Metering systems projects
Reference
Alpha CENTER
Brand New Metering Technology from Russia

Russia is one of the biggest producers of energy all over the world and now makes liberalization of the electric power industry. In this background new power companies need only a modern metering system, which can enable them to become the most competitive in the market. And today Elster Metronica is a leading provider of advanced metering infrastructure (AMI) solutions in Russia and CIS.

Since 1996 Elster Metronica has been developing metering systems based on innovative digital metering technologies. Today we offer up-to-the-minute Metering technology Alpha CENTER. Alpha CENTER is the metering system that completely meets stringent requirements of Russian Power Industry. Alpha CENTER suits perfectly both large Utilities and Industrial companies with thousands of meters and small enterprises with several meters.

Hardware
Elster Metronica produces and supplies all the necessary equipment for building metering systems:
- High functional, fully programmable solid-state electricity meters ALPHA series.
- Data acquisition, processing and communication controllers RTU-325 series.
- Meter, RTU and AMR server's cabinets ELSTER MC-200.
- The Alpha CENTER software package.
- Data communication equipment, workstation.

Software
Alpha CENTER metering systems are specially designed for energy and power metering and billing purposes including automated meter reading, data collection, processing, storing, and easy-to-analyze display of received data.

Alpha CENTER is the series of software products; it is based on the principles of client-server architecture (Oracle, Windows NT/2000). The program collects and analyzes data from meters, balances the accounts and integrates it into business administration systems. The system is designed for billing, managing networks or consumption, load management and measuring and analyzing of electricity quality parameters.

Turnkey solutions
Elster Metronica supplies metering systems on a turnkey basis or integrate it in close cooperation with customers. We render support on every stage of metering system implementation, including enterprise investigation, system’s installation, adjustment, commissioning, training etc.

Elster Metronica has a wide experience of large-scale AMR projects in Russia and CIS. Further you will find detailed description of some of them.
Alpha CENTER Metering System Configuration

Control Center with Database Server and Workstations in Moscow

Federal Network Company

Energy sales department

ELSTER MC-250

GSM

F.O.

United Power System Dispatch Center

Operator of Wholesale Energy Market

Regional Data Acquisition and Communication Center

ELSTER MC-240

F.O.

Substations

Substations

RS-485

F.O.

RTU-325

Modem

ALPHA Meters
Metering system for the largest Russian Generation Company – Concern Rosenergoatom

In 2005 Elster Metronica has finished the installation of the state-of-the-art metering system ALPHA CENTER on 9 nuclear power stations of Concern Rosenergoatom.

The system is specially designed for energy and power metering and billing purposes to work on the wholesale energy market of Russia. The metering system performs automated meter reading (AMR), data collection, processing, storing, and easy-to-analyse display of received data.

The metering system includes:
- High functional, fully programmable solid-state electricity meters ALPHA series.
- Data acquisition, processing and communication controllers RTU-325 series.
- Meter, RTU and AMR server's cabinets ELSTER MC-200.
- The Alpha CENTER software package.
- Data communication equipment, workstation.

The system is capable of providing complete and reliable information in practically real time (each 3 min data form all generators is collected in Moscow) on the amount of electrical power generated, released and received. The Rosenergoatom metering system allows controlling sales of electrical power on the wholesale market, reducing commercial and technical loss, recording deviations from planned production schedules and electrical power consumption.

Background
The Russian state company Concern Rosenergoatom produces electrical power and heat. The company includes 10 nuclear power plants in Russia. The Rosenergoatom generate more than 40% energy of the Russian wholesale energy market.

In 2004, Rosenergoatom together with specialists of ELSTER Metronica started creating a corporate electricity metering system that would meet the requirements of the wholesale energy market.

All during 2004-2005, Rosenergoatom conducted large-scale work to build AMR systems for all power stations: at the Kolsk, Leningrad, Kalinin, Smolensk, Kursk, Novorozhenskaya, Beloyarsk, Balakovsk and Volgodonsk nuclear power stations.

The new Rosenergoatom metering system provides timely and reliable information on power generation, online control, monitoring and optimization of stations’ functioning on the electricity market. Various services and divisions will use these billing systems, which satisfy Rosenergoatom’s interests on the electricity market.
System Objective
The Rosenergoatom AMR system is designated for metering of electrical power and capacity, automatic collection, processing and storage of data from electricity meters, transmission of this data to collection points and representation of received information in a way conducive to analysis.

