

Information Technology Support for Power Supply Company that Operates in Open Utility Market

Elvedin Grabovica, Džemo Borovina, and Selma Kovačević

Abstract—This article gives a brief description of a role that an Information technology has in one electrical energy supply company. When we consider open energy market, it is well known that Utility sector in European Union has already been liberalized and all the steps in joining that market are defined in legislatives. When it comes to IT role in such a company, we can be sure that IT plays a significant role in adopting to a new market. This work describes some of IT segments critical for achieving those goals, that have already been or will be implemented in public company for producing, distributing and supplying electrical energy in Bosnia and Herzegovina. As mentioned, some of IT projects have already been implemented in order to prepare the company for the upcoming open market. However, some information systems still need to be implemented, as a crucial for a competitive position of a company in a new market.

Index Terms—Billing, business process management, customer relationship management, disaster recovery.

I. INTRODUCTION

All business areas in utility sectors, such as producing, transmitting, distributing and retail of electrical energy traditionally have been defined as monopolistic areas which have no competition. In that manner, all business processes were defined and managed by unified, centralized and vertically integrated subject which has a monopoly on regional market of electrical energy. However, the only segment that actually should be protected from the competitors is network operator. All the other segments such as producing and supplying of electrical energy can and should be considered as potential concurrent services.

Inside the European Union, utility sector has been liberalized and defined in EU law regulations (Directives 96/92/EC and 2003/54/EC, in order to make the energy market open for the competitors. According to these directives, all states that are members of EU must establish full market competition, as well as the possibility for customers to choose their supplier. Deadline for these obligations were July 2007. In Bosnia and Herzegovina, all customers except households are in a position to choose supplier of electrical energy. Households will have the same opportunity from the January 2015. In order to establish successful competition in power supply process, it will be necessary to change the role and the position of Distributed System Operator. In EU states, Operators that have more than 100.000 customers using their network must implement all

mechanisms of separations, while operators with less customers have to implement separation of accounting data and information [1].

II. BUSINESS PROCESS MANAGEMENT

Centralized and standardized business process management in a company is extremely important to business. Good definition of business processes and resources needed for their work is necessary for continual, reliable and secure IT support. Relationship between the IT and business processes is mutual and continual through the process life cycle. In the context of open market for supplying electrical energy, IT systems must provide full support of internal transformation process and business process management [2]. It is necessary to implement software solutions for managing business processes, that will provide:

- 1) Process design and analysis
 - Object-based definition of organizational units, risks, material and IT resources
 - Creating and presenting repository of business processes
 - Information structures modeling
 - Simulation of different scenarios and process optimizations
 - Static and dynamical analysis of business process model
 - Change Management
 - Best practices in modeling
 - Integration of ERP systems (SAP)
 - Compliance with Business Process Modeling Notation standard
- 2) Business Process Reengineering
- 3) Monitoring and control of business processes
 - Monitoring according to Key Performance Indicators (KPI)
 - Trend and impact analysis
 - Measuring of realization with KPI indicators
 - Calculating of Return of Investment parameters
 - On-line monitoring of business continuity

III. CUSTOMER INFORMATION SYSTEM

Business and technical information systems must be fast, flexible, scalable and secure in order to provide all needed support for business in a deregulated market of electrical energy. Sluggishness and slow changes will not be tolerated as it used to be in a privileged position of a company. Information systems must be able to transform themselves and to adjust to changes in business and organizational aspect, as well as in terms of providing new services to customers.

Manuscript received November 14, 2013; revised January 14, 2014.

The authors are with the Public Company for Producing, Distributing and Retail of Electrical Energy, Sarajevo, Bosnia and Herzegovina (e-mail: e.grabovica@elektroprivreda.ba, dz.borovina@elektroprivreda.ba, se.kovacevic@elektroprivreda.ba).

On the customer service side, CIS should support multiple client interaction channels — such as call center, interactive voice response/voice response units (IVR/VRUs) and SMS — as well as customer self-service needs [3].

In a competitive market, a CIS also needs to enable data exchanges with other market participants, such as metering service companies, network companies, competitive retailers/suppliers and market operators.

The CIS product requirements defined by electric utilities tend to be more complex because of the intricate nature of the business. Issues such as the inability to store and manage commodity (electricity), more complex market structures (such as retail competition and unbundling), smart grids and the deployment of advanced metering infrastructure (AMI) tend to keep the electric utility at the forefront of business innovation in the CIS market, compared with other utility sectors [3].

