

Aspects of Energy Use Monitoring Systems

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Abstract: The system presented is based on Energomanager application installed on large energy consumers. The application is described in detail in the latter part of the paper; to the first part is the description of acquisition and communications equipment used. Teleinventory system performs a complete solution for power management, both at branches and at branches, using the most modern information and communication technologies.

Key-Words: Electric and solar, Data acquisition, Communication, Monitoring.

1 Introduction

The most important sources of energy currently used technologies available, are represented by fossil fuels, the most common types of fuels such as oil and products thereof, natural gas and coal. Currently, approx. 85...90% of annual energy consumed on Earth, is produced by burning fossil fuels [14]. In 2030, it is estimated that in terms of source used, the structure of energy production will be: 75...85% of conventional fuel combustion, 10...20% fission, 3...5% of waterpower, approx. 3% of solar and wind. For 2030, given the pace of population growth, energy production is projected to reach 22 Twa/year and given the pace of economic growth will reach 36 Twa/year. Of these amounts, the electricity is about. 18 ... 20%, a significantly higher percentage being represented by the heat [4].

2 The Acquisition

Data acquisition system used to monitor power and energy is composed of counters equipped with pulse outputs of several types (Iskra producing companies, ABB, etc.) and adder (Poreg 2, or Iskra P2S Communicator) depending on the number of entries necessary. If consumers equipped with ABB counters equipped with the system load curve could acquire data directly by using AlphaPlus application (program offered by the company ABB) in the lite version and storing data in the same system. For such consumers, at this point are available by following the curves of load in the near future to be contained and values and indexes

billing meter. Block diagram of a system acquisition can watch the application description [11]. Data acquisition systems located in substations Electrica was equipped with UPS (Uninterruptible Power Supply) and voltage stabilizers to protect from shocks of the network and communication equipment with galvanic decoupling, and other solutions for protection to atmospheric discharges.

3 Network Communications

Communications network is based on 3 types of communication: radio communications in the 2.4 GHz band RS232-TCP/IP conversion, communication modems, GSM and GPRS with dial internal communications and Electrical and the public telephone network (Romtelecom) with ordinary modems. Radio communications are made by connecting radio network headquarters CNLO Electrica Oltenia and transfer data on a server in an internal database format SQL Server. Data transfer can be done on request or can be programmed to start automatically after a given program [7].

Data acquisition is done in servers CNLO (National Company of Lignite Oltenia). At stations equipped with converters can be RS232/TCP-IP access and direct access to the adder for parameterization is allowed only with password. Communications GSM based modems are at refueling of motor vehicles (Petrom) direct access of add-ons.

The general scheme of the communication network is shown in Fig. 1.

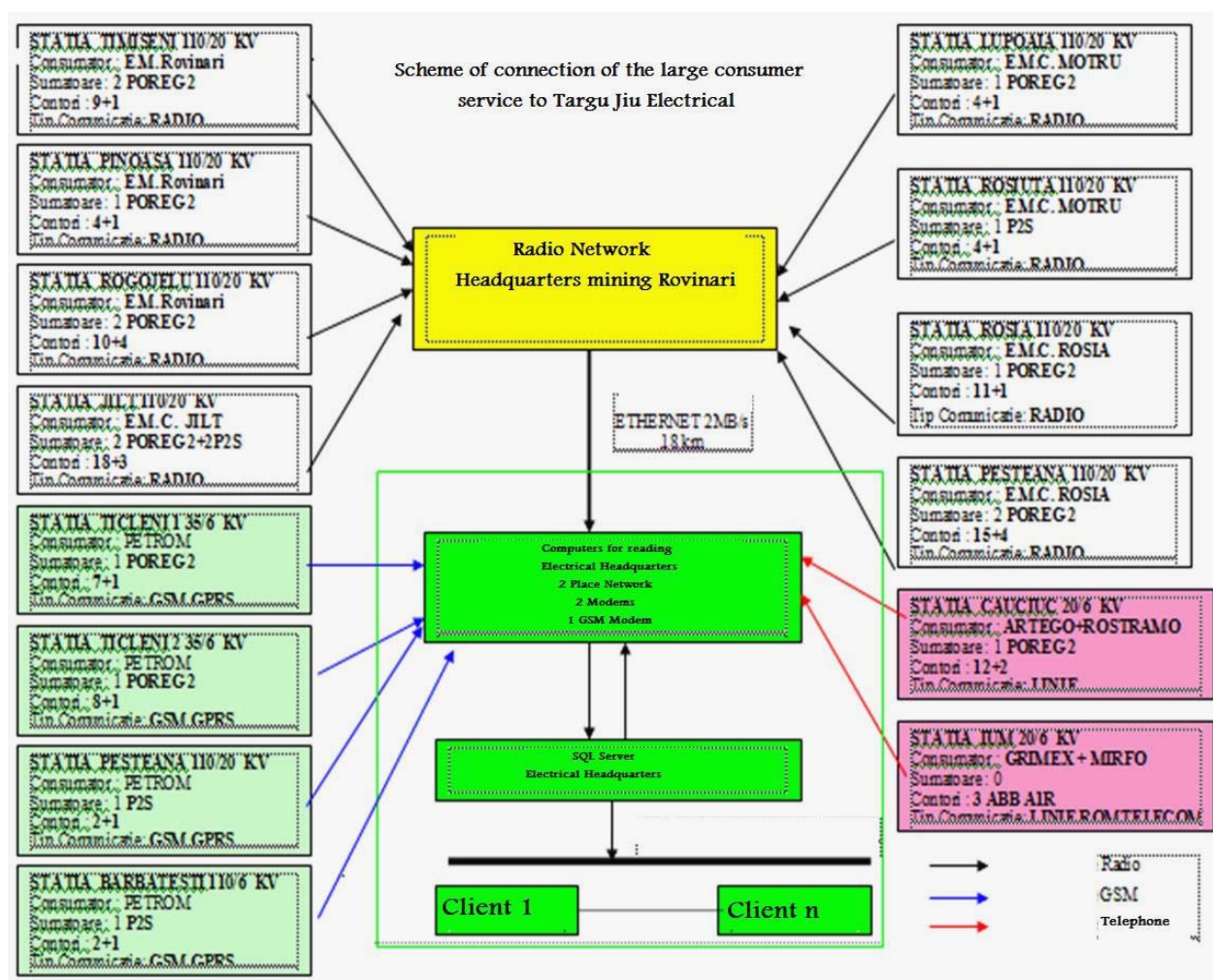


Fig. 1: The general scheme of network communication.

4 Application Software

Data acquisition consists of a server application for transfer of data from servers to clients on the server dedicated Electrical written application. To purchase data directly from the adder is used Energomanager application [13]. For consumers where there is no adder but counters ABB, modems and communication lines have created an application for reading and transferring data in database application based on Energomanager convert text files generated by the program Alphalite. Also this application was written and dedicated to Electrica.

To view and print a customer's data was based on unit dedicated Electrical Energomanager V1.0 client application that was removed pursuit of online traffic to avoid undue growth. However, the computer which makes data acquisition (if necessary or for certain studies) may be used and On-line application. This allows visualization of power on all lines at intervals of 30 s. On this computer there is the possibility of depth analysis for specific customers using version 2.0 of the

application Energomanager. Data acquisition of both the adder Iskra allows analysis of load curves as well as values that billing computer replication Euromedia panels [12].