The major objectives for integrating the system were:
- Providing for Rosenergoatom billing on the wholesale electricity market.
- Improving the accuracy, reliability and completeness of measurements, timeliness of transmission of information on the parameters of power generated, released and received by the stations.
- Reducing the labour-intensiveness and cost of collection, transmission, processing and documentation of information.
- Replacement of electrical billing systems that have outlasted their usefulness and are obsolete.
- Monitoring the productivity of electrical billing resources and devices from remote locations.
- Facilitating timely regulation of the fulfilment of the dispatcher load profile at each isolated generating plant.
- Reducing technical loss of electrical power.
- Exact fulfilment of the wholesale energy market requirements.

System Solutions
The Rosenergoatom AMR system was built on the basis of Elster Metronica metering hardware and software solutions as a hierarchical, multilevel, geographically distributed and automated system.

Power station metering systems are made according to a generic design and the main system components are:
- High functional, fully programmable solid-state electricity meters ALPHA (ALPHA Plus, ALPHA A1600)
- Intellectual controllers RTU-325 series (data acquisition, processing and communication units)
- ELSTER MC-200-series AMR low-voltage switching gear.
- Alpha CENTER Software for multilevel distributed Enterprise Edition systems.
- Communication and essential equipment (workstations, servers, adapters, cables etc.)

Collection Point Level
0.2S Accuracy Class ALPHA meters are installed at all of the nuclear power plant's collection points. They measure the active and reactive electrical power and capacity in two directions. All meters include an additional memory card for storage of load profiles and an RS-485 digital interface card for connection to communications equipment and data transmission to higher levels.

Object level
The object level includes the data acquisition and transmission unit RTU-325, server boxes, meter data collection channels, communications equipment, system time synchronization devices, automated user workstations with Alpha CENTER software installed.

The RTU-325 - series data acquisition and transmission unit is designated for collection of measurement data from the meters, formation of group measurements and data transmission to higher levels.

The data acquisition and transmission unit is supplied with the server ELSTER Metering Cabinets MC-250-series AMR. The ELSTER MC-250 provides the capability to place equipment in industrial premises, prevents unauthorized access to equipment, and provides weather protection of equipment and long-term information storage.
Software
Alpha CENTER software is installed at all system levels. Alpha CENTER software is based on client-server architecture principles (Windows 2000) and ORACLE database management system.

A server with Alpha CENTER software in concurrent mode (simultaneously) automatically performs data collection from the meters and RTU-325, analyses data integrity, performance of additional calculations and collection of missing data. Processing and storage of commercial billing data and system operation settings adjustment is done on the server.

Alpha CENTER allows forming computational groups of measuring points, making automated calculations in accordance with the descriptions of computational groups and according to their time zones, compile archives of calculation results, support a unified system time with the aim of providing synchronized measurements. In order to facilitate high productivity, the system conducts automatic diagnostics and records all instances of malfunction in an event log.

Alpha CENTER presents commercial data in a form convenient for analysis, documents the power billing parameters in graphic forms and report printouts and formulates data for transmission to the Rosenergoatom Information Center.

Consumer System Specifications
A multi-user access mode is used in the Rosenergoatom Automatic Metering Testing Station. User rights are delineated via passwords of different levels. The operating life of a data acquisition and transmission unit is 24 years, and the operating life of meters is 30 years.

The system is amenable to further upgrading and development. For example, adding new metering points and increasing the number of automated user workstations is done without interrupting the operation of the system.

System Integration
Elster Metronica and Rosenergoatom have been working together in the electrical power field since 1997.

In addition to production of equipment Elster Metronica did the following work:
- Initial investigation of measurement systems.
- Development and coordination of technical specifications.
- Development of a detailed design and operational documentation.
- Examination and coordination of the project with the Nonprofits Partnership Administrator of Trade System and power system.
- Development and testing of measurement methods.
- Development of a method and program for testing.
- Installation and pre-commissioning work.

In next future it is planned to conduct metrological testing and commission the system. Confirm the compliance of the system to the technical specifications of the wholesale electrical power market with assignment of a billing system quality rating.
Results
The Rosenergoatom unified metering (AMR) system made according to all specifications and using quality equipment will become a state-of-the-art solution for organizing commercial billing of electrical power in Russia. Such a system is capable of providing complete and reliable information in practically real time (each 3 min data form all generators is collected in Moscow) on the amount of electrical power generated, released and received.

The Rosenergoatom metering system allows controlling sales of electrical power on the wholesale market, reducing commercial and technical loss, recording deviations from planned production schedules and electrical power consumption.

