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### ***Systematic Approaches of the Company UAB „SIGMA TELAS“ in the Area of Automated System for the Control and Metering of Energy Resources (Smart Metering from UAB „SIGMA TELAS“)***

The software of Smart Metering from UAB „SIGMA TELAS“ has been under development by leading specialists of our company since 1989. The name **EMCOS – Energy Monitoring Commercial System** emerged in 2000, when a licensing agreement with Eastlink Energy Consulting (Sweden) was concluded. The agreement provided for the use of energy metering software developed by UAB „SIGMA TELAS“ by Eastlink Energy Consulting in its own developments.

The information and metering system for the commercial metering of energy resources EMCOS (a product of UAB „SIGMA TELAS“, Lithuania) is registered in the State Register of Metering Means and is permitted for the application in the Russian Federation, Uzbekistan, Kazakhstan and Ukraine. The certification process is underway in Belarus and Georgia.

For the first time, the corporate version of the system **EMCOS Corporate** was implemented in April 2001, when our company became the winner in the tender announced by the Lithuanian company AB Lietuvos Energija (Lithuanian Energy) for the development of a national new-generation commercial electricity metering system (290 biggest facilities of Lithuania and 3,000 metering points). In 2003, our company won the tenders announced by the Lithuanian electricity operators AB Vakarų Skirstomieji Tinklai (Western Distribution Networks) and AB Rytų Skirstomieji Tinklai (Eastern Distribution Networks) for the designing and implementation of similar systems. All the three systems under development have a feature of synchronous exchange in information being accumulated (the constantly expanding system currently contains more than 1,250 facilities and 13,000 meters). In 2003, the National Energy Metering System was adjusted for the interaction with the national dispatcher system. Currently, collection of moment information (phase-by-phase voltages, currents etc) from the 34 key facilities (176 metering points) is carried out with **a resolution of 2 seconds**, while collection of commercial information of every current hour is carried out **every 2 minutes** on an accrual basis.

In Lithuania, there are approximately 200,000 multi-functional electronic meters installed, while around 13,000 ones are integrated into multi-level automated metering systems. In the meanwhile, at the level of the national system (transmission network), all meters were replaced for electronic ones and integrated into the national Smart Metering from UAB „SIGMA TELAS“ system as early as in 2002. One should also note the fact that in addition to the national Lithuanian system and systems of distributions networks, specialists of UAB „SIGMA TELAS“ developed and implemented further more than 200 systems for small-sized and major Lithuanian enterprises including all the 10 systems of Lithuanian power plants. As a result, losses in Lithuania (total technical and commercial losses by transmission and distribution networks) have been reduced from 35-40 % to 8.5-9.5 %.

It should be mentioned, that besides Lithuania, our company operates on the markets of another 13 countries. We have partners in Russia, Ukraine, Belarus, Kazakhstan, Uzbekistan, Kirgizstan, Azerbaijan, Georgia, Latvia, Estonia, Sweden, Germany, and Finland. The system EMCOS was orderly adjusted in accordance with the requirements of various markets while integrating new metering facilities and developing necessary functions. This path has led to positive results. For example, cooperation with the Russian partner Telecor («Телекор») resulted in the implementation of 7 top-level systems in Russia within the projects of КомиEnergo (КомиЭнерго), PenzaEnergo (ПензаЭнерго), StavropolEnergo (СтавропольЭнерго) (chain of Kuban hydropower plants), KhabarovskEnergo (ХабаровскЭнерго), Cheboksary Hydropower Plant, Far East Generation Company, FEГC (Дальневосточная Генерирующая Компания, ДГК) and Far East Distribution Network Company, FEDNC (Дальневосточная Распределительная Сетевая Компания, ДРСК) as well as around 40 local-level systems (power plants and enterprises). All the systems were commissioned to the Administrator of the Trade System of the Wholesale Electricity Market of the United Energy System. At the same facility, FEDNC (ДРСК), the stage-by-stage (by 2013), implementation of the Automated Information and Measuring System for the Commercial Metering of Electric Power of the Retailing Market (more than 250,000 meters in 6 interconnected systems) based on the solutions of our company was started. Systems of gas and heat metering of the facilities of KES Holding («КЭС Холдинга») will be implemented in cooperation with another partner of ours, the company R.B.S. («Р.В.С.»).