5 Integrated Energomanager

Using power tariffs and taxes for billing electricity consumption has great need of this application based on the following considerations:

1. Stick to power and energy consumption is beneficial to the consumer price by getting a lower return per MWh as well as the provider is not obliged to take measures to cover these additional costs overruns. The use of contracted too much power leads to enormous unnecessary costs and use of contracted power limit without consequences may also lead to huge costs through penalties only by overcoming a period of 15 minutes in a month contracted power [10].

2. The possibility of a follow-up can lead to avoid exceeding the contracted power. The idea is based on using 15 min measurement period for adjustment so that the average power consumption

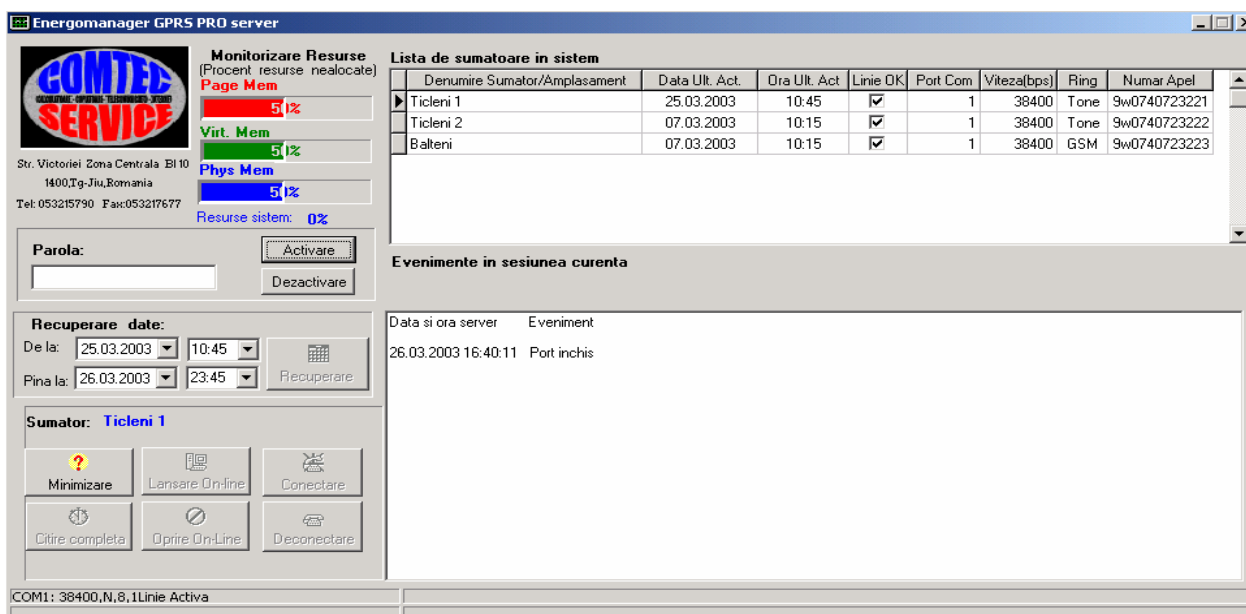


Fig. 2: Screen Control Server.

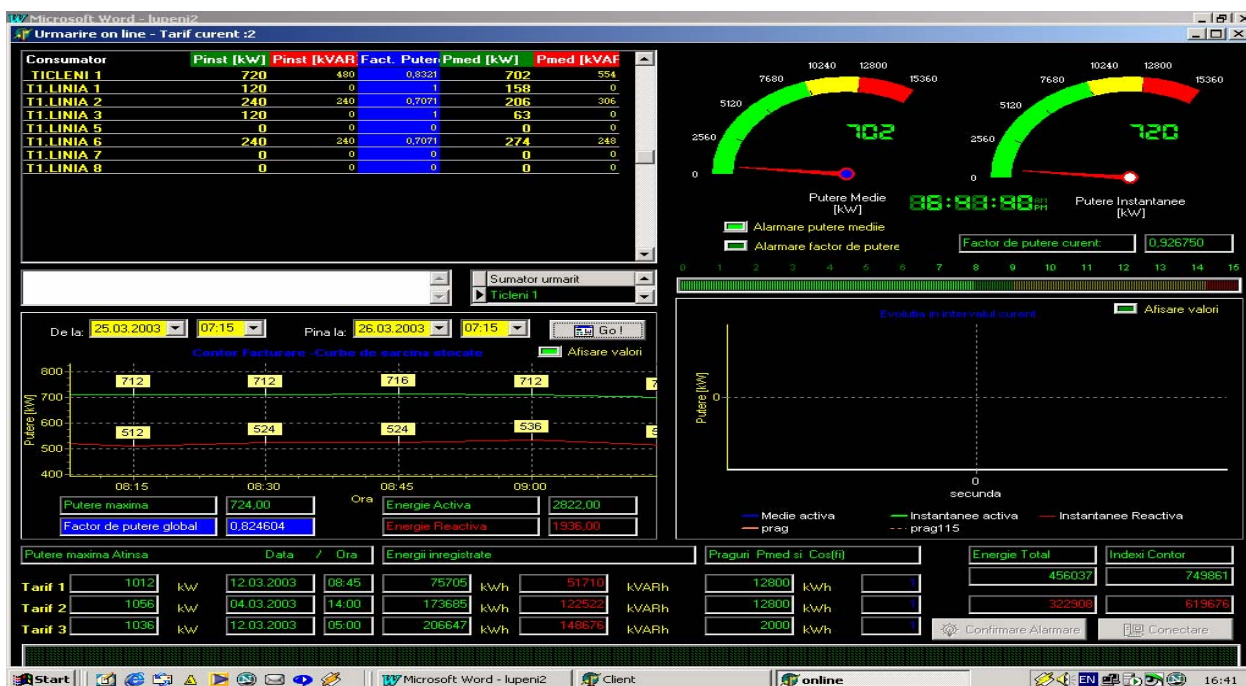


Fig. 3: Screen Force - online tracking.

in this period does not exceed preset threshold. Thus, average power measured continuously from the beginning of the measurement at 30 s intervals and warn the user when approaching a threshold that can stop a consumer hub that at the time the power measurement to be registered under the threshold. The issue hit the target by the time the measurement is a false problem because the last time period if the measure should go below this threshold the average increase above the threshold can be carried only instant power increased dramatically.

This risk still exists but his appearance may occur only in limited circumstances [8].

3. Besides the above user can offer information on consumption distribution lines, shops, workshops expenses as energy, time and loading machines [2].

4. Analysis of the consumption curves and a period can help consumers and suppliers to make a decision to switch to an appropriate pricing system.

5. Possibility summation real-time power can demo account described in the schedule, and taking into account only can billing related customer lines (and not an output transformer supplier [6]) has led to a solution based on the adder.