In addition, the greatest advantage of the billing system at Rosenergoatom lies not only in its precision and timeliness of receiving information, but also in its response to this information for optimising the loading conditions of nuclear power plants. This allows for maximum economic results from the generated electrical power and capacity and delivered to the wholesale market.

This facilitates Rosenergoatom's successful participation and acquisition of advantages in working both on regulated and competitive of the wholesale electrical power market in Russia.

ELSTER MC-250 Server Cabinets
The ELSTER MC-250 server cabinet consists of:
- RTU-325 data acquisition and transmission unit
- Data Base server
- Modems
- System Time synchronization device
- Monitor with integrated keyboard
- FO/485 converter
- Exchange for devices included in the server
- Optical cross-panel
- Thermostat
- Uninterrupted power supply
- Thermostats
Metering system for the largest Russian power Network Company "FGC UES" (Federal Grid Company of the United Energy System of Russia)

In 2005 Elster Metronica with its partners have finished the installation of the state-of-the-art metering system ALPHA CENTER on 150 substations all over the Russia. The system is specially designed for energy and power metering and billing purposes to work on the wholesale energy market of Russia. The metering system performs automated meter reading (AMR), data collection, processing, storing, and easy-to-analyse display of received data.

The metering system includes:

- High functional, fully programmable solid electricity meters ALPHA series.
- Data acquisition, processing and communication controllers RTU-325 series.
- Meter, RTU and AMR server's cabinets ELSTER MC-200.
- The Alpha CENTER software package.
- Data communication equipment, workstation.

Background

Federal Grid Company of the United Energy System of Russia (FGC UES) is the organization that manages the unified national (all-Russia) power grid and is one of the main elements of the wholesale electrical power market in Russia. Its main objective is to provide the customer with electrical power of the necessary quality and with a minimum of loss. In order to work on the wholesale electrical power market and integrate means of controlling company losses, it was necessary to create its own automated metering system.
Objectives
Creation of the metering system for FGC UES is one of the largest projects for integrating commercial metering systems in Russia. The metering system includes all 7 subdivisions of FGC UES power grids – Center, Northwest, South, Volga, Urals, Siberia and East.

Main objectives for integrating the billing system:
- Data collection from 150 sites with nominal voltage of 330 kW and higher.
- Full automation of commercial metering.
- Protection from unauthorized access and siphoning of electrical power.
- Monitoring and identification of loss structures.

System Solutions
The AMR system is being built based on Elster Metronica software and hardware:
- More than 6000 ALPHA Plus and ALPHA A1600 high functional, fully programmable solid-state electricity meters.
- 150 data collection and transmission unit RTU-325.
- 300 ELSTER МС-200 series meter cabinets.
- Alpha CENTER software for Enterprise Edition.
- Computer and communications equipment, workstations, database servers.

The AMR for FGC UES is being built as a hierarchical, territorially-distributed automated system including the following hierarchy levels:
- AMR sites level.
- Data collection and processing centers and intersystem power grid companies level – is included in the assembly schedule for future development.
- The DCPC IPGC level.
- The upper level of the FGC UES metering system.

Typical structure of the sites
FGC UES substations are equipped with ALPHA A1600 electricity meters with accuracy ratings of 0.2S and 0.5S (up to 40 items), which measure the active and reactive electrical power and capacity in two directions. All meters are equipped with an additional memory card for storage of load profiles and RS-485 digital interface cards for connection to communications equipment and data transmission to higher levels. The meters are supplied with a back-up power function to provide for the meters’ function if other equipment is shut off.

The focal points for metering in this structure are the RTU-325 data acquisition and transmission units. With the goal of easier installation and providing protection from unauthorized access to the collection center and its server, ELSTER MC-200-series meter cabinets was supplied.

All meters connect to the RTU-325 data acquisition and transmission unit through RS-485 interfaces while accounting for a large number of metering points. The data acquisition and transmission units were equipped with 8 RS-485 ports, which provide the capability of connecting a large number of meters. ALPHA meters are provided with the capability of assessing the operating condition of the grid. At the design stage, limitations were imposed on a number of meters connected to one interface, which provides the capability collecting data on the operating condition and transmitting it from data acquisition and transmission units with a frequency of no more than 3 minutes.

For time synchronization, a GPS receiver was installed at each substation.
Typical structure of collection centers

The ELSTER MC-250 server cabinets provide storage and support for the functional part of the collection center. The communications server, to which a modem is connected, provides the capability of expanding the modem configuration for connection of a large number of sites. Interaction between them and automated workstations is accomplished with the aid of an exchange. Each collection center is provided with time synchronization. Each collection center is equipped with a network printer for printing reports.

