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Computational Methods in Social Sciences

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Developing a High Performance Software Library with MPI and CUDA for Matrix Computations

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Abstract

Nowadays, the paradigm of parallel computing is changing. CUDA is now a popular programming model for general purpose computations on GPUs and a great number of applications were ported to CUDA obtaining speedups of orders of magnitude comparing to optimized CPU implementations. Hybrid approaches that combine the message passing model with the shared memory model for parallel computing are a solution for very large applications. We considered a heterogeneous cluster that combines the CPU and GPU computations using MPI and CUDA for developing a high performance linear algebra library. Our library deals with large linear systems solvers because they are a common problem in the fields of science and engineering. Direct methods for computing the solution of such systems can be very expensive due to high memory requirements and computational cost. An efficient alternative are iterative methods which computes only an approximation of the solution. In this paper we present an implementation of a library that uses a hybrid model of computation using MPI and CUDA implementing both direct and iterative linear systems solvers. Our library implements LU and Cholesky factorization based solvers and some of the non-stationary iterative methods using the MPI/CUDA combination. We compared the performance of our MPI/CUDA implementation with classic programs written to be run on a single CPU.

Keywords: parallel algorithms, linear algebra, CUDA, MPI, GPU computing.

1. Introduction

From physics and engineering to macroeconometric modeling, solving large linear systems of equations is a common problem. Such problems rely on high performance computing. One of the parallel programming paradigms is the message passing with its implementation using the MPI library [21]. About ten years ago MPI clusters were the first choice for many scientific applications but nowadays GPUs are used for performing general computations. In 2003 [10] pointed out a new approach to obtain a high megaflop rate to the applications when he started to use GPUs (graphical processing unit) for non-graphics applications. Current Graphics Processing Units contain high performance many-core processors capable of very high FLOP rates and data throughput being truly general-purpose parallel processors. Since the first idea of Mark Harris, many applications were ported to use the GPU for compute intensive parts and they obtain speedups of few orders of magnitude comparing to equivalent implementations written for normal CPUs.

At this moment, there are several models for GPU computing: CUDA (Compute Unified Device Architecture) developed by NVIDIA [15], Stream developed by AMD [1] and a new emerging standard, OpenCL [12] that tries to unify different GPU general computing API implementations providing a general framework for software development across heterogeneous platforms consisting of both CPUs and GPUs.

Combining the message passing based clusters with the very high FLOP rates of GPUs is a relatively recent idea [8]. We developed a hybrid linear algebra library that uses both MPI for spreading the computations among the computing nodes in a cluster and CUDA for performing the local computations on each node of the cluster. Thus, our library exploits a complex memory hierarchy: a distributed memory among the computing nodes in the cluster and a shared memory on each node which is, in fact, the device memory of the local GPUs.

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2. Serial iterative and direct methods

Stationary iterative methods such as Jacobi and Gauss-Seidel are well known and there are many textbooks that describe these methods [9]. An alternative to the stationary methods are Krylov techniques which use information that changes from iteration to iteration. Operations involved in Krylov methods are inner products, saxpy and matrix-vector products that has the complexity of $O(n^2)$, making them computational attractive for large systems of equations. One of the most used Krylov' method is the conjugate gradient (CG) [9] which solves SPD systems and in exact arithmetic gives the solution for at most *n* iterations.

A relatively new method for general non symmetric linear systems is the Generalized Minimal Residuals (GMRES) introduced by [20]. GMRES uses a Gram-Schmidt orthogonalization process and requires the storage and computation of an increasing amount of information at each iteration. These difficulties can be alleviated by restarting the computations after a fixed number of iterations. The intermediate results are then used as a new initial point.

Another non-stationary method is the BiConjugate Gradient (BiCG). BiCG generates two mutually orthogonal sequences of residual vectors and A-orthogonal sequences of direction vectors. The updates for residuals and for the direction vectors are similar to those of the CG method, but are performed using system's matrix and its transpose. In our library we've implemented a version of BiCG called BiCGSTAB.

The alternative to the iterative methods for solving a linear system Ax = b is the *direct method* that consists in two steps:

- The first step consists in matrix factorization: A = LU where L is a lower triangular matrix with 1s on the main diagonal and U is an upper triangular matrix. In the case of SPD matrices, we have $A = LL^{t}$.
- In the second step we have to solve two linear systems with triangular matrices: Ly = b and Ux = y.