The application is a data acquisition system of the recorder type Iskra Poreg2 Data Logger or P2S

Press Iskra and contains 2 modules that perform the following functions:

A. *Server module*: These modules are for reading data from the recorders and store them in a database. There are two modes of operation for this module:

1. Synchronizing internal clocks with an error adder's max. 2 s.

2. Recovery curves of task and of journey events during periods in which for any reason the online mode was not active (communication interruptions, lack of tension, failure of the computer). It

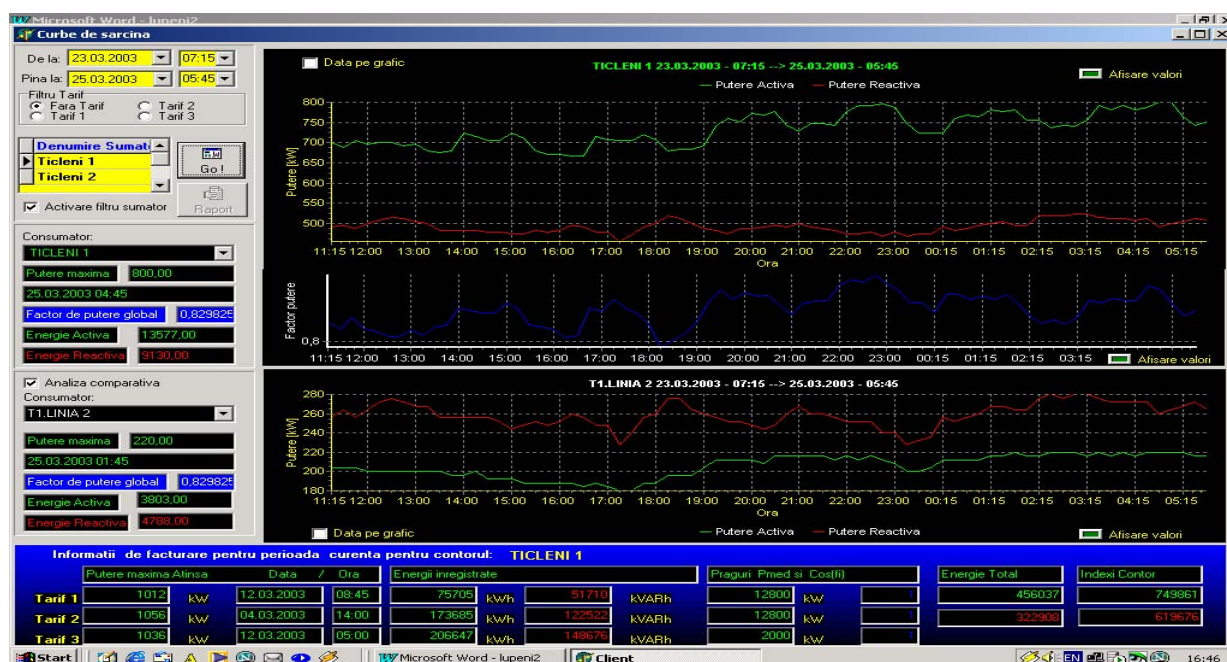


Fig. 4: Comparative analysis of the load curves.

How On-line:

1. Data acquisition in power and time: this mode allows reading data from Seattle regular intervals by the user between 15 s and 5 minutes and their transmission to the client module with a maximum delay of 5 s. The advantage of using this system reside in that store data and summing the counters add-ons is coupled to inputs in real time limit is imposed only by the ratio of energy per pulse of the meter. The system allows the customer billing pursuit in this case of strength in real time by summing up the powers of the lines [1].

2. Energy acquisition and billing: the end of the measurement system download energy values for each entry such as information relating to energy consumption is shown with frequency measurement period. Also, all the end of the period of measurement are read values stored billing (power, energy) so the billing period (usually months) but the actual last concluded.

3. Other functions fulfilled: automatic reconnection in case of error line, displaying a log (file with a.txt) with events in the current session.

Off-line mode: a way of working is the server is not permanently connected with consumers' and enable the user to execute the application connection and read data in online mode and the following additional functions:

mentioned that an adder loaded with 16 entries retained within the load curve for a period of about 53 days.

The client: Enables processing of acquired data to the server and displaying them in a user friendly manner [5]. Allows the user to track all of the current energy purchase a server on a single screen. It contains:

- The curve of load on the current range with resolution to read until second period as the threshold current of power appropriate contract No. current.
- Display the average power during the last period of the measure and average power of reading lately on virtual instruments marked with yellow and red near the top to the overrun.
- Display current day load profile on the resolution of the latter period values in the adder.
- Show all lines in tabular form with information system for power and power factor.
- Show data recorded for the current billing.
- Acoustic warning the user if the default overruns.
- Acoustic warning the user if the descent below the predetermined power factor [3].
- Warning sound if the user hair connection with the server.
- Acoustic warning the user upon termination of data acquisition server.

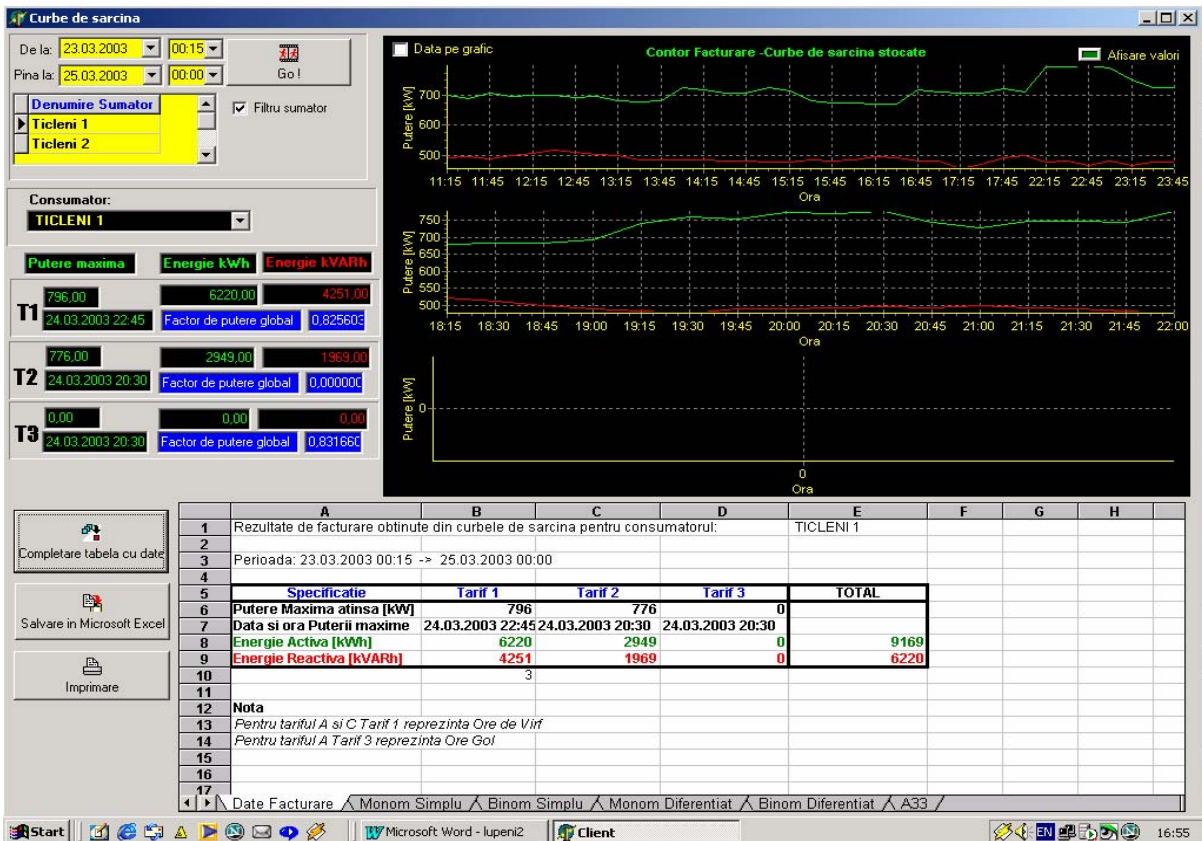


Fig. 5: Calculation of the energy bill.