Key elements of Customer Information system in Supply Company that operates on open market support are:

- Billing system
- Customer Relationship Management (CRM)

Those systems will directly be in charge for customer services support. Besides, other information systems that will play important role in supporting open market changes are:

- Meter Data Management (MDM)
- Financial Management Information System (SAP)
- Distributed information system for new customers
- Database of electrical objects (DEEO)

A. Billing System

When considering Billing system in terms of open market, it is necessary to point out that electrical energy supplier that works in open market must be competitive. It has to be fast when serving customers, at the same time providing new services and solving all problems customer has while using the service. Supplier must work proactively having in mind the competition. Billing application must provide the following functions when serving customer needs in open market [4]:

- Signing, analysis and monitoring contracts with qualified customers
- Signing, analysis and monitoring contracts with producers/dealers
- Collecting/archiving accounting data for qualified customers
- Accounting and bill delivery to qualified customers
- Charging, financial monitoring of debits and interests
- Customer data analysis, financial cards, reclamations, complaints
- Data exchange with other interested actors in the open market, in order to provide support for new processes, such as: change of supplier and customer moving.

Fig. 1 shows data exchange workflow between CRM, MDM and Billing modules, including new services.

New Billing system should support many advanced and sophisticated applications and modules that are related to open market, such as:

- Contracts
- Marketing strategy
- Accounting and billing
- Selling and services
- Advanced Metering Management

- Energy consumption metering
- Customer accounts and finance metering

Fig. 2 presents brief overview of Customer Information system modules.

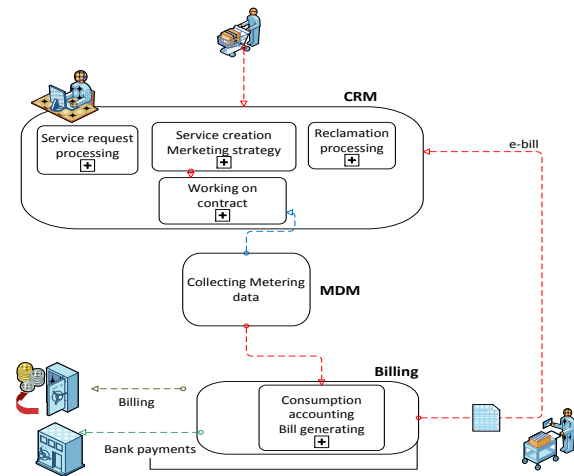


Fig. 1. Customer information system [4].

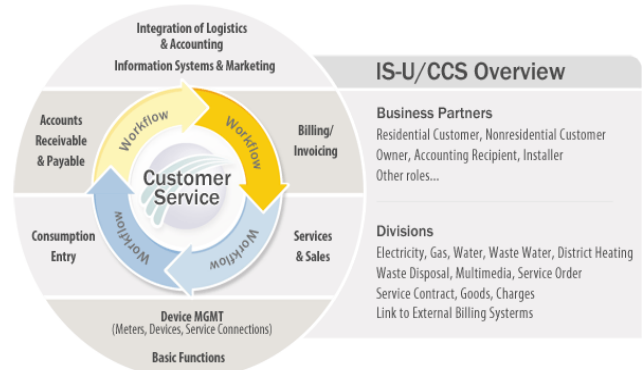


Fig. 2. Billing system applications/modules [4].

B. Customer Relationship Management

In terms of Customer Relationship management, communication with customers should be analyzed and implemented in a closely coordination with supply process and its requirements. In a Public company for supplying electrical energy, CRM solution that was recently implemented is Oracle Siebel Energy&Media.

According to Gartner researches, some of the strongest new areas of CRM focus, that should be implemented in Supply Company that operates on open market are [5]:

- Cross-channel CRM customer engagement applications, including customer-controlled communication
- Social networking systems that improve customer service through input taken directly from customers
- Video customer service and delivery systems, especially for the support of mobile consumers
- Mobile-based, location and context-sensitive technologies
- Customer service analytics, including big data
- BPM tools that enable the entire migration of increasingly complex customer service tasks and interactions for Web customer service
- Applications that optimize customer service agent interactions through advances in skills management, knowledgebase, search and real-time decision support

- Technologies that support rapid iterations and improvements in business processes
- Analytical tools that predict the most likely intent of customers' requests for service, as well as emerging needs for services and the optimization of each interaction to cross-sell or upsell products and services

All those functions and tools should provide a competitive advantage for the company.