The standard LU factorization algorithm with partial pivoting is given in [9]. The computational complexity of this algorithm is $\Theta(2n^3/2)$. After computation of the matrix factors L and U we have to solve two triangular systems: Ly = b and Ux = y These systems are solved using forward and backward substitution with a computational complexity of $\Theta(n^2)$, the most important computational step being the matrix factorization.

Computers with memory hierarchies are used more efficiently if the matrix factorization uses BLAS Level 3 operations [7] besides level 1 and level 2 operations [13], [6]. It is well-known, level 3 BLAS operations have a better efficiency than level 1 or level 2 operations. The standard way to change a level 2 BLAS operations into a level 3 BLAS operation is delayed updating. In the case of the LU factorization algorithm we will replace k rank 1 updates with a single rank k update resulting a block algorithm. A detailed description of the block LU factorization algorithm is given in [17].

3. The implementation of parallel algorithms

The serial algorithms presented here may not always be appropriate for very large matrices, parallel versions being more suitable for such matrices.

Software packages for solving linear systems have known a powerful evolution. A software package for linear algebra problems that emerged as a de-facto standard was LAPACK [2] which was adapted for parallel computation resulting ScaLAPACK [4] library. Many other software packages for parallel computation have been developed so far: PETSc [3] PARPACK [14], SuperLU [23].

Since the introduction of GPU general computation frameworks (CUDA, and Stream) many numerical libraries were ported to them: CUBLAS [16] is a CUDA implementation of the BLAS library, MAGMA [11] is a collection of next generation linear algebra GPU accelerated libraries for heterogeneous GPU-based architectures, CULA [5] is a library that provides an accelerated implementation of the LAPACK and BLAS libraries for both dense and sparse linear algebra.

Previously [17] and [18] we presented a library that implements parallel algorithms for linear systems solving - PLSS (Parallel Linear System Solver). The PLSS library was designed with an easy to use interface

almost identical with the serial algorithms' interface. Now, we improved this library combining the distributed computing used in PLSS with CUDA accelerated local computations. We named the new library CUPLSS.

The library has a very simple interface that makes the software developing process very easy because the parallelism is hidden from the user. This goal was obtained by means encapsulation of data and distribution and communication in opaque objects that hide the complexity from the user. Our library was developed in C and we used MPICH implementation of the MPI for the communication between processors. The local computations on each MPI node is further accelerated using CUDA, so that each local call of a computational intensive kernel is sent to be executed on the GPU device. The simplified structure of the computing architecture used for our tests in presented in Figure 1.





Fig. 1. MPI – CUDA hybrid architecture

MPI is used to facilitate the communication between nodes and exploit coarse grained parallelism of the applications and CUDA accelerates local computations on each node exploiting the fine grained parallelism. In our experiments we used a cluster of 16 workstations each having an Intel QuadCore Q6600 processor and NVIDIA GeForce GTX 280 GPU. The communication between nodes is achieved using a standard Gigabit LAN.

Our library is structured on four levels, as we can see in Figure 2.



Fig. 2. CUPLSS structure

The first level contains the CUDA runtime, CUBLAS, MPI and C libraries which all are architecture dependent. The second level provides the architecture independence, which implements the interface between the first level and the rest of the CUPLSS package. The next level implements the data distribution model concentrating the details regarding distribution of vectors and matrices on processors.

The top level of the CUPLSS library is, the application programming interface. CUPLSS API provides a number of routines that implements parallel BLAS operations and parallel linear system solving operations: direct methods based on *LU* and Cholesky factorization and nonstationary iterative methods GMRES, BiCG, BiCGSTAB. The CUPLSS library uses a logical bidimensional mesh of processors (computing nodes). Wherever we used CUDA accelerated local operations the general flow of the computations was [19]:

- Step 1 : Allocate memory for matrices and vectors in the host memory;
- Step 2 : Initialize matrices and vectors in the host memory;
- Step 3 : Allocate memory for matrices and vectors in the device memory;
- Step 4 :Copy matrices from host memory to device memory;
- **Step 5:** Define the device grid layout:
 - Number of blocks
 - Threads per block
- **Step 6** : Execute the kernel on the device;
- Step 7 : Copy back the results from device memory to host memory;
- Step 8: Memory clean up.