- Maintenance of a log file that are recorded alarms and user confirmation for further study. Such a record contains the local computer date and time, date and time value of consumers' power and the

alarm thresholds and if the user is there and confirmed by pressing a button with the mouse before alarm).

Off-line mode: Enables the processing of task

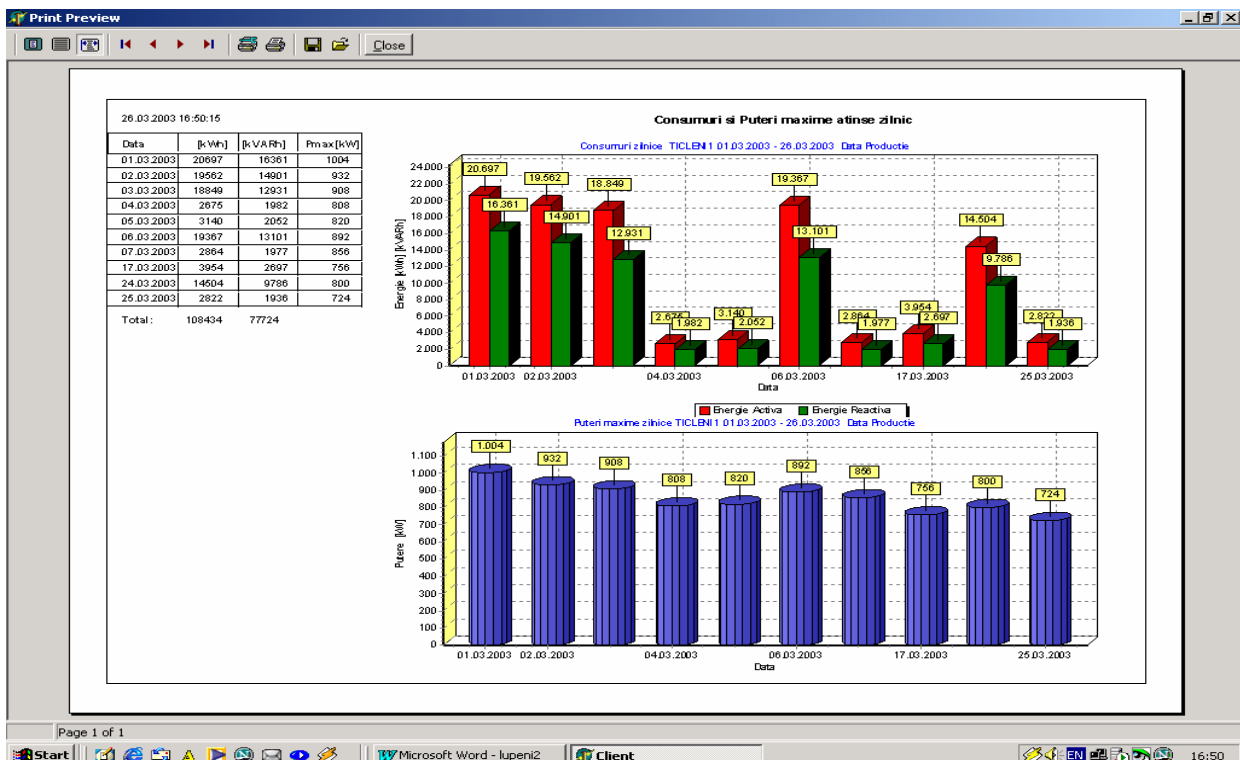


Fig. 6: Screen Daily consumption - view before printing.

information curve and extraction of text and graphic reports for further analysis on energy consumption and electricity costs. It enables the study of electricity costs on any return period of kWh price calculation taking into account both charges and reactive energy power.

these links in Microsoft Excel sheet and their storage and processing of this application. For counters calculated load curves are obtained by adding energy at each interval. This is the only safe solution billing software counters calculated.

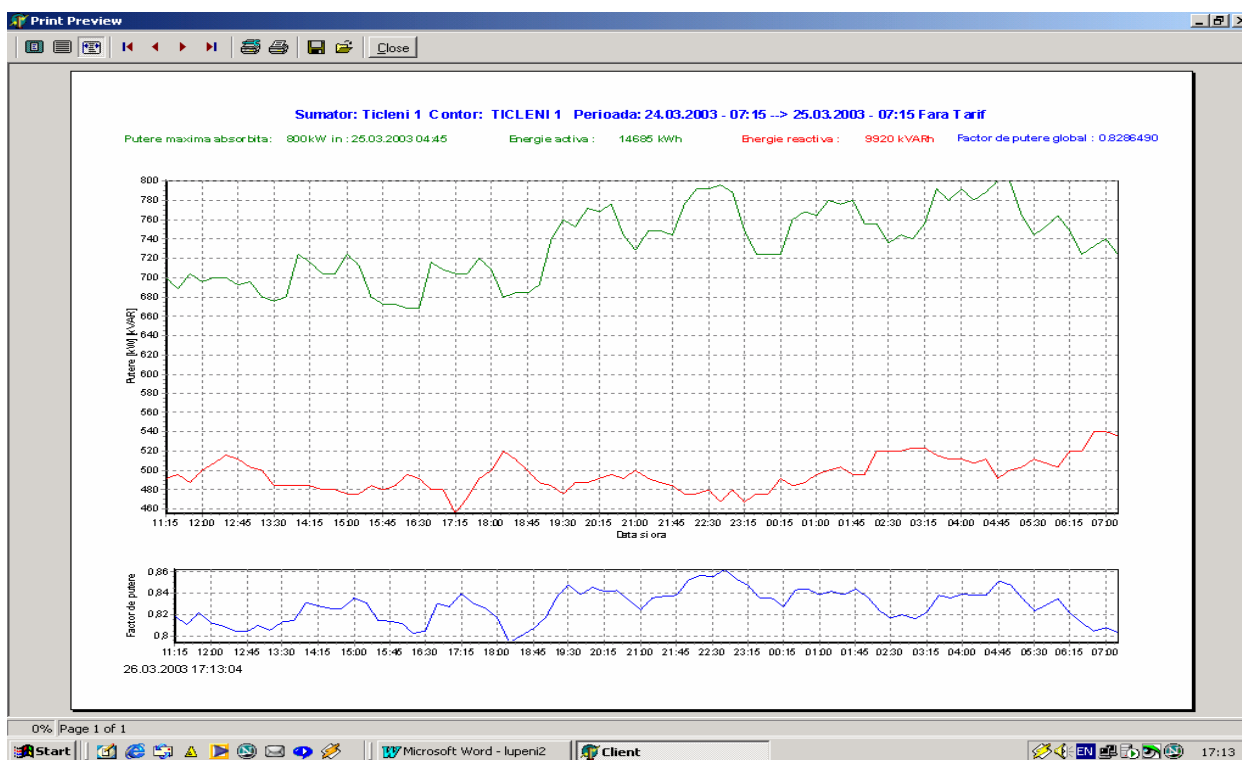


Fig. 7: Screen ratio chart - load curve.