The following Fig. 3 shows data model that CRM uses for exchanging data with other information systems in a company.

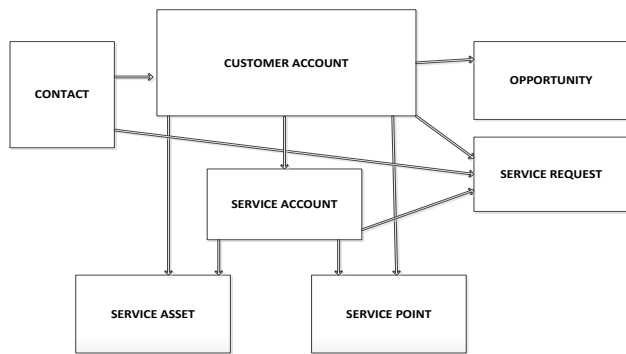


Fig. 3. CRM data model [6].

Key entities of CRM data model are:

- Customer Account
- Service Account
- Service Point
- Service Request
- Contact

CRM data model is based on existing relations between Customer Account and Service account data, as well as between Service account and Service point data. Customer account entity keeps basic information about customers before they start using electrical energy, while Service Account entity keeps information about customers who are already connected to electrical power network.

The following Table I gives availability parameters in a company.

TABLE I: AVAILABILITY PARAMETERS IN CRM [6]

Service Availability	<input type="checkbox"/> Monday - Friday	<input checked="" type="checkbox"/> Each day
Availability hours during working week	<input type="checkbox"/> 7 – 17h	<input checked="" type="checkbox"/> 0 – 24h
Availability hours during working weekends and holidays	<input type="checkbox"/> 7 – 17h	<input checked="" type="checkbox"/> 0 – 24h
Regular maintenance	Every second Wednesday in a month	
Time of regular maintenance	7-7:45h	
Required availability weekly	<input type="checkbox"/> 75%	<input type="checkbox"/> 90% <input type="checkbox"/> 95% <input checked="" type="checkbox"/> 99% <input type="checkbox"/> 99,9%
Required availability monthly	<input type="checkbox"/> 75%	<input type="checkbox"/> 90% <input type="checkbox"/> 95% <input checked="" type="checkbox"/> 99% <input type="checkbox"/> 99,9%
Reaction time	<input type="checkbox"/> 5 min	<input checked="" type="checkbox"/> 15 min <input type="checkbox"/> 30 min
Correction time	<input type="checkbox"/> 15 min <input type="checkbox"/> 30 min	<input checked="" type="checkbox"/> 60 min <input type="checkbox"/> 150 min

For companies that compete for customers in open market, CRM is extremely important segment of business. It should provide high available access to the service, reliable and accurate data, as well as professional and kind staff that serves customer needs.

Some of new functions that a modern and innovative CRM system in our company will have to provide at the start point are [6]:

- 1) Multi-channel outgoing campaigns (call, SMS, e-mail):
 - Planned shutdowns of energy objects notifications
 - Warning for customers who do not pay bills
- 2) E-bill service: Paying bills using web services
- 3) SMS services:
 - Notification of accounting data
 - Notification of planned shutdowns
 - Notification of planned reconstructions

For any of those services, it is necessary to define marketing campaign for promoting services, in which customers are enforced to choose a specific service they are interested in, as well as to provide contact information necessary for using the service.

Methods for implementing previously defined services are [6]:

- 1) Notification of planned shutdowns by sms
 - CRM filters all the customers that will be covered by the planned shutdown
 - We define the type of the campaign (call/email/sms)
 - CRM filters customers that have contact data such as phone number, email address
 - CRM sends generic sms message such as “Your area will be out the electricity for a period..., thank you for the understanding...”
- 2) Warning for customers who do not pay bills
 - Billing system send the list of customers who did not pay the bill
 - We define the type of the campaign (call/email/sms)
 - CRM filters that have contact data such as phone number, email address
 - CRM sends generic message such as “We kindly ask you to pay the bill for the electricity, otherwise your power supply will be shutdown...”
- 3) Outgoing phone call campaigns for planned shutdowns
 - CRM will have one daily task that will be in charge for generating this list of customers that will be covered by planned shutdown in the period of 3 days
 - Detailed information regarding planned shutdowns CRM will be receiving from the Dispatching application that is primarily responsible for managing those data.
 - Generated list of customers that will be in a planned shutdown will be imported to Contact center and CRM, together with data such as: phone number, date and time of shutdown.
 - Contact center will automatically make phone calls to the customers from the list and present predefined message “Your area will be out the electricity for a period..., thank you for the understanding...”