4. Performance tests

We've tested our library for both single precision and double precision floating point numbers. For our tests we used a cluster of workstations connected through a 1000Mb Ethernet local network, each station having 4GB of main memory. The CUPLSS package uses the MPICH implementation of the MPI library and, for the local BLAS operations, uses the CUBLAS library that provides a high FLOP rate. Each node in the cluster is a computer with Intel Core2 Quad Q6600 processor running at 2.4 Ghz, 4 GB of RAM and a NVIDIA GeForce GTX 280 graphics processing unit (GPU) with 240 cores running at 1296 MHz, 1GB of video memory and 141.7 GB/sec memory bandwidth. The operating system used was Windows Vista 64 bit.

We have tested the CUPLSS package for both iterative and direct methods, for 1, 2, 4, 8, and 16 computing nodes. The dimension of the matrix was maintained fixed: 60000 rows and columns. Figure 3 shows the speedup of the parallel algorithms for the case when iterative methods are used to solve the model and figure 4 shows the speedup in the case of direct methods. The speedup is computed comparing the parallel algorithm with a serial version the uses one CPU. Both speedups are computed for single precision floating point numbers.

We wanted to evaluate how much CUDA accelerated local computation contributes to the overall performance. To achieve this goal we replaced all the calls to CUBLAS or other CUDA computations for local computations with calls to a serial BLAS implementation – ATLAS [22] and calculated again the speedups. As figures 3 and 4 show, CUDA accelerated local computations improves the overall performance but this increase in the speedup is not very high. The main reason for this is the GPU memory contention on GPU device and the communication overhead incurred by the MPI processes that acts as synchronizing points between CUDA calls. The main advantage of using MPI and CUDA hybrid model is that it allows solving very large systems which could not fit in the GPU memory of one computer. Although a pure CUDA implementation of linear systems solvers shows very high speedups, very large matrices do not fit in the GPU memory so that distributing the matrices and using MPI message passing model is an advantage that cannot be neglected.



Fig. 3. The speedup for parallel versions of the iterative algorithms



Fig. 4. The speedup for parallel versions of the LU factorization

5. Conclusions

We developed a hybrid MPI-CUDA library CUPLSS, that implements non-stationary iterative methods (GMRES, BiCGSTAB, BiCG) and direct methods for solving linear systems. We've made performance tests for our library in a network with 16 computing nodes and we obtained a good speedup. The speedup is higher for the methods based on matrix factorization compared with the iterative algorithms. We also tested how much CUDA accelerated local computation contributes to the overall performance by replacing all CUDA accelerated code with a serial code. The results shows that CUDA accelerated local computations improve the overall performance but the increase in performance is not very high mainly because of the GPU memory contention and MPI communication overhead.

In the future we intend to extend our library and to port it to OpenCL which will give hardware independence because CUDA is linked with NVIDIA devices.

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A quantitative research of consumer's attitude towards food products advertising

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Abstract

Identifying the consumers' attitude towards television/radio/press advertising is especially important, a fact which is highlighted by national and international speciality literature. The attitude of the consumer towards a television commercial influences the attitude towards the promoted product or brand. Thus, a positive attitude towards the commercial for a brand determines a positive attitude towards the respective brand and, eventually, may result in the formulation of the purchase intent. It is hard to say which aspects of advertising have the greatest influence on the formation of consumer attitudes and purchase intent formulation, but not impossible to find out. In this context, through this study, we aim at contributing to the determination of the consumers' attitude towards televised advertising aimed at promoting food products.

Keywords: marketing research, consumer behavior, attitude, dimensions of consumer behavior, statistic survey.

1. Introduction

The specialists agree that identifying the consumers' attitude towards television/radio/press advertising is especially important, a fact which is highlighted by national and international speciality literature.

Knowing the consumers' attitude towards the advertising phenomenon has different purposes. For example, for the purpose of understanding the effects of advertising on consumers, the specialists usually propose the research of the consumer's attitude in relation to the advertising and the persuasion process through promotional communication, this being, first of all, for the purpose of amending certain attitudes against certain brands, a desideratum that can be accomplished through promotional communication. The attitude of the consumer towards a television commercial influences the attitude towards the promoted product or brand. Thus, a positive attitude towards the commercial for a brand determines a positive attitude towards the respective brand and, eventually, may result in the formulation of the purchase intent. It is hard to say which aspects of advertising have the greatest influence on the formation of consumer attitudes and purchase intent formulation, but not impossible to find out.

In this context, through this study, we aim at contributing to the determination of the consumers' attitude towards televised advertising aimed at promoting food products.

2. The concept of attitude

Attitude is the term used when we consider the total assessment (including of oneself), performed by one consumer, of persons, objects or problems, that takes into consideration how favorable/unfavorable or how positively/negatively is the judged object considered.