Functions performed in offline mode are:

1. Study load curves and parameters of billing in the current load period with the possibility of comparative analysis between the lines by extracting essential parameters of the curve of load on the requested period. It also admit extraction of parts of the curve corresponding tariff rates set by existing table to table initial. This configuration can be automatically completed with one of the rates in force in Romania or manually with a user fee.

2. Energy study two systems of time: date of production (in which the user configuration that defines its time to start working on for easy reporting of specific consumption) or the calendar day (beginning at 00:00). The possibility of printing the report may give the user a complete view on consumption Analysis of actual costs with electricity is made using energy bill option. This allows the time requested billing rates to be automatically extracted depending on the billing tab and sent a check Excel where the user can describe their own "sheet" sites depending on the contract and the prices negotiated with supplier and types of fare used. Also, this control may be included consumers who are not entered into the system based on visual readings. Also useful is exporting

6 Description of a Centralized System Teleinventory

Descript system still applied for Branch of Electricity Distribution Oltenia (FDSEE) and branch components and provides real support to the monitoring points instead of branches, and the subsidiary. Reports made available to give a true exchange of electricity by illustrating each component of energy flow, emphasizing the amount of energy received and delivered exchange points, regardless of voltage and geographic location of the point of view. Are offered daily reports, monthly, annual or certain period desired by the user. Energy reports are configurable and are provided in an intranet or Internet environment. Teleinventory electricity system is open, extensible, with visitors or more meters, allowing connection to the remote secure access schemes. Allows management of data read from electronic meters which are part of Teleinventory systems of each branch, regardless of their type. The software is designed for centralization, data storage and presentation video-spelled FDSEE level or higher and SDFEE for outline applications within Electrica.

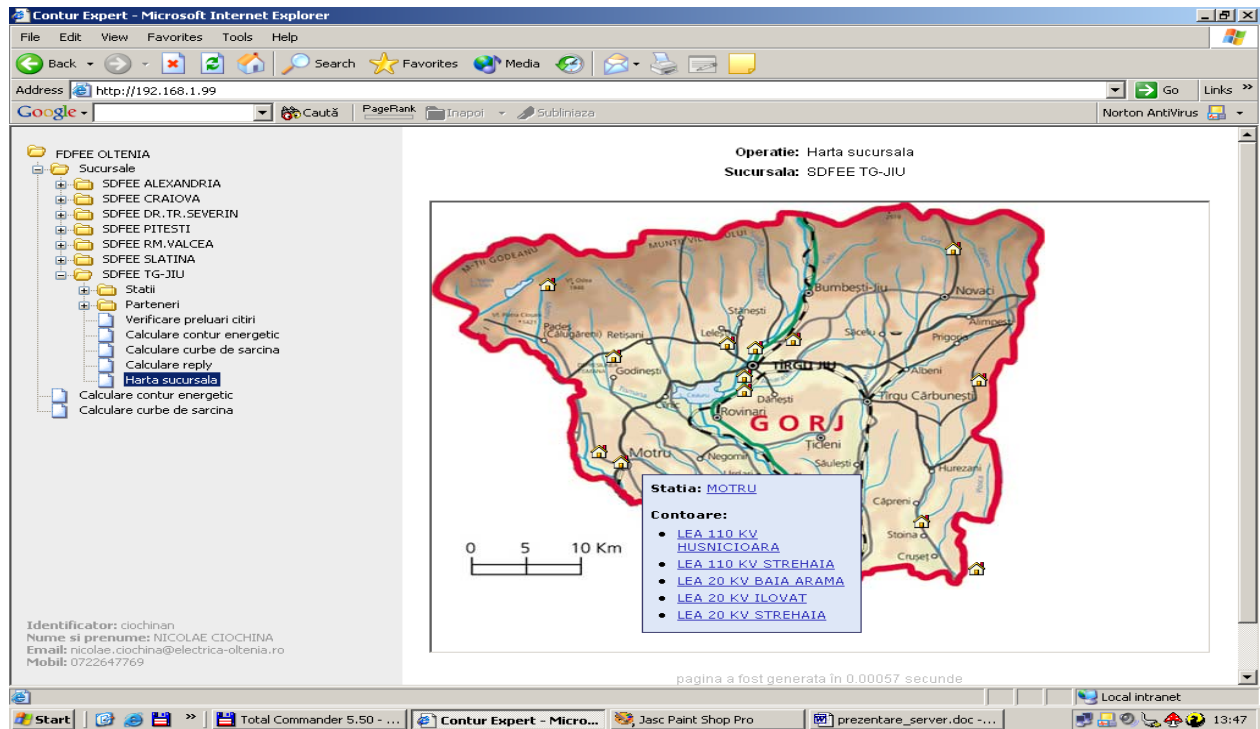


Fig. 8: Show map branch.

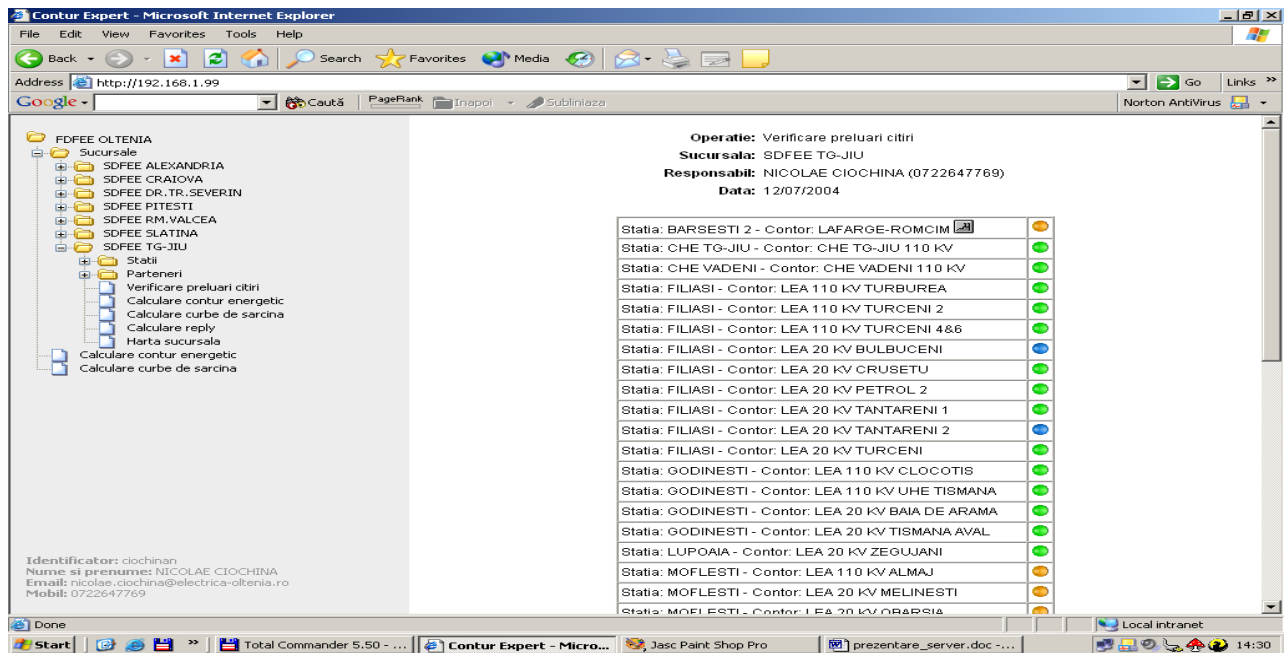


Fig. 9: Verification screen reads takeovers.