In Ukraine, we implement the Smart Metering from UAB „SIGMA TELAS“ of the biggest Ukrainian energy system, ДнепрОблЭнерго (ДнепрОблЭнерго). Another system under implementation is the Smart Metering from UAB „SIGMA TELAS“ in DonbasEnergo (ДонбассЭнерго). In Kazakhstan, UAB „SIGMA TELAS“ participates, jointly with our partner and prime contractor TOO SK Alem Kuralys Ltd (TOO «СК Алем Курылыс ЛТД») in a project for the implementation of Smart Metering from UAB „SIGMA TELAS“ at 7 divisions of Kazakhstan Railways («Казакстан Темир Жолы»), where 8 systems with a total number of meters exceeding 29 thousand. Remarkably, the system combines high-energy meters (Kazakhstan Electricity Grid Operating Company (KEGOC), distribution networks), retailing market meters (legal entities – tenants) and household meters. Commercial metering systems at transmission and distribution systems and those for settlements with legal entities are equipped with meters, which rank among the most reliable in the market of the CIS member countries, EPQS and EMS manufactured by the Lithuanian company Elgama Elektronika (more than 5,000 items), which were provided to KEGOC for trials and received a high appraisal. In August, an agreement on the implementation of a commercial metering system was signed with the corporation KazakhMys (Kazakhstan Copper) which would cover the whole territory of Kazakhstan and will service for minery, metallurgical complexes, power stations etc.

Recently, for many people, UAB „SIGMA TELAS“ is associated with large-scale projects. For all this, we were deeply impressed by the approach to the formation of Smart Metering from UAB „SIGMA TELAS“ in Belarus. In this country, they arrived to a conclusion that it would be more economic and optimal for the Belarusian energy system to select one software solution for the whole hierarchy of the systems of the concern BelEnergo («БелЭнерго») from top to bottom. An international tender was announced for the procurement of software for 252 systems at a time (national, regional, district, systems of power plants, and serviced substations). The technical assignment sets an extremely high hurdle of requirements for time characteristics of the collection of data and their exchange between adjacent systems and systems of different levels, for

possibilities of creating forms, reports, and mnemonic diagrams by a user, for the quality and reliability of data, and for the calculation and analytical part. The requirement for the exchange of information in accordance with the rules to be adopted by the CIS member countries with other countries was defined separately. UAB „SIGMA TELAS“ is highly proud of the fact that it became the winner in this tender and carries out work for energy entities of Belarus. It is a unique project which is second to none at the territory of the former USSR.

We would like to emphasise the requirement for the availability of a calculation and analytical subsystem in the Belarusian tender. This is a one of the critical points. Globally, the concept of Automatic Meter Reading (AMR) into the new concept of Smart Metering. Users require from systems more than simple reading of data and reflection of charts, and even more than automated reporting. Their requirements include analysis, conclusions, and system response. The human is unable to digest huge amounts of information. And it is here, where the new component of the Smart Metering from UAB „SIGMA TELAS“, the analytical system, demonstrates its performance. It is this system which takes care of the quality and correctness of data, monitors the condition of communication and operating capability of meters, compliance with the established consumption limits, and timely transfer of data to other systems.



The ideology of Smart Metering, preparation of solutions and their lobbying in the European Parliament is the responsibility of the organisation uniting European manufacturers, experts and system integrators – **ESMIG (European Smart Metering Industrial Group)** headquartered in Brussels ([www.esmig.eu](http://www.esmig.eu)). Our company is the only company in the former USSR which is a member of this organisation and takes part, as far as it is possible, in discussing the projects and ways of developing Smart Metering in the Member States of the European Union.

UAB „SIGMA TELAS“ has been developing its systems for energy efficiency for many years already and, in relation to this, has been expanding

the analytical part in its EMCOS systems. The new version of our product EMCOS Corporate is aimed at creating maximum flexibility in the operation of both Smart Metering from UAB „SIGMA TELAS“ itself and the analytical subsystem.

We would like to point out a few specific features of the system *EMCOS Corporate* which distinguish it from other system available in the market.