IV. DECISION SUPPORT SYSTEMS

In general, IT systems provide different ways of corporate management support, based on data that comes from the

transaction systems, as well as on data received from partners, suppliers and customers. Information system provide different management levels, from building short-term plans and small department budgets, up to the long-term plans and budgeting for the entire organization. In that context, we have two kinds of information systems that are important for business decision support:

- Decision Support systems / Business Intelligence
- Management Reporting systems

Although each information system basically supports decision making, Decision Support systems are initially defined and created for this function. Their main focus is on analyzing large amount of data collected from different data sources, as well as predicting, suggesting and finally giving a model for decision making in a specific context. Well-structured DSS represents an interactive software-based system which empowers business decision making to persons that are responsible for decision making. DSS will use different source data, such as:

- Structured data sources (database tables and other objects)
- Documents
- Employees knowledge
- Business models
- Business processes

Typical activities of Decision Support system are:

- Access to different types of heterogenous data, including databases, OLAP cubes, data warehouse and data mart
- Comparative analysis of data in a certain time period
- Comparing different possible business decisions in the context of their impact on business

DSS in the company for supplying electrical energy will allow huge independency of business users from the IT support, in a way that they can create and change queries and reports itself. As a result, they become key users of Business Intelligence system in a company. All the metrics, calculations and measures become centralized and managed, which guarantees single and unique version of any data in organization. Through the implementation of DSS, Business Intelligence becomes integrated part of a business process and its lifecycle, which brings the full interaction between business and IT. Generally, we will consider two models of DSS:

- Model-driven
- Data-driven

In a model-driven DSS, model is applied on a limited set of data. One example in a context of Power supply company are Billing data for a certain time frame (quarter, for instance). Business analyst establishes interactive dialogue with DSS, providing different "What-if" scenarios for a specific situation, and based on results it gets from the DSS, analyst creates some predictions and business decisions for monitored period.

In a data-driven model, the system analyses huge amount of data that were aggregated through some period in a Data warehouse, using the data mining process. The main role of Data mining process is to recognize certain patterns of specific data behavior, such as: sequences, clusters, correlations. Based on those patterns, system makes some decisions.

Management reporting systems enables creating and managing different types of reports and forms adapted to a specific role and responsibility that a user has in a system. Although those reports are used for analyzing data in a past and present, combined with BI tools, they can be used for giving some predictions on a market. Reports generated through such systems use processed and aggregated data from different relevant data source, which guarantees consistency and accuracy of shown data. This system prevents different reports on the same data set, which often happens especially in a distributed environments.

In the context of deregulated market of electrical energy, Decision supporting systems will be providing continual monitoring and advanced analysis of customer's behavior, in order to understand their profiles in a better way. This knowledge will create some presumptions for providing different service packets adapted to a specific customer profile. All this will lead to obtaining new customers, and keeping existing customers as well, which is one of market goals of the company. Therefore, traditional information systems for transactional data processing and reporting will not be enough. Opposite, it will be necessary to operate proactively and to change the approach according to the market needs. Decision supporting systems will use data collected from different data sources, analyze them, make some predictions, and finally, based on all those data suggest a specific service packet for every customer profile on a market. Prerequisites for those actions would be:

- Accurate, consistent and reliable data and information about customers on a market
- New information system model for advanced analytics, decision support and reporting.

Finally, implementing business intelligence in Power Supply Company will affect company's image on the market, and show that the company cares about its customers and their needs, which will have a huge impacts on business results and achievements.

V. IT SERVICE MANAGEMENT AND INFORMATION SECURITY

On the open market of electrical energy, IT services that a company provides to its business users and customers must be reliable, fast, secure, while on the other hand, information received from the IT system must be accurate and consistent.