6.1 Composition, Functions and Communication Channels

The system consists of the following modules:

- The client (is installed at each branch),
- The server (he settled in branch),
- The presentation (Internet Explorer - is installed to beneficiaries stored information).

Functions that are:

a) how the client: import data from databases of existing applications in the branches Loading imported data server, data transfer and security of information stored and manages meters, partners and stations of the branch;

b) the server: manages the database, manages the information stored beneficiaries, ensure the integrity and safety of stored data, generate graphs, reports and export data files, validate data, apart from the validated data validated, configured

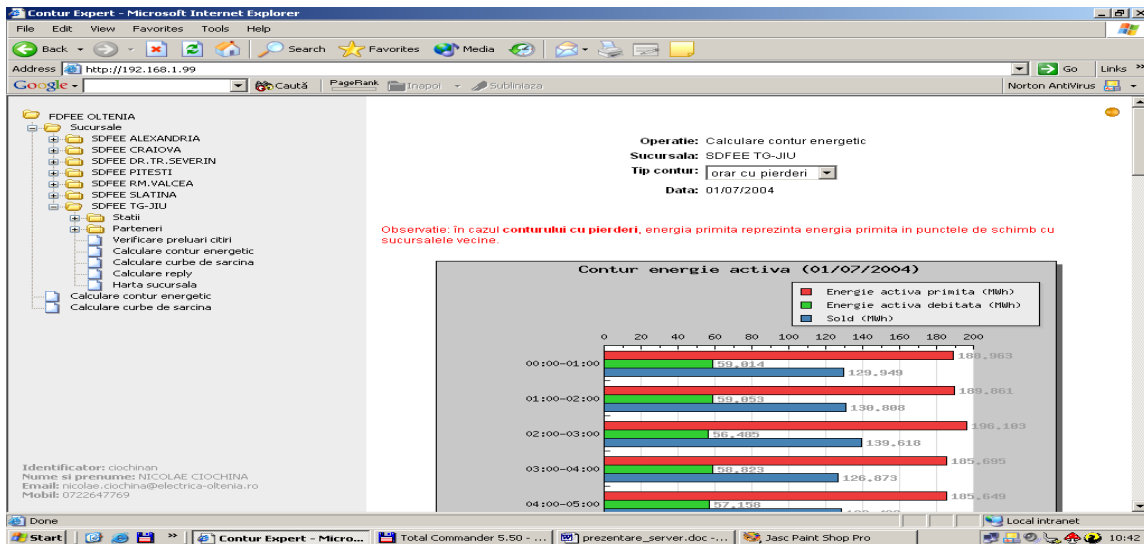


Fig. 10: Screen contour branch - time loss.

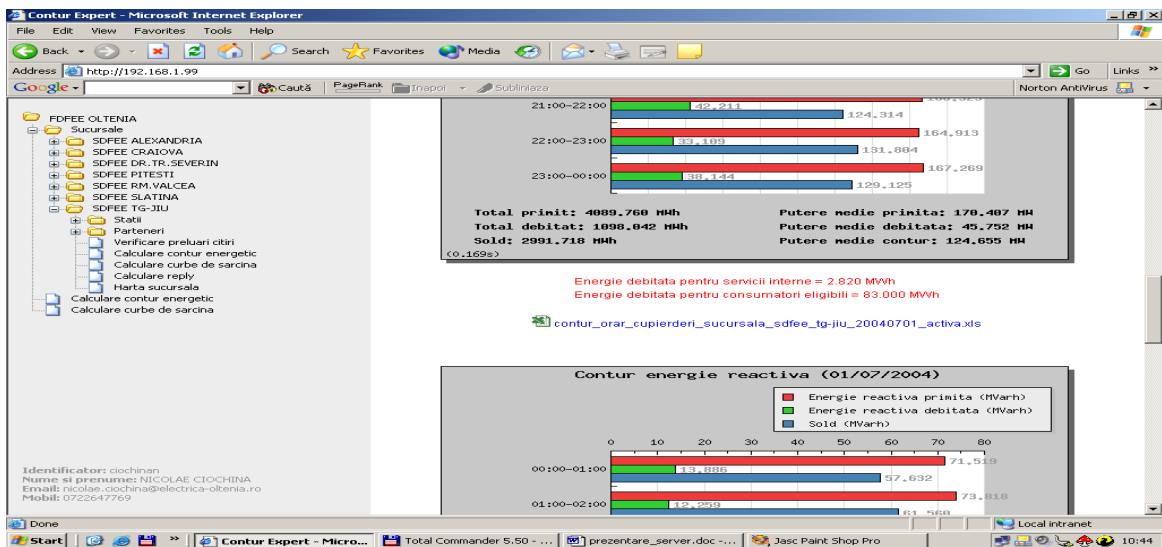


Fig. 11: Screen: Summary outline.

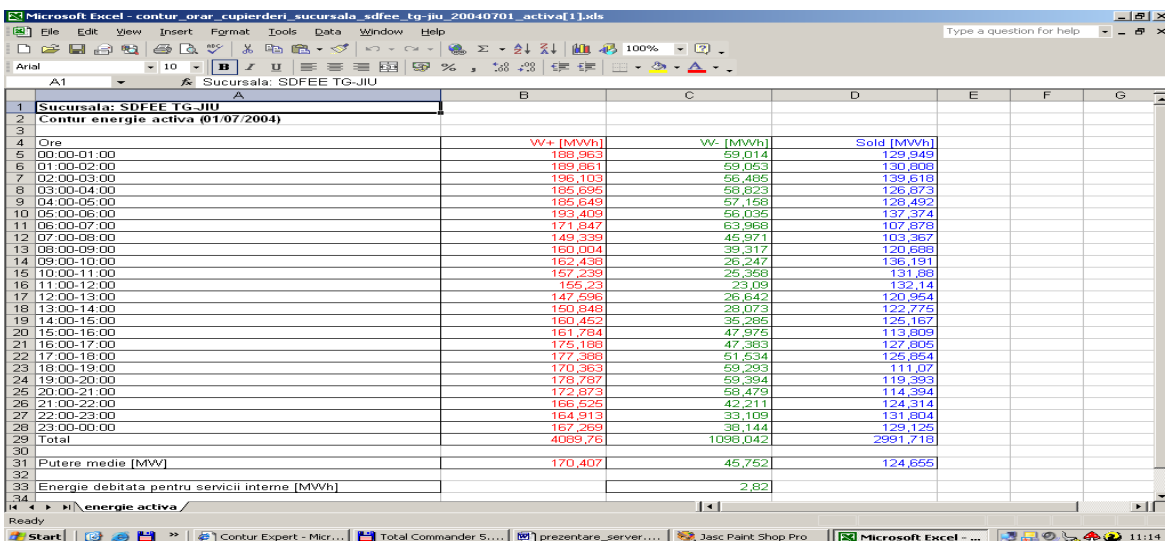


Fig. 12: Excel file.

reports, register journals and operations events and automatically transfer information to external partners validated. Tools used are [4]:

Windows 2000 Server, SQL Server 2000, Apache (Web Server) + PHP, Internet Explorer and Borland Delphi.