First of all, this system was originally created for a big (tens and hundreds thousands) number of meters, facilities and users. This predetermined the architecture of the software. Functionally (for large-scale systems and on a unit-to-unit basis), the software is divided into three servers:

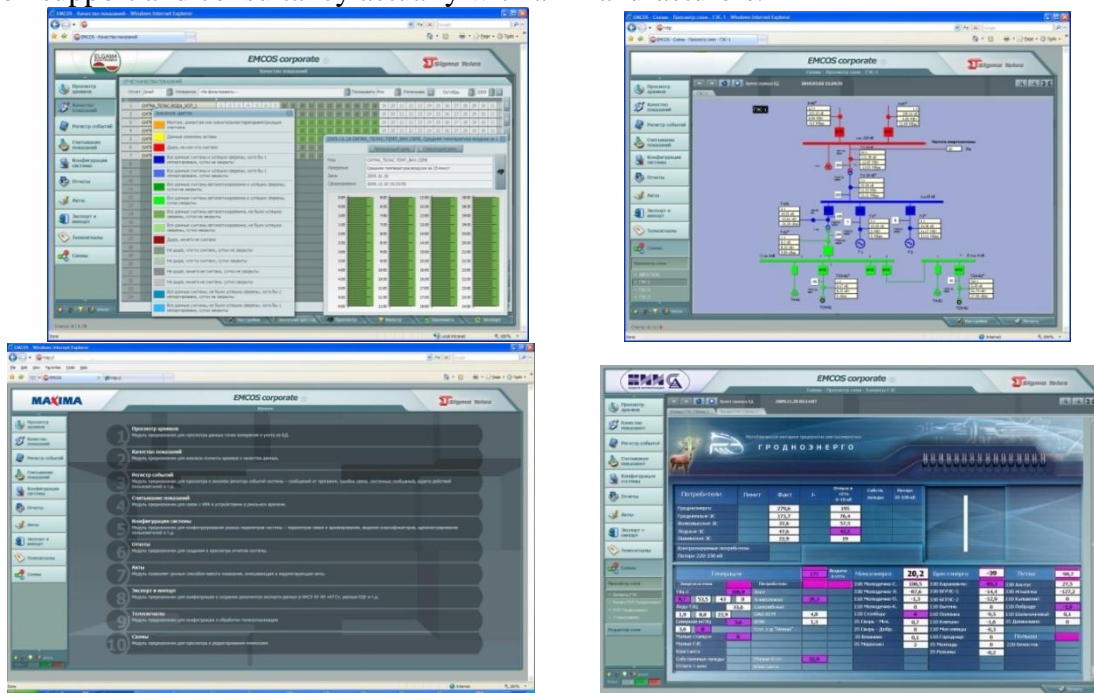
- 1) Oracle SQL Server, the database server of the Database Management System, for the storage and processing of information. It insures high productivity of the system and possibility of connecting a great number of meters.

- 2) Data collection server ensures collection of data of commercial metering and their placement into the database. It can open hundreds of sessions with facilities in parallel, which allows drastic reduction in the time needed for data collection and switching between alternative communication channels. The architecture allows flexible integration of drivers of new devices.

3) WEB server for the provision of information to the Automated Working Station. The user interface is fully constructed with the use of WEB technologies. The ASCMER portal allows complete abandonment of specialised software at work places and operation of the system from any computer that has an internet browser (subject to use rights) and access to the network of the portal. This also resolves a number of problems related to the updating of versions of the system.

Secondly, **EMCOS Corporate** is intended for and is certified as a system for commercial metering of various energy carriers: electricity, water, heat, gas etc while allowing determining the values of the accounting indicators used in the financial calculation of an enterprise. The system also supports the connection of discrete signals (bypass circuit breakers, alarm systems, outputs of protection relays), by including them, when necessary, into the logics of commercial calculations.