Attitude is considered by some marketing specialists as representing a latent size of the consumer's behavior as being the result of certain affective and learning processes, which create the predisposition to act based on certain convictions, reuniting the influences exerted by skills, habits and reasons in a single behavioral component with a more pronounced stability in time.

Attitudes can vary in a large number of ways. We can take into consideration the attitudes based on their fundamental aspects and thus we can discriminate attitudes based on emotions, faiths or behaviors and previous experiences, or we can approach the attitudes that have an internal consistency (being significantly

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associated with feelings, attributes and positive behaviors) or ambivalent attitudes (composed by a combination of positive and negative attributes) [4]. Also, from the beginning of the 90s, the idea that attitudes may develop as a byproduct of the subconscious gained momentum, as an automatic or default process, creating the notion of a default attitude, representing traces of previous unidentified experiences in the introspection process and that mediate feelings, thoughts or favorable or unfavorable actions in relation to social objects, much more strongly influenced by unconscious processing. Consequently, a dissociation shall be made within the research between explicit (or declared) attitudes and the implicit ones. Thus, constructions that are based on what respondents declare in the case of measuring vanity, stigmatized behavior and that "dark" part of the behavior, such as, for example, drug and alcohol use, can be affected by the refractory behavior of the subjects, manifested at the moment when exact statements are requested of them, due to prejudices related to social desirability [3].

Three dimensions were associated with attitude [1]:

- an *affective dimension*, representing the favorable or unfavorable disposition towards a certain social object;
- a cognitive dimension, respectively knowing or ignoring the object in cause;
- a conative dimension, namely the firm attention to act or behave in a certain way towards the attitude object.

Attitudes lead to the formation of a way of thinking based on the acceptance or rejection of an object, on the approaching or distancing from it and, also, they determine people to have a relatively constant behavior towards similar objects. These have the role of saving energy and the effort of thinking, this is why it is actually very difficult to change them. Due to the power of attitudes to determine several actions, it is not surprising that millions of Euros, dollars, pounds and yens are spent each year in the attempt to influence and change assessments done by consumers on objects, problems and persons.

Attitude change simply means that the individual assessment manner changes from one value to the next. Attitude changes can manifest as their *polarization*, which occurs when these change towards their initial trend (the favorable attitude of a person becomes even more favorable) or as their *depolarization*, which occurs when the attitude changes towards an opposite direction. As a rule, specialty literature does not include any conceptual distinction between the formation of attitudes and their change, because past researches suggest that it is more useful to look at changing attitudes as varying within a range between non-attitude and strong attitude, a scale elaborated by taking into consideration the attitude's accessibility level, in the sense of the availability of it being changed, the knowledge that the consumer has on the attitude object, along with many other factors [4].

The functional attitude theory, first proposed by Smith (1947), is considered to be among the most popular theories on attitude, being proven by the fact that most of the social psychology books and those regarding the behavior of consumers present its early development. Smith's idea was that attitudes have certain functions for the individual, a perspective which highlights its motivational roots [2]. Subsequently, psychologist Daniel Katz (1960) has continued to develop this theory, which enunciates the fact that the consumers that wait to face certain situations in the future shall begin to form certain attitudes before the event takes place.

There are four attitude functions proposed by Kats, namely [5]:

- *utilitarian function* it is related to the basic principles of reward and punishment, according to which people develop certain attitudes towards a product, depending on the positive or negative consequences of the consumption or use of the respective product/service.
- *value-expressive function* the consumer forms his attitude towards a product, not based on the benefits of its consumption, but based on what the adoption of the product could communicate about him, as an individual. These attitudes are relevant in the lifestyle analysis, which shows the manner in which the consumer carries out a series of activities and cultivates certain interests and opinions in order to express a specific social identity.
- *ego-defensive function* it is fulfilled by those attitudes formed for the purposes of protecting the consumer from external threats and from internal feelings, as well.
- *knowledge function* it is fulfilled by attitudes formed due to the need to organize, to identify a significance. It is the case of new products or of the situations in which the consumer is ambiguous.

A certain attitude can fulfill several functions, however, only one shall be dominant at all times.