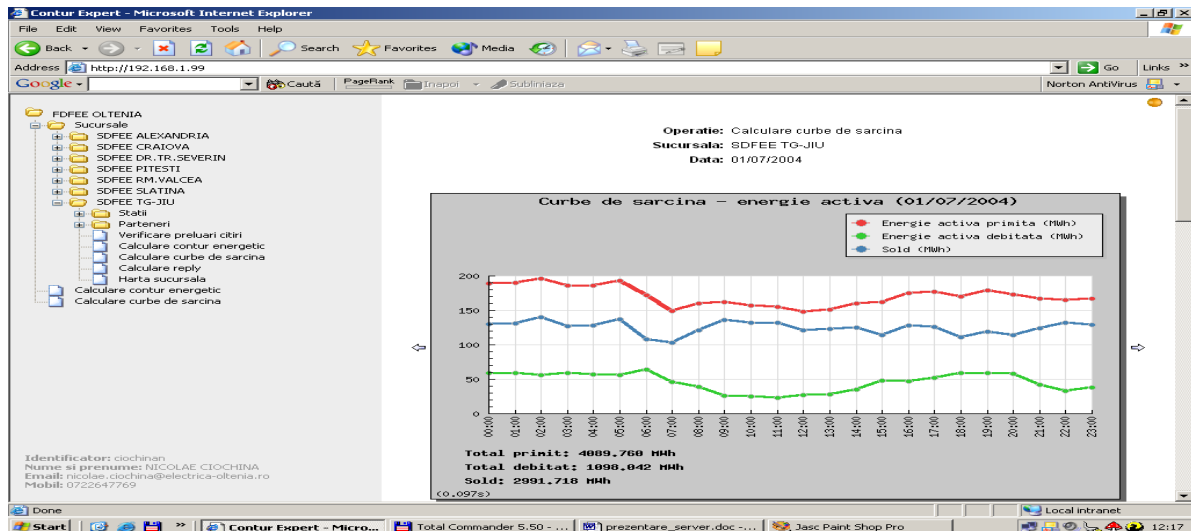


Fig. 13: Contour branch - time loss.

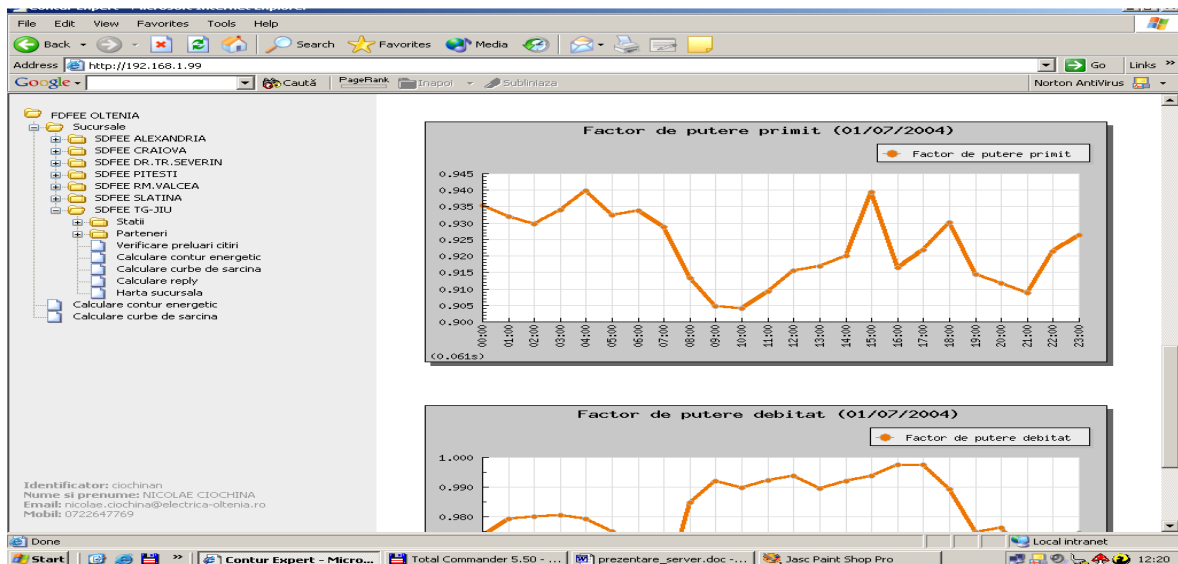


Fig. 14: Power factor branch.

Operatie: Calculare reply
 Sucursala: SDFEE TG-JIU
 Data: 01/07/2004

Contor	Diferente	Erori	Contor	Diferente	Erori
Contor LEA 110 KV TURBUREA Statia FILIASI SDFEE TG-JIU			Contor TURBUREA Statia FILIASI SDFEE CRAIOVA		
W-	0.00 MWh	-	W+	0.00 MWh	-
W+	424.23 MWh	- 0.46 MWh - 0.11 %	W-	424.70 MWh	-
Qe	108.56 MVarh	-	Qi	0.00 MVarh	- 108.56 MVarh - 100.00 %
Qi	0.00 MVarh	-	Qe	0.00 MVarh	-
Contor LEA 110 KV TURCENI 2 Statia FILIASI SDFEE TG-JIU			Contor TURCENI 02 Statia FILIASI SDFEE CRAIOVA		
W-	4.79 MWh	-	W+	4.83 MWh	+ 0.04 MWh + 0.83 %
W+	109.14 MWh	- 0.07 MWh - 0.06 %	W-	109.21 MWh	-
Qe	0.00 MVarh	-	Qi	0.00 MVarh	-
Qi	337.95 MVarh	+ 337.95 MVarh + 100.00 %	Qe	0.00 MVarh	-
Contor LEA 110 KV TURCENI 4&6 Statia FILIASI SDFEE TG-JIU			Contor TURCENI 04 Statia FILIASI SDFEE CRAIOVA		
W-	0.23 MWh	-	W+	0.20 MWh	- 0.03 MWh - 11.43 %
W+	0.00 MWh	-	W-	0.00 MWh	-
Qe	10.43 MVarh	-	Qi	0.00 MVarh	- 10.43 MVarh - 100.00 %
Qi	0.00 MVarh	-	Qe	0.00 MVarh	-
Contor LEA 20 KV CRUSETU Statia FILIASI SDFEE TG-JIU			Contor CRUSETU Statia FILIASI SDFEE CRAIOVA		
Diferente			Diferente		
Erori			Erori		

Fig. 15: Calculation reply.