The main communications channels for collections centers with substations (RTU-325 data acquisition and transmission units) are telephone exchange and dedicated lines. Fiber-optic and GSM digital communication lines are also used for data collection. The spare channel is data transmission over proprietary subsystem channels of low Earth orbit Gonets AMR satellite communications.

The planned sampling rate in data collection centers in intersystem grids depends on the status of communication with a specific site and is anywhere from 30 minutes to 24 hours. The data collection and processing centers being made in the OAO FGC UES intersystem grid and executive apparatus have a generic structure. In order to provide for data collection from a large number of sites in the server part of the DCPC, supplied within a 19-inch box, a separate communications server and DB server are provided. The capability of collecting data with all available communications resources is supported. Protection of data and DCPC functions from unauthorized access is provided for by the software and hardware (authorization and authentication of users, organization of a separate VLAN 1 network, packet filtration), as well as limiting of physical access to the DCPC server.

The highest-level collection center uses both Internet and telephone exchange channels. Within the framework of projects developed for AMR of the first order, data transmission and exchange with adjacent sites is provided by using e-mail resources.
AMR provides for interaction with other FGC UES information systems that are part of the corporate information management system – exchange between the AMR and the executive system, maintenance management system, repair and other systems. Alpha CENTER provides for data export-import formats on the basis of which data exchange with adjacent sites is possible.

Results
The FGC UES metering system was created in 2004-2005. Construction and pre-commissioning was completed at all substations and tests were conducted. Construction and mounting work in the data collection centers was also completed. The system has been commissioned for trial operation.

The FGC UES metering system provides automated data collection from all of 6000 electricity ALPHA meters. The objective that was set for the system was achieved, and the system was commissioned.
AMR system of Armenia

In the middle of 2002 the metering system of Armenia was put in commission. Metering project of Armenia metering system began in 1999, when Elster Metronica, Moscow, Russia supplied 3000 meters (are used in system) of A1600 ALPHA type. In the beginning of 2001 year Elster Metronica started introducing it's in-house design - Alpha CENTER metering system. The Alpha CENTER system in Armenia automates electricity metering of whole country and covers 14 power stations and 14 high-voltage substations.

The task of the designed system is to provide all participants of Armenian electricity market with the necessary information about energy generation, distribution and consumption. Specialists of Elster Metronica set the system up and trained Armenian engineers to use the equipment efficiently. The Ministry of Armenia supervises this project and in December the system is being put in commission.
Metering system of Armenia comprises more than 3,000 ALPHA meters.
The Customer Company: Oktyabrskaya railroad (Moscow-Sankt-Petersburg-Murmansk)

Starting point:
The railroads in Russia are among the largest power consumers. Millions of kilowatt-hours are spent for hauling operations and functioning of enterprises included in the system of the Ministry of Railways of Russia. Currently, a specific share of expenses for electric bills amounts is nearly up to 15% for railroad networks, including 8% for electrified railroads thus exceeding all other costs being second only to the wages fund.

Main objective: Cutting down the cost of electric bills
In modern conditions, when the federal wholesales market of energy and power (FOREM) is being formed, the main way to cut down the costs is nothing but the provision of railroads with the state-of-the-art time-of-use (TOU) meters, introduction of automated meter reading systems (AMR) and entering the FOREM.

Integrated solution: Installation of TOU meters and AMR
Introduction of new technologies was carried out by stages. During 1997-2000, more than 2,000 electricity ALPHA meters were installed throughout the railroad covering basic commercial billing activities. Total for railroads of Russia it was produced 10,000 ALPHA meters.

In the year 2000, in the framework of metering automation activities, the Alpha CENTER AMR system was launched. The Alpha CENTER AMR system was designed by Elster Metronica’s engineers and programmers with regard to specific needs of large consumer enterprises and power utilities. Data collection and processing centers form the basis of the system.

System structure
In the framework of the project, the data collection and processing system as well as the data display system can be distinguished. The structure of the data collection system is represented by the four-level architecture:
1. Meters level.
2. Communication servers level.
3. 1st-level data collection and processing centers level.
4. 2nd-level data collection and processing centers level.
This architecture made it possible to organize data collection from a vast territory. Currently, three communication servers located in Moscow, Bologoye and Petersburg are collecting data from traction substations spaced at several hundred kilometers. The specific feature of this project is a joint utilization of communication channels with the remote control system that imposes limitations on the meters handling rate (50 Bd). Communication servers collect data according to a schedule that can be flexibly adjusted.