In order to achieve goals previously mentioned, it is necessary to implement a centralized Management system for service-based monitoring and managing all the components of ICT infrastructure. This implies following management dimensions:

- 1) IT process management by ITIL approach
 - Incident Management
 - Request for Fulfillment
 - Change Management
 - Problem Management
 - Asset Management
- 2) IT services management
 - IT service catalog
 - IT service identification
 - Mapping services on a certain infrastructure that works behind it
 - Adopting IT service catalog by the Company Board

which makes it relevant for all the users in a company

- Service Management
 - Service-based management of IT systems
 - Analysis and correlation of events in IT systems
 - Drill-down analysis for locating problem source
 - Root-cause analysis
- 3) Information Security Management Systems by ISO/IEC 27001 standard
 - Defining ISMS scope
 - Defining and adopting Information Security Policy
 - Identification of critical processes inside the ISMS scope
 - Identification of information assets and asset owners
 - Information validation assets, identification of vulnerabilities, threats and possible impact on information assets
 - Classification of information
 - Risk analysis and risk assessment
 - Determination of acceptable risk
 - Identification of risk controls and goals
 - Determination of methods for control implementation
 - Plan for risk management
 - Internal audits
 - Verification by the company board
 - Certification of ISMS by ISO 27001 standard

Parallel with implementing Information Security Management system, it is necessary to work on defining and implementing Business Continuity Plan which will have to contain plan of acting in a situation of breakdown or disaster. BCP is extremely important for any company, especially for a company that works on a open market and serves customers. Business Continuity Plan for a Power supply company that operates on a open market should minimally contain following sections:

- Deep analysis of all the business and information systems segments that are or can become critical to business
- Analysis of impact that any kind of dysfunctionality can have on business (Risk assessment)
- Action plan in the case of disaster or system breakdown with clearly defined roles and responsibilities of employees, steps for recovering the system and data all the way to establishing the normal work

Public company for producing, distributing and retail of electrical energy has already implemented different systems for improving the security of information and information assets. Some of those systems are:

- Database audit and protection system
- Security Information and Event Management system
- System for managing security vulnerabilities in IT
- Disaster Recovery system

A. Database Audit and Protection System

Database audit system allows protection of the many segments and aspects of information security such as [7]:

- User interfaces
- Databases operations and connections to application interface
- Database administration
- Data definitions and documentation
- Security and access control

- Organizational rights and priorities
- Business continuity
- Law regulations

Database audit system provides the most robust solution for assuring the privacy and integrity of trusted information in data center, while reducing costs by automating the entire compliance auditing process at the same time. The following Fig. 4 shows an architecture of implemented solution for Database audit and protection.

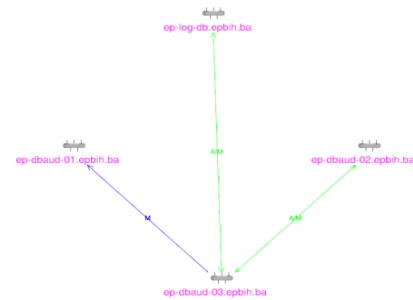


Fig. 4. Database audit and protection architecture [8].

It allows identification of any unauthorized or suspicious activity by continual monitoring of databases, data warehouses and file share platforms in real-time. It addresses the entire database security and compliance life cycle with a unified web console, back-end data store and workflow automation system. Fig. 5 shows an implemented architecture, including monitored servers.

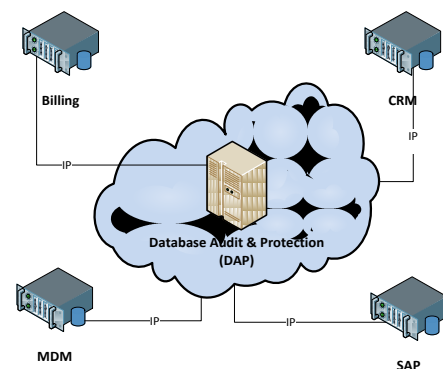


Fig. 5. Database audit and protection implementation.

Database audit system provides [9]:

- Finding and classifying sensitive data in corporate databases
- Assessing database vulnerabilities and configuration flaws
- Ensuring that configurations are locked down after recommended changes are implemented
- Capturing and examining all database transactions, including local access by privileged users — for all supported platforms and protocols — with a secure, tamper-proof audit trail that supports separation of duties
- Tracking activities on major file sharing platforms
- Monitoring and enforcing policies for sensitive data access, privileged user actions, change control, application user activities and security exceptions such as login failures
- Automating the entire compliance auditing process

—including report distribution to oversight teams, sign-off and escalations — with preconfigured reports for SOX, PCI Data Security Standard (DSS) and data privacy

- Creating a single, centralized audit repository for enterprise-wide compliance reporting, performance optimization, investigations and forensics.