3. Research methodology

The marketing research process was carried out based on the following coordinates:

→ Research purpose and objectives

The research presented within this article has the purpose of determining the *attitudes of the consumers from the Bucharest area towards TV advertising aimed at promoting food products*. Such a study is not aimed at highlighting the impact of advertising on attitudes but rather to highlight the attitude that the consumers have towards advertising in general and, especially, towards TV advertising destined for promoting food products. The questions for which we seek answers are: Is advertising "a necessary evil of our society"? How do we look at the explosion of commercials around us, from television, radio and press? What things would we like to change, and how? How much do we need advertising? How invaded and influenced are we by it?

Taking into consideration the increased number of means through which advertising is done nowadays, the study is limited only to the main mass-media instrument, which is television. The main reason that supports this delimitation of research only to TV advertising is determined by the results of the studies performed by various institutes that reached the conclusion that, at present, TV advertising is predominant among the promotional techniques used in the promotion activity of an organization.

Why only food products? Because an increasing percentage of the advertising done through television is designed to promote food products. Commercials that display arguments that are, more or less, direct, regarding health, promises for maximum health, maximum shape, figure, energy for an entire day, and so forth. How influenced are we by the messages sent by advertising, how much attention we give them and what is the impact that the commercial has on us when we are making the decision to buy represent the questions, regarding televised advertising destined to promote food products, that require an answer.

The objectives adequate for the aforementioned purpose are:

- Identifying the manner in which food products advertising is perceived and appreciated by the consumers;
- Determining the extent to which advertising is present in the life of consumers;
- Establishing the degree of attention given to advertising messages;
- Determining the impact that advertising has on the consumers;
- Identifying the image of advertising as a psycho-social phenomenon for the consumers;
- Identifying the main features that a commercial or a food product should possess in order to achieve a high impact advertising promotion.

→ *Research collectivity and sample volume*

The general collectivity that represents the object of the research is represented by the Bucharest population aged 15 and above, from which a single sample was taken. Taking into consideration the fact that advertising is a phenomenon manifested not only in the Bucharest area, for the purposes of determining the attitudes against food product advertising, it would be ideal for the research to be performed on a countrywide scale.

In order to define the population variation degree, the "Sex" and "Age" variables were the starting point. It is known from previous researches with similar topics that these variables are strongly correlated with the defined interest variables, starting from the proposed objectives.

The observation unit is represented by the natural person that is part of the researched collectivity and the survey unit is the same with the observation unit.

Because the questions from the questionnaire that was used are transposed in qualitative variables, the sample volume determination, using the relationship for qualitative variables, was considered adequate. Because the populations are not homogenous, it is possible for certain variables to have a scatter degree higher than that of auxiliary variables. For this reason, the sample volume is calculated using the maximum possible value as dispersion for qualitative variables (p = 0,5). The probability of guaranteeing results is 95% and a maximum admitted limit error of ±5%. The size of the investigated collectivity, namely the persons aged 15 and above residing in Bucharest, reaches a number of 1,709,280 persons, based on the data supplied by the National Institute of Statistics [6]. Thus, the sample size shall be determined depending on the established restrictions, as follows:

$$n = \frac{1,96^2 \cdot 0,5 \cdot 0,5}{0,05^2 + \frac{1,96^2 \cdot 0,5 \cdot 0,5}{1,709,280}} = 384,074 \cong 385$$
(1)

Within the research, 385 persons were interviewed based on the questionnaire, of which 21 questionnaires were eliminated, which had incomplete data and contained non-data. Therefore, we have a final sample of 364 persons. The rate of response thus reached a satisfying level of 94.5%.

→ *Research questionnaire*

The process of elaborating a questionnaire always determines a structure that finally allows the researcher to use an original scheme when analyzing data. It is also the case of the questionnaire elaborated for collecting data for the purpose of determining the attitude of the consumers from the Bucharest area regarding the food product televised advertising.

First of all, the rule that must be observed when compiling the questionnaire is for it to be formulated so that it is possible to obtain all necessary information in order to be able to answer adequately to all the objectives and hypotheses established in subsequent stages. A questionnaire that does not represent a reflection of all the objectives, hypotheses and variables has no value for the performed research.

Another aspect taken into consideration when elaborating the questionnaire is the method established for data collection. This has an effect on the content and the manner in which questions are formulated, on their type and succession, on the questionnaire length and on its other characteristics. Thus, the information collection method used in this case was established as being the personal survey (face to face) performed in heavy-traffic public areas with street approach. Due to the reduced duration of the interview imposed by the information collection method, a small questionnaire length must be ensured, resulting in a questionnaire with 17 questions and with low complexity. These conditions imposed the use of the structured procedure for presenting the questionnaire questions. Also, in such a situation, the use of overly complex instruments for measuring phenomena must be avoided, so the scales used were part of the accessible scale category, such as: semantic differential, Likert scale and the rank order method.