For instance, if the meters interrogation is performed by means of conventional telephone lines (automatic telephone exchange), then in the day-time the lines can be used by the plant personnel, and at night can be switched over to the data collection system.

Every communication server simultaneously collects data from several communication lines. Several communication servers operating in parallel deliver data to one database server (the 1st level data collection and processing center). Data collection and processing are fully automated.

The software package keeps a continuous track of data completeness and performs additional collection of data that are missing. Then these data are automatically involved in calculations. As the result, the system users continuously follow actual power demand conditions. Information in this case can be represented with a various degree of detailing.

The data collection and processing centers are organized on the basis of servers Windows NT. The professional multiuser ORACLE DBMS is used as the database. The software has the client/server architecture. In the Alpha CENTER version 2.05.5 the applications load balancing has been performed, thus making it possible for remote users to communicate with the database using conventional telephone lines. Alongside with this, the entire system has a multi-level data protection system (on the OS level, on the DBMS level, on applications level).
Software content
Applied software and maintenance documentation are supplied on CD (415 Mb).

Applied software includes:
- Communication server.
- Calculations server.
- System control modules.
- Package for generation of a basic set of users with an access right differentiation
- Database scheme image (dump) with a completed reference data system.
- Client's software (screen interfaces, reports generating modules).

The delivery includes a coordinated DBMS ORACLE (standard edition) version provided with engineering support for a period of one year and a complete set of applications software installation packages for applications server, communication server and the user workstations.

The advantages of integrated solution represented herein are as follows:
- Parallel data collection
- Parallel calculations and diagnostic system.
- Multiuser mode of operation
- Client/server architecture
- Scalability and extensibility

Final results:
The meters and the system handling expertise testifies to a high efficiency of the solutions applied, namely: reduction in power consumption for hauling operations, overall cutting down of the railroad electric bills costs and reduction in the unit power consumption per unit of cargo conveyed.

These results were obtained due to
- Increased energy metering accuracy.
- Transition to time-of-use energy billing.
- Reduction of the customer contract demand during the power system peak hours.
- Load control.
- Organization of data collection from the ALPHA meters installed.

Comprehensive energy resources metering
The next step in the work planned to develop the integrated AMR system for Oktyabrskaya railroad will be elaboration of the automated energy resources metering system for the Oktyabrskaya railroad energy-intensive enterprises (depots, terminals, stations). Introduction of this system will allow the enterprise to organize metering of consumed electrical and thermal power, including hot and cold water, gas by means of installation of energy, heat, water and gas meters and, consequently, to proceed with payments for consumed and metered resources in settlements with their suppliers.
Изменение расхода на тягу по одной из подстанций за три дня.

Examples of Alpha CENTER AMR system screens
The Customer Company: Surgutneftegaz (oil & gas)

Surgutneftegaz – one of the leading oil & gas companies in Russia.

Starting point:
In recent years, Surgutneftegaz, like all other Oil and Gas companies, was facing the problem associated with a raised share of expenses in the cost of oil.

Main objective: Cut down the cost of oil at the expense of comprehensive updating of electricity metering
One of the ways to raise the efficiency of energy management at the enterprise is mainly associated with energy resources demand metering, and particularly, the electrical energy. That was the reason why Surgutneftegaz took a decision to carry out comprehensive updating of electricity metering through installation of digital time-of-use meters and organization of advanced automated meter reading system (AMR).

Integrated solution: Installation of time-of-use meters and AMR system introduction
The updating was carried out by stages and finally has been introduced throughout Surgutneftegaz AMR system.

At the first stage of the project the master power-supply sources and some one-part consumers were provided with 2,000 ALPHA meters. The ALPHA meters developed by Elster Metronica were accepted for application as the result of comparison of all electricity metering products available on the market with regard to such features as price/quality, functional capabilities and operation within the AMR system. The ALPHA meters provide electricity and power metering with an accuracy of 0,2S, bidirectional active and reactive energy measurements, storage of billing data for a period of up to 6 months and have digital interfaces for their integration into metering system.

The second stage – integrated AlphaMet solution.
The important task to be solved at the first stage of the ALPHA meters introduction was the formation of a basis for introduction of the AMR system that would be capable of energy and power demand management. In the framework of the AMR system development it has been decided to collect the ALPHA meter readings via various communication channels using the AlphaMet system.