B. Security Information and Event Management

Security Information and Event Management system was implemented as a Log Management system, which collects log data from different devices and software, analyzes them, correlates and reports on them. The following Fig. 6 shows different types of hosts that were included in the security information and event management project.

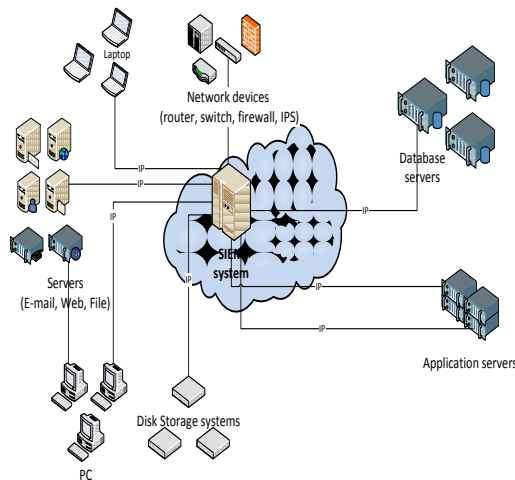


Fig. 6. Security information and event management implementation.

C. Disaster Recovery System

Disaster Recovery system is crucial for high availability, reliability and consistency of data, information and services provided to customers. Disaster Recovery system shema is shown on the following Fig. 7.

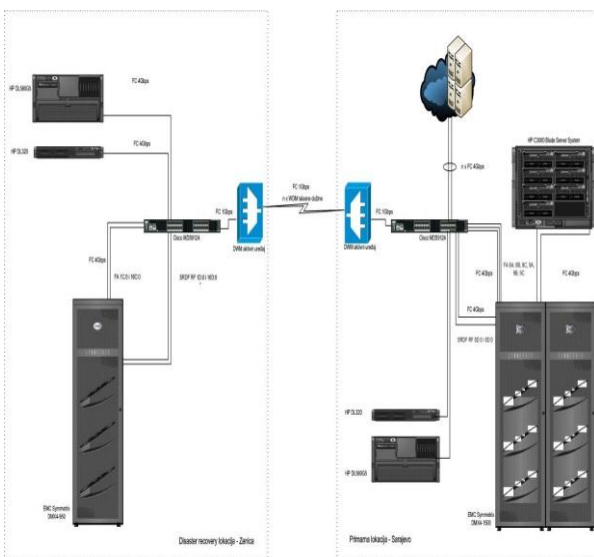


Fig. 7. Disaster recovery implementation [10].

One segment of Disaster Recovery system that should be considered is data replication between databases that are part of Customer Information system. Data replication takes place in real-time, between Billing and CRM databases on primary

and Disaster Recovery location, preventing data loss and providing high availability of the service. (See Fig. 8).

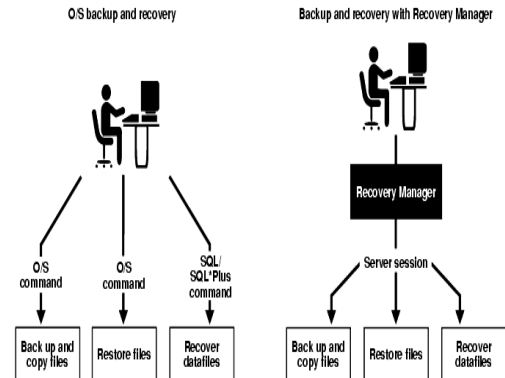


Fig. 8. Oracle real-time data replication.

D. Penetration Testing

Parallel with these implementations, penetration tests have been periodically implemented in order to identify main threats and risks for different information systems that are considered to be critical for the business in the company, such as: Billing, SCADA systems and many others.

Main goal of those tests was to determine and analyze the current security level of monitored systems, and to give brief recommendations on how to improve the overall IT security. Company board has recognized the importance of those penetration testings, as well as many other security projects. In the context of liberalized market of electrical energy, IT security will be even more important, because it will directly influence productivity, efficiency and effectiveness of business.

VI. CONCLUSION

Full benefit of implementing new IT model will be completely achieved after the market deregulation. However, results that have been achieved until now are:

- Central database repository and management of customer data, as well as exchanging relevant customer data sets with corresponding databases.
- Full visibility and monitoring of database traffic in the system
- Centralized management of security and event information in the system.

