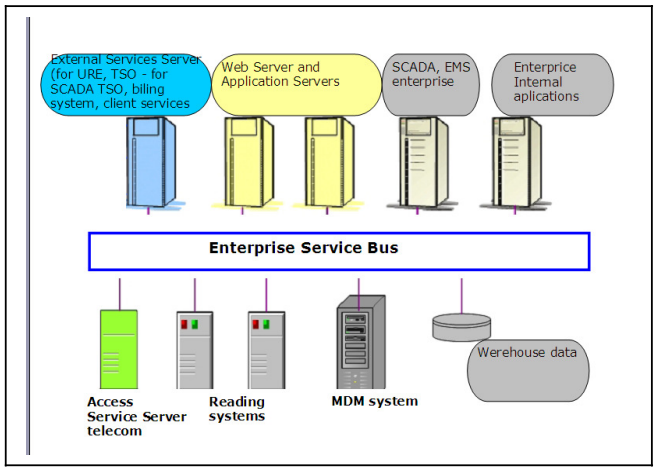

Fig 4.ICT architecture design for IOM. Development on the basis of [5].

Currently, software solutions offered projects for Smart Metering and MDM systems are based on SOA (fig. 4).

In Poland, first projects presented by IBM and WINUEL are combining their software components such as a solution to support measurement and data acquisition (applications from Winuel) with WebSphere ESP solutions. The aim is jointly constructed and offered by the system (presentation - May 2010) designing its modularity, orientation towards support of open standards and flexibility to adapt to the requirements of the final customer.

Connected components there are:

1. Data acquisition system with different types and models of energy meters.
2. The system of central collection and validation of measurement data in a uniform format.
3. Handling the system of measuring consumers.
4. Grid measurement service system.
5. Bus Integration -WebSphere ESB that enables the connection of multiple acquisition systems and the conversion of interfaces to a common standard CIM. Bus will also allow the connection of other systems belonging to other utilities participating in the typical business processes of the AMM
6. WebSphere Process Server system to automate common business processes of the AMM
7. Dashboard's Websphere Business Space – allowing end users a comprehensive surveillance and monitoring of the AMM system based on defined KPI's (Key Performance Indicators), portfolio (procedures) tasks according to defined business processes AMM.
8. System Websphere Business Monitor - for the calculation of defined KPIs (Key Performance Indicators).

V. Conclusion

The main advantages of setting up the IOM according to the energy market analysts are as following [2]:

1. Providing quality service to the mandatory exchange of the measurement data in the process of mutual settlements, in the process of changing the supplier (a temporary regime of access to data) etc.

2. Ensuring neutrality and equal access to information for all market participants:

- Enhancing the competitiveness of the market: a real separation from the DSOs.
- Increased attractiveness for new entrants due to the elimination of barriers to the access of data.

3. Maintenance and use of open standards for the exchange of information between market participants:

- The advantage is the smaller number of standards to develop.
- Maintaining the freedom of market participants to choose their supplier of measuring tools (DSO can select the setting of solutions providers of smart meters).

4. Reducing the amount of work needed (changes) in existing systems:

- Each participant in the market fully integrates with only one player: the IOM;
- Reducing costs and the elimination of financial barriers for the entry of new players (especially for retailers).

5. Ensuring finance transparency of new business projects (smart projects) by all market participants.

6. Simplifying data collection on the market and customer behavior.

7. Opening up the EM in terms of power system data exchange with network operators in Europe.

However pilots are needed to implement, both remote reading (such as the implementation of the company Energa: Converge system, system-Amateur Radio) as well as ICT systems, built in SOA architecture, where virtual platforms for trade and management of the measurement data acquisition and archiving are in the IOM set of services.

Work on standardization, smart metering, acquisition, storage, sharing and reporting, and management of the measurement data through the ICT systems are currently in progress. However, due to the complexity of the issues involved and the scale and diversity of systems already operating on the market this is envisaged to be a highly expensive and complicated design.

Appendix

Short definitions of the term "**virtual"**:

1. *Virtual*- means: such as: almost, virtually- so it is something that has potential (through the development and implementation of the new ICT tools-it is greater then ever before). The characteristics of the object does not physically exist, or exists in a sparse and economical form. 'Nearly' and 'almost' does not mean 'better' or 'worse'. Usually it is something more than just a physical object, being value-added and built on its virtual features.

2.*Virtual* means digital – that is, a facility that can be stored in computing systems and databases (broad approach).

Virtual Energy Market: (virtual actors), - approach to the construction of the structure of the market applying a similar model to the Internet and using its potential of communication and information processes for the management at the EM.

CVPP – Commercial Virtual Power Plant- - distributed generation, the object dispersed, potentially possible, flexible, dynamically variable in its action, quickly responding to market needs and the energy balance system. CVPP applies intelligent information management systems and knowledge. All processes can not be managed without the support of ICT tools. CVPP is a virtual organization dispersed with EM actors, managed by information management systems that aggregate the market in terms of "above the network" [9].

Abbreviations

DSOs – Distribution System Operators
TSO – Transition System Operator
AMI – Advanced Metering Infrastructure
AMM –Advanced Metering Management system
AMR- Advanced meter reading
MDMS Measurements Data Management System
CVPP Commercial Virtual Power Plant
IRiESD - the policy for DSO activities
CDA – Comprehensive Distribution Agreement (in Polish: GUD- Generalna Umowa Gystrybucyjna)
URE- Energy Regulator on the EM which regulate a policy and principles of market (in Polish: Urząd Regulacji Energetyki).

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