The AMR system allows to perform:

- Active and reactive energy demand metering (including reverse flows) for given time intervals including individual meters, preassigned groups of meters and the whole enterprise with due regard for the time-of-use capability.
- Calculate average (half-hourly) active power (load) values during day- and night-time maximum demand periods including individual meters, preassigned groups of meters and the whole enterprise.
- Generate half-hourly and, if required, three-minute load patterns needed to organize efficient power consumption at the enterprise.

Surgutneftegaz made use of several standard versions of the AMR system organization with regard to the enterprise specific features:
**AMR for meters interrogation via optical port**

The system of this type was used when the meters were spaced at too large distances, and communication channels were unavailable. In this case the number of meters is not limited since the interrogation is performed “individually” by means of a portable computer via Unicom Probe cable.

**AMR for meters interrogation via multiplexer**

For this AMR type the meters interrogation is performed by means of Elster multiplexer which provides possibility for connection of up to 16 meters. In this case the meters are placed at a distance of 1-1.5 km from the computer to which a multiplexer is connected.

**AMR for meters interrogation via modem**

This way of the system organization was realized at substations having reliable communication channels, the meters were integrated by means of a multiplexer and were placed at a distance of not above 1.5 km from the local computer.
Final results:
Remarkable economic efficiency and reduced cost of oil.

Today, the Metering System system collects and processes data coming from over 2000 energy meters. For the first time, after the meters were installed at master substations, there were obtained virtually true data on the demand quantities and patterns. The forecasting accuracy in energy and power demand remarkably increased and became much more simple.

Expertise in ALPHA meters and AMR system operation at Surgutneftegaz testified to considerable economic efficiency of their application amounting to 88 thous. rubles per one meter p.a. It was attained due to:

- Modernization of commercial and technical billing.
- Remarkable costs reduction due to strict power supervision.
- High forecasting accuracy in probable future demand.
- Optimization of electrical networks performance at the expense of cutting down active energy and power demand.
- Limitations of the power system peak hours active power demand.

A fairly important consequence of the meters and the system introduction is an ever-growing mutual confidence between OAO “Surgutneftegaz” and the Surgut power utilities (who have also installed the AlphaMet system). This became possible due to strict meter data readout supervision mutually performed by the enterprise and by the power utility. Now both, the producer and the customer only enjoy advantages from mutually beneficial cooperation. The former enjoys significant savings in energy demand, and the latter has a reliable client who timely clears the electric bills.
The Customer Company: Kolenergo (power system)

Starting point:
Today, the transition to the market economy requires radical changes in organization and activities in the national power-engineering sector. In recent years, the program for the development of the Russian Federal Wholesales Market of Electrical Energy and Power (FOREM) has been rapidly elaborated. However, this process faces a number of problems, one of them being associated mainly with the necessity to carry out large-scale re-equipment of electricity metering devices and organize automated meter reading systems (AMR).

Main objective: Entering the FOREM
In the framework of transition to the FOREM, Kolenergo outlined its activities as follows:
- Updating of electricity metering. Installation of the time-of-use meters of high class of accuracy 0.2S.
- Elaboration of systems for meters data collection and introduction of higher-level software for data storage and data processing.

New equipment in this case should undergo metrological certification, be certified by the Gosstandard Russian Authorities and be capable to assure proper protection of commercial information.

Integrated solution: Organization of the advanced AMR system
In November, 1999 at "Kolenergo Ltd" an intelligent AMR system with the Alpha SMART distributed data processing system was put into commercial operation. The project lasted as long as two years and included the ALPHA meters installation, arrangement of the automated data collection system and a prolonged period of pilot operation. This article will give you the knowledge of the results obtained during the year after the system was put into commercial operation.

Elster Metronica supplied equipment to "Kolenergo Ltd" substations and performed a full scope of work on the system introduction at these substations, system upgrading to meet the Utility and the North-West Integrated Dispatching Service (IDS) requirements including testing of communication channels and the complete system adjustment.

System structure and functions
The system includes the Kolenergo intersystem connections with the Kolskaya nuclear power plant and Karelenenergo. The system integrates two substations: the Kolskaya nuclear power plant and the hydro power plant GES-11.
The meters data are automatically (in 3-minute intervals) delivered from these substations to data collection and data processing units RTU-310. (The system block diagram is given in figures). At substations, the RTU employs interface RS-485 for meter data readout. At the Energosbyt and the Automated Dispatching System (ADS) the dial-up PLC channels are used.

Time-shared RTU data are delivered via dial-up channels to:
Energosbyt (once a day) for generation of commercial reports on Kolenergo intersystem connections. These reports are transferred to the Energosbyt billing department.

The substations are provided with the higher-level software that provides the real-time monitoring.