Communication channels used are on the intranet and the Internet outside Electrica.

6.2 Usage

Show map branch (Fig. 8): stations are highlighted on the map [9]. By moving your mouse on a displayed station meters from the station.

Total contour (Fig. 11): the end of each graph is shown a summary and a link to an Excel file with data from the chart.

Excel file (Fig. 12): Data from the chart can be found in Excel.

Contour branch - the loss zone (Fig. 13): energy received energy is received in exchange views with

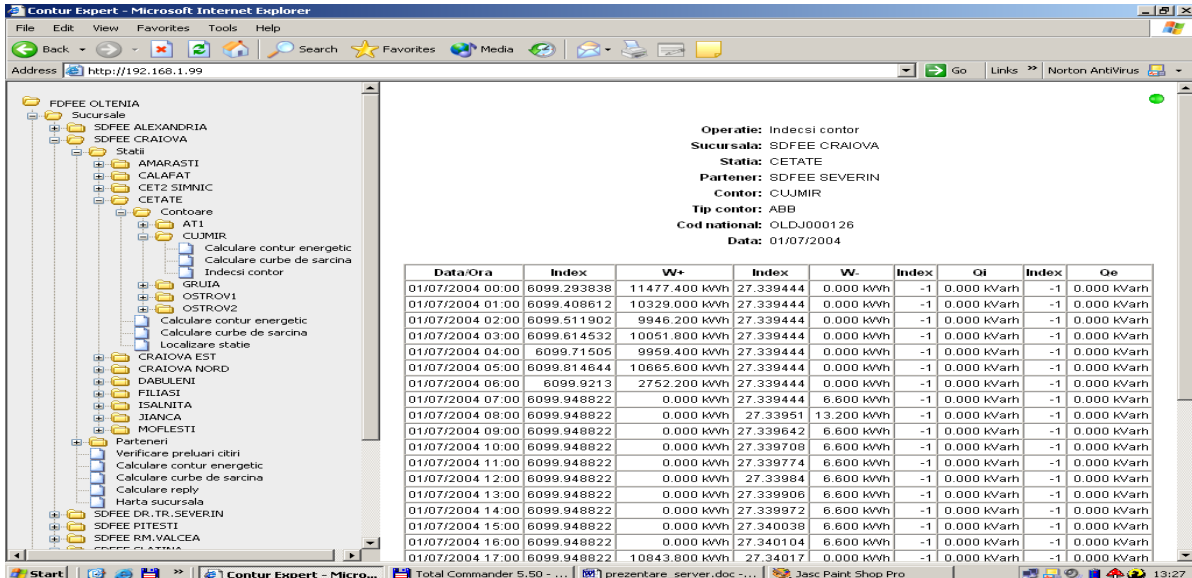


Fig. 16: Index counter.

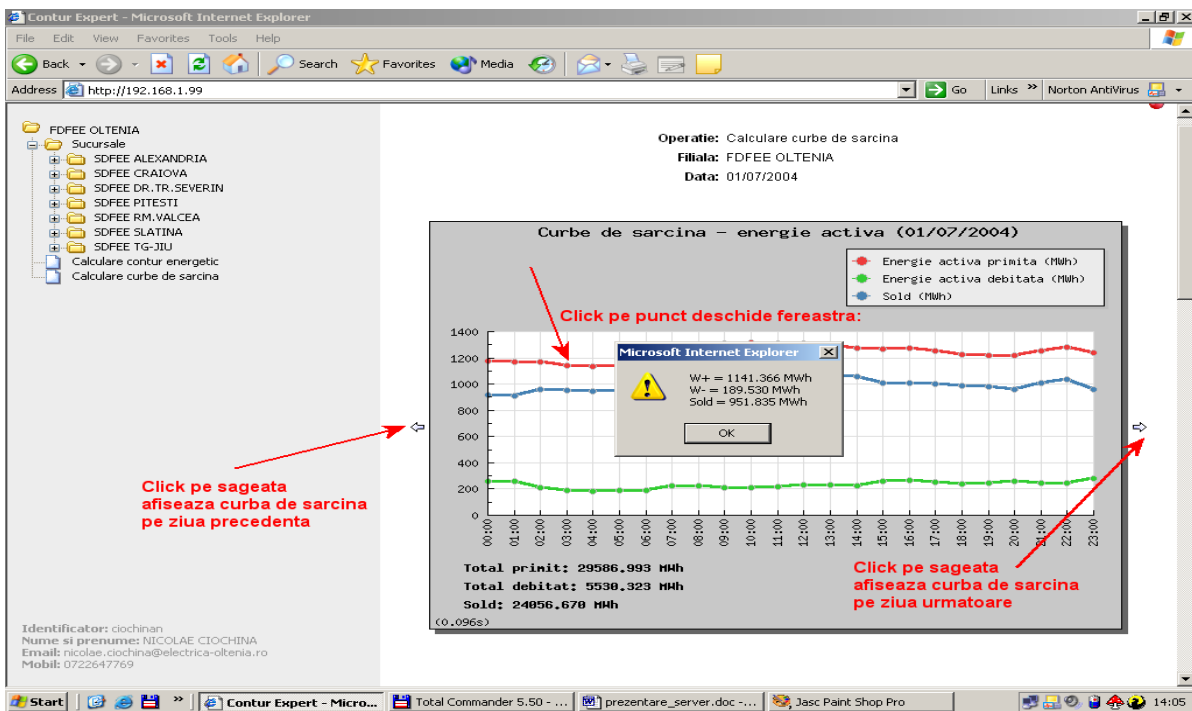


Fig. 17: Functions of load curves.

Check takeovers readings (Fig. 9): are displayed the status of all meters branch (read automatically, manually read, unread, eligible, in review).

Contour branch - the loss zone (Fig. 10): energy received energy is received in exchange views with neighboring branches.

neighboring branches.

Power factor branch (Fig. 14): energy received or charged.

Calculating reply (Fig. 15): selected range of electricity is calculated differences measured between points of exchange.

Index meter (Fig. 16) and functions of load curves (Fig. 17).

7 Conclusions

Concluding we can say that the system allows them to track the average power during read and (very important) the average power measurement range is basically 15 min intervals between 15 s and 5 minutes (typical time is 30 s) of meter billing meter or any other physical or virtual.

Also during the current period of measurement past and current work rate is read along with power. This system interruption pursuit of power both in time and date on which the interruption registered tensions. Today National Energy Regulatory Agency (ANRE) requires all eligible customers to take time to settle the registered consumption zone. Remote reading panel can be implemented in the national energy system for energy management.

The system reduces production costs by optimizing energy consumption, following the consumption of energy consumption sites, thereby avoiding taxes and applied for exceeding the power supply. The new consumption and cost tracking system permit is generating standard reports - in graphical form and tabular form to: active power/reactive delivered/received/debit, development of maximum power 15 min, operational quantities: voltage, frequency. With this system may be counted losses distribution networks and transport energy and non-technical losses. It can also watch the surpassing power and if it can disconnect certain inputs of a company without exceeding the contracted power.

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