Thirdly, **EMCOS Corporate** supports an unprecedented number of types of meters and data acquisition and transmission devices (currently amounting to more than 150), which allows building an open system with a possibility of expanding it in the future. As a matter of fact, our operations cover almost all meters manufactured in Russia, Lithuania, Kazakhstan, Belarus, Uzbekistan and most meters made in West Europe and North America. Our company also assumes the obligation of integrating any new devices as the customer may require. It can be mentioned that the following electricity meters can be used: those manufactured by Elgama Elektronika (Lithuania), Schneider Electric (meters ION are the most powerful electricity meters), Landis&Gir / Siemens, Actaris/Itron, Elster Metronika («Эльстер Метроника»), meters F669 (LEMZ) (Ф669 (ЛЭМЗ)), SET ¾ (СЭТ3/4), Mercury («Меркурий») Inkotex (Инкотекс), Energomera (Энергомера) as well as heat, gas, and water meters SensyCal manufactured by ABB, various meters made by Danfoss, Endress+Hauser, EMCO, Iskra, DPFC and a whole number of other companies. As a matter of fact, all main types of data acquisition and transmission devices manufactured in the CIS member countries are supported. Complete specification is carried out at the stage of pre-design examination and following designing. It can be mentioned that we have official relations and agreements on support and consultancy actually with all manufacturers.



*Options of various information windows of the system, including the dispatcher subsystem, created by the built-in mnemonic diagram editor.*

One more distinguishing feature (it is the fourth, and most important point) of the system **EMCOS Corporate** is the analytical part of the system. As long as the data arrive to the system, they undergo various cross-checks in order to identify incorrect data or impermissible consumption or theft of power. This process includes calculation of the balance of the facility in the course of collection of information, comparison of data of various resolution (for example, comparison of the amount of semi-hours with the per day energy consumption) and collation of power consumption with the pre-established patterns (or generation with the set dispatcher schedules). It should be mentioned that the number of these algorithms and checks is limited only by the fantasy of the user. Our system provides the user with a tool for the implementation of any of these algorithms.

The new version of the system has an option of dynamic formation of patterns of consumption and limit settings. Thus, an averaged schedule of consumption for a certain previous period of time, for example, the average for the previous week, can be generated as the pattern (in order to trace deviations from regular consumption). Averaged consumption of a number of other similar facilities for the same intervals of time and under similar conditions (in order to identify insufficiently adjusted facilities or undisciplined consumers) can serve as another example. We called such algorithms of data analysis, when we assign only rules for the calculation of figures rather than specific figures, while figures change in as the process of the system operation goes on, “self-adjusting algorithms”.



*Consumption of electric power (the green line) deviates from the average consumption schedule by more than the dynamic limit set by the user for three nights in succession (detected by the system automatically)*

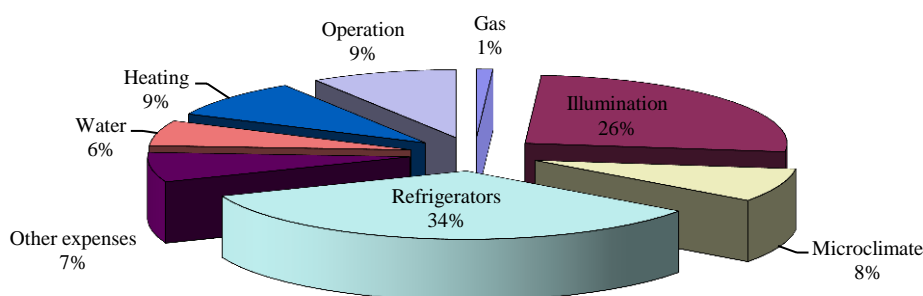
Also, an option of flexible configuration of the process of information collection in the configuration of the system is envisaged: it includes support of alternative communication channels, alternative points of the readout of the same information (with possible indication of different depth of archives in different points of readout – for example, the depth of the semi-hour profile in the meter is greater than in the data acquisition and transmission devices), and even alternative archiving lists depending on the current communication channel (e.g. every-second or every-minute collection is

allowed provided optics are in place, but it will be too expensive in case of communication via GPRS or satellite).

Maxima stores, a Lithuanian chain of supermarkets, became the first facilities where the new version is to be implemented (the system is in the process of implementation). Maxima operates more than 500 stores in Lithuania, Latvia, Estonia, and Bulgaria. In each store, there are numerous (sometimes several hundred) tenants such as small stores, restaurants, cinemas, pharmacies etc. The system is created for all kinds of energy carriers with connection of temperature sensors, refrigerator units, monitoring of illumination and alarm systems, and interaction with local BMS systems. The systems of each country will exchange information with the central system in Vilnius. Currently, Lithuanian (232 stores and more than 2,500 metering points) and Latvian (133 stores and more than 1,000) systems are being completed, and the configurations in the Estonian system are being specified.