**Works performed**
Under this project, Elster Metronica, alongside with production and supply of basic equipment, performed the work as follows:
- Development and coordination of the AMR project.
- System upgrading according to Kolenergo and the North-West IDS requirements.
- Supervision of installation, start-up and adjustment.
- Personnel training.
- System certification at the substation and putting into commercial operation.

The company has undertaken to support the system throughout the whole period of its operation. The warranty period for the whole equipment will be 3 years.

**Final results**
- Volume and validity of the obtained data on energy flows in the AMR system meet requirements set forth in regulatory documents.
- Data stored in the ALPHA meter fully coincide with information read by PCs.
- The AMR sample output reports meet Kolenergo users' requirements.
- Intercomputer data exchange on interstate flows between Kolenergo and the "North-West" Integrated Dispatching Service (IDS) via dial-up channels was organized.
- Data transmitted to the North-West IDS meet the FOREM commercial metering and billing requirements.
System development

The expertise in the Metering system handling testifies to correctness of engineering solutions applied and shows vast prospects for AMR system based on digital meter data transmission. In this connection, a decision was taken to continue further development and improvement of electricity metering by means of the following programs:

- Increase the amount of meters at the Kolskaya nuclear power plant to make it possible to calculate the overall balance of the plant.

- Organize dedicated channels between the substations and the Kolenergo ADS to provide supervision of operating conditions.

- Organize the higher level in Kolenergo and Energosbyt making use of UNIX servers and ORACLE database for billing procedure automation.
Elster Metronica has developed and installed the automated meter reading system (AMR) on the Armenian railway.

In April 2004 the AMR system was commissioned. The project documentation was prepared by the company energy Energosetproject. Elster Metronica made the delivery of the equipment. At 35 traction substations of the railway 200 EuroALPHA meters and Software Alpha CENTER AC_SE were installed.

In the opinion of transport and communication minister of Armenia Mr. Manukyan, the preliminary results of AMR system operation at Armenian railways have shown that the main task – electric power cost saving – has been solved. At present the cost saving already amount to 15-20% and this system enabled to control more than 90% of electric power consumed by traction substations.

The users have noted multifunctionality of Elster Metronica equipment and software and also opportunity of immediate estimation of a substation condition for the accurate metering of the consumed electric power.
Modernization of Energy Billing in Georgia

PA Government Services Inc., with the financial support of the United States Agency for International Development (USAID), under contract with the Unified Energy Distribution Company (UEDC), Tbilisi, have begun modernizing electricity metering at the main sites in Georgia, at power network substations and primary consumers. The Russian company Elster Metronica was selected as the equipment supplier and manufacturer.

Elster Metronica has a wide international experience of large-scale AMR projects and produces all the necessary equipment for project execution of metering systems were produced, supplied and be installed at substations in Georgia in 2004:

- High functional, fully programmable solid state electricity meters ALPHA series.
- Meter and AMR servers’ cabinets.
- The state-of-the-art Alpha CENTER AMR software package.
- Data communication equipment, workstations.
- 440 ELSTER MC-210 Meter Cabinets were installed at substations, including those in remote mountainous regions of the country.

ELSTER MRC-200 series is a product family designed to combine all essential AMR equipment into one elegant industrial cabinet. The MRC-200 Meter Cabinets incorporate meters, data processing controllers, converters, modems, communication equipment and AMR Server.

ELSTER MC-210 Meter Cabinets include the ALPHA A1600 high functional solid state electricity meters, GSM-modem and back-up power device. The Meter Cabinets were assembled and tested and at a factory in Moscow and were supplied as a ready-made product. This eliminates the need for a mounting and set-up process by local specialists and significantly reduces the time needed for commissioning work and the integration of the automated meter reading system on-site.

The ELSTER MC-250 Meter Cabinets with AMR Server, workstation, modem pool, UPS, climate control and Alpha CENTER software is installed at the data acquisition and processing center in Tbilisi. The supply kit includes communications equipment as well – GSM-antennas, cables and other communications systems.

Incorporation of Automated Meter Reading system components into the Meter Cabinets with an access protection system allows cutting down on unauthorized use of power resources.