The process of market deregulation accompanied with the market competition requires one completely new approach and crucial changes in organization and management at the same time. IT role in that process is very important for the following reasons:

- IT should provide technical, logistic and administrative support for improving existing and implementing new customer services at deregulated market (outgoing campaigns, e-services, m-services,)
- IT should help in achieving better competitive position on the market
- From the position of support process IT should evolve to strategic position which will allow IT to participate in defining strategic goals and new IT services that will be provided to customers.

The main goal of IT is to balance user needs and business

priorities while maintaining control.

Business process reengineering, adoption to legislative, as well as the internal reorganization of the company will not be possible without IT support. IT will eventually be involved in all aspects of planning and defining business goals, choosing appropriate IT solution, up to the final implementation.

REFERENCES

- [1] D. Grote and F. Peter, *Role of Distributed System Operator as a Neutral Promotor of Open Energy Market*, USAID, 2013.
- [2] *Impact of New Legislation Regarding Electrical Energy on Internal Reorganization in Company*, Public Company for producing and distributing electrical energy in Bosnia and Herzegovina, 2013, p. 1.
- [3] Z. Sumic. (June 2013). Magic quadrant for utilities customer information systems. [Online]. Available: www.gartner.com
- [4] *Study on Implementing New Billing System*, Public Company for Producing and Distributing Electrical Energy in Bosnia and Herzegovina, 2013, pp. 9-25.
- [5] M. Maoz. (July 2013). Hypo cycle for CRM customer service and support. [Online]. Available: www.gartner.com
- [6] *Technical Documentation on Implementing New Centralized Contact Center and CRM*, Public Company for Producing and Distributing Electrical Energy in Bosnia and Herzegovina, 2013, pp. 52-55, 64, 73.
- [7] S. Kovacevic, R. Devlic, and N. Halebic, "Using IBM infosphere guardium system for improving database security in public company for electrical energy," presented at the BH K CIGRE, Neum, September 2013, pp. 16-19.
- [8] *Survey of Implementing Database Audit and Protection System*, Public Company for Producing and Distributing Electrical Energy in Bosnia and Herzegovina, 2013, p. 18.
- [9] S. Kovacevic and D. Borovina, "Database audit system as an effective way of improving the overall database security," presented at the Information Technology Conference, Cavtat, June 24-27, 2013.
- [10] *Survey of Implementing Disaster Recovery System*, Public Company for Producing and Distributing Electrical Energy in Bosnia and Herzegovina, 2010, p. 14.



Elvedin Grabovica was born in Sarajevo, on May 18, 1975. In 2011 he received PhD in economy science. In 2004 he received master science degree in information system management, School of Economics and Business in Sarajevo, Bosnia and Herzegovina. In 1999 he graduated from School of Economics and business in Sarajevo, Bosnia and Herzegovina. Elvedin works as CEO in Public company for producing and distributing electrical energy in Bosnia and Herzegovina. From 2005 to 2011, he has been working as a CEO in T3 Telecom. In this period he has also been working as an assistant in School of economics and business in Sarajevo. From 2000 to 2005, he has been working as an IT auditor and IT support consultant in the Office for revision in Bosnia and Herzegovina. His research interests are: Customer Relationship Management, Decision Support systems and Business Intelligence.



Džemo Borovina was born in Foča, on Januar 13, 1962. In 2007 he received master science degree in telecommunications, Faculty of electrical engineering in Sarajevo, Bosnia and Herzegovina. In 1989 he graduated Faculty of electrical engineering in Belgrade, Yugoslavia. In 1984 he graduated technical academy for aviation in Sarajevo, Yugoslavia. Džemo works as ICT CEO in Public company for producing and distributing electrical energy in Bosnia and Herzegovina. From 2008 to 2012 he has been working as an assistant at the Faculty of electrical engineering in Sarajevo. His research interests are: Smart Grid Management, Customer Information systems in Utility companies and Automatic Metering Infrastructure/Meter Data Management.



Selma Kovačević was born in Sjenica, on January 1, 1979. In 2008 she received master science degree in computer science, Faculty of Electrical Engineering in Sarajevo, Bosnia and Herzegovina. In 2002 she graduated Faculty of Electrical Engineering in Sarajevo, Bosnia and Herzegovina. Selma works as an expert for planning, developing and implementing ICT projects, in Public company for producing and distributing electrical energy in Bosnia and Herzegovina. Her research interests are: Information technology security, Customer Information systems in Utility companies and IT Service Management.