The described system, despite of its complexity and price, is, however, effectively payable. Below, there is an example of the operation of the system and its efficiency indicators.

### Expenses on Energy Resources



When performing metering and control of the consumption of electricity, water, heating, gas, control of illumination, temperature and emergency situations in the network of supermarkets, it was planned to reach the following levels of saving:

- for electricity consumption – 3.7 %;
- for heating consumption – 8.4%;
- for water consumption – 6.5%;
- operating expenses – 6.7%.

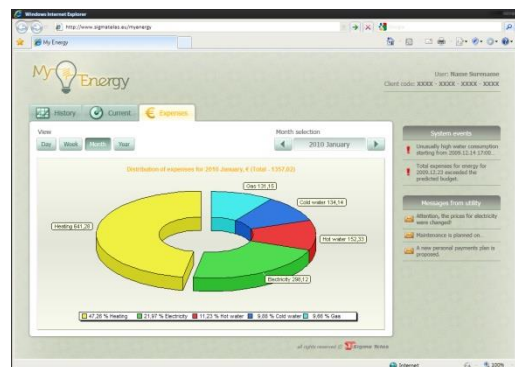
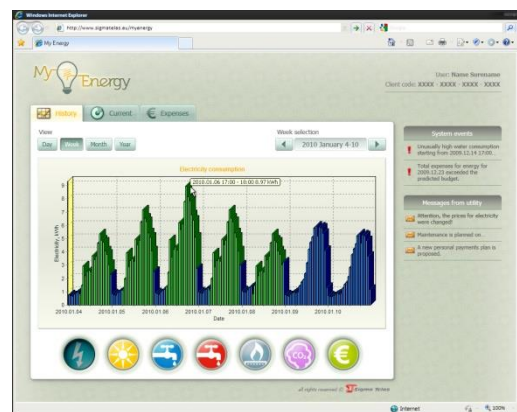
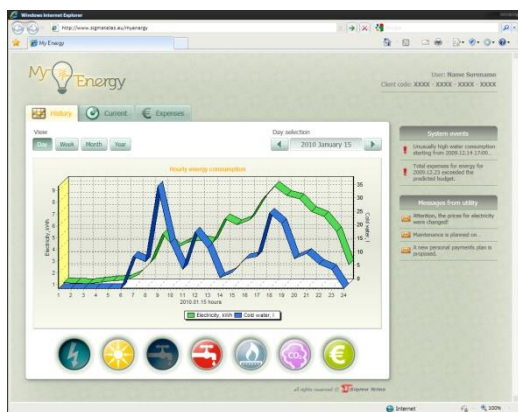
The planned payback period of the system was 3 – 3.5 years. The beginning of actual operation of the system demonstrated a considerable field of actions for achieving saving levels exceeding the established indicators. After the commissioning of 75 % of the facilities into the system, analysis and detection of particular problems allowed to adjust the main indicators to the following:

- for electricity consumption – up to 10%;
- for heating consumption – up to 9.5%;
- for water consumption – ranging from 10 to 50 % by different facilities;
- operating expenses – not less than 10%,

while the payback period decreased to 1 – 1.2 years. Store managers receive daily reports on comparison of actual consumption levels with planned ones with indication of overconsumption or savings. Summary rating tables with the indication of the

success rate of energy saving efficiency of the facility are generated. The system generates reports on the optimality of the selected rates plan for each facility for the selection of necessary permissible capacity with recommendations on required change of the plan. The latest press release issued by Maxima showed even more interesting figures: during 2009, energy savings amounted to LTL 20 million versus the cost of the system of LTL 8.5 million.

Recently, our company has been actively operating in the European market. It was a proposal of our German partners, on the basis of which we started developing a “simple” interface for household users (please see illustrations below). It became evident that implementation of such interface is required in housing and public utilities and markets of Russia, Uzbekistan, Kazakhstan, and Belarus.



Owing to its universality, the aforementioned system is used for a great variety of systems, for example, for systems operating municipal illumination, for mobile communication providers, for large-scope energy systems and retail market systems, for systems of geographically spread corporations and systems of real property administrators, for business centres and schools. This is the most powerful system of all those offered in the Smart Metering from UAB „SIGMA TELAS“ market at the territory of the former USSR.