Earlier, Georgian specialists (Power IT), with the participation of Elster Metronica, created an automated meter reading (AMR) system in Poti, the main port city of Georgia. The system uses more than 40 ALPHA A1600 meters with Alpha CENTER software. However, at present, the capabilities of this system allow only data collection via an optical port with the aid of LapTop. In the future, there are plans to increase the number of collection points to 50 and make data collection fully automated.
Power Utilities

AMR system Surgut netorks (1996-97)
Tyumenenergo, Russia, West Sibiria
Equipment: ALPHA polyphase multifunctional meters (500 pcs), software, primary and support equipment for AMR (Automated Meter Reading system)
Solution: AlphaMet ver.2.16

Modernization of metering equipment (1996-97)
Tyumenenergo Russia
Equipment: ALPHA meters (4000 pcs), AlphaMet software, primary and support equipment for AMR, Establishing of Service Center in Tyumen region
Solution: EmPplus, reading through optoport

AES Telasi, Georgia
Equipment: ALPHA meters, software, primary and support equipment for AMR, AMR Alpha SMART
Solution: Alpha SMART

AMR systems of generation of Yarenergo (1999-2000)
Jarenergo, Russia
Equipment: ALPHA meters, software, primary and support equipment for AMR, AMR Alpha SMART
Solution: Alpha SMART

Kolenergo, Russia
Equipment: ALPHA meters, controllers RTU-300, ALPHA meters, software, primary and support equipment for AMR, AMR Alpha SMART, PC, communication servers, data bases. Establishing of Service Center with Calibration and Testing laboratory
Solution: Alpha SMART

Ministry of Energy of Armenia
Equipment: ALPHA meters (10,000 pcs), controllers RTU-300, ALPHA meters, software, primary and support equipment for AMR, PC, communication servers, data bases, Alpha CENTER (Oracle + Windows NT/2000)
Solution: Alpha CENTER

AMR system MES CENTER (2001-2002)
United Power Grid of Russia
Equipment: ALPHA meters (500 pcs), controllers RTU-300, ALPHA meters, software, primary and support equipment for AMR, PC, communication servers, data bases, Alpha CENTER (Oracle + Windows NT/2000)
Solution: Alpha CENTER

AMR system turnkey project for Dneprohydroenergo (2001-2002) (EBRD finance)
Alstom for Ukraine customers
Equipment: ALPHA meters (350 pcs), controllers RTU-300, ALPHA meters, software, primary and support equipment for AMR, PC, communication servers, data bases, Alpha CENTER (Oracle + Windows NT/2000)
Solution: Alpha CENTER
Industry

Organization of metering in Noyabrsk Oil and Gas company (1996)
Noyabrsk Oil and Gas company, Russia
**Equipment:** ALPHA meters (400 pcs), AlphaMet software, primary and support equipment for AMR
**Solution:** EmfPlus, optoport

AMR system for Surgutneftegas (1997-2000)
Surgutneftegas, Russia
**Equipment:** ALPHA meters (2000 pcs), software, primary and support equipment for AMR, AMR AlphaMet, PC, communication servers, data bases. Calibration and testing laboratory
**Solution:** AlphaMet 2.19, dedicated, dialup lines, optoport

Modernization of meters on Tatneft (Oil & Gas) (1999)
Tatneft (Oil & Gas)
**Equipment:** ALPHA meters (1000 pcs), software, Calibration and testing laboratory
**Solution:** EmfPlus, AlphaMet

Udmurtneft (Oil & Gas) (2000)
Udmurtneft
**Equipment:** ALPHA meters (500 pcs), software
**Solution:** EmfPlus, AlphaMet

AMR systems for Urengoygazprom, Tymentransgaz, Lentransgaz, Mostransgaz, Gazprom (1996-99)
**Equipment:** ALPHA meters, software, primary and support equipment for AMR
**Solution:** EmfPlus, AlphaMet

AMR system for Oil pipeline "Druzba" (1999-2000)
Transneft
**Equipment:** ALPHA meters (1,000 pcs), controllers RTU-300, ALPHA meters, software, primary and support equipment for AMR, AMR Alpha SMART, PC, communication servers, data bases
**Solution:** Alpha SMART

AMR system for Russian Railways (1996-2004)
Ministry of Railways of Russia
**Equipment:** ALPHA meters (10000 pcs), controllers RTU-300, software, primary and support equipment for AMR, PC, communication servers, data bases, Alpha CENTER (Oracle + Windows NT/2000)
**Solution:** EmfPlus, Alpha CENTER

AMR system for Gazprom (2005)
The largest gas producing company in the world
**Equipment:** ALPHA meters, controllers RTU-300, ELSTER Metering Cabinets, primary and support equipment for AMR, PC, communication servers, data bases, Alpha CENTER software (Oracle + Windows NT/2000)
**Solution:** Alpha CENTER

In all projects: development of requirements specifications, project specifications, training, verification and commission