Finally, as a consequence of the structured procedure and of the limited time for obtaining information, a questionnaire that contained only closed questions resulted, with a single dichotomous question, namely the one for establishing the sex of the respondents, the rest of the questions being multichotomous (with a multiple response option). Also, during the elaboration of the questions' content, the importance of correlating the content with the respondent's knowledgeability with respect to the matter at hand was also taken into consideration, thus ensuring that his response was given in full knowledge.

The language used for the elaboration of questions is simple and direct, so that it does not cause confusion and leaves no place for interpretation, being adapted to the investigated collectivity characteristics. Regarding the order of the questions, the approach by the respondent task (effort) principle was applied (The Work Approach), which requires the questions that involve a greater mental effort for an answer to be located at the center of the questionnaire.

→ Collecting, verifying and processing data

The collection of information must be performed with care, in order to remove possible error sources and to reach results that do not contain major errors. Thus, in the data and information collection stage, several types of errors can occur - non-answers, inadequate sample, operator's influence, inexact answers of the respondents, etc. - which must be minimized as much as possible.

Following the questionnaire completion after interviewing the respondents, the codification operation shall be performed, followed by the elaboration of individual-variables tables for the subsequent processing and analysis.

As a rule, a prior stage of the statistical analysis and the interpretation of results is represented by establishing the sample representativeness for the population from which it was selected. This is performed starting with the auxiliary variables: "Sex" and "Age", for which the distribution parameters in the population

are known. It is a well known fact that, if the differences from the estimator's value obtained based on the survey data are significant, the sample is not representative.

The percentage of women within the entire sample was 54.1%. In order to see if there are significant differences from the value known at the level of the entire population, according to official data (53.3%), z test was used (normal volume sample) for the purposes of comparing the proportion from the sample with the one from the population. Thus, taking into account the fact that the calculated test value $z_c = 0,268$ is lower than the theoretical value $z_1 = 1,96$ established for a 95% research result guarantee probability, to which

a $\alpha = 0.05$ significance level corresponds, we can conclude that the sample is representative.

Regarding the "Age" variable, the distribution form of this variable in the target population is known, due to the data supplied by INS (National Institute of Statistics), so that, for the purposes of verifying the sample representativeness, we used the χ^2 test to compare this distribution with the one from the selected sample. In our case, following the test, we obtained $\chi_c^2 = 4,7814$. The theoretical value of the test taken into consideration for a $\alpha = 0,05$ significance level and a number of df = k - 1 = 5 - 1 = 4 the degree of freedom is 9.49. Thus, $\chi_c^2 < \chi_{0,05;4}^2$ condition which leads to the acceptance of the null hypothesis and the formulation of the conclusion, according to which the two distributions are consistent and, therefore, the sample is representative.

4. Research results

Following the study for determining *the attitudes of consumers from the Bucharest area towards TV advertising for promoting food products*, we could formulate the following conclusions, as a response to the objectives and hypotheses established in the preliminary research stage:

• The first research objective aimed at *identifying the manner in which food products advertising is perceived and appreciated by the consumers.*

Most of the respondents (70% of them) consider that the main communication means are saturated in advertising. The fact that the respondents feel choked by advertising does not reflect a positive perception.

The public receives conglomerates of advertising messages mixed with programs that they watch for personal reasons, having no control on the phenomenon. For the service that they offer by broadcasting commercials, television companies, radio stations and newspapers receive material benefits which they need for the purposes of carrying out their activity and the public accepts this as such.

With respect to the *credibility of commercials*, the results fall under the same repertory, only less positive. The respondents do not give much credit to the information supplied through these messages. This may be determined by the fact that there were significant discrepancies between what the message promises and what the product actually offers, discrepancies that affected the attitude of the consumer towards advertising. The conviction that advertising offers a "made up" reality is not necessarily due to incidence of discrepancies, knowing that, through its construction, advertising must attract attention even with the price of exaggeration.

On the other hand, regarding the *utility* of the advertising, the respondents' opinions place advertising in the low utility category (48% of the interviewees placing advertising in the useless category). Consequently, we can affirm that, regarding the role that commercials have when making the purchase decision, we can say that it is quite modest.

However, despite the slightly negative appreciations of the main advertising characteristics, the attitude of the respondents towards food product advertising is a favorable one, a fact confirmed by the 61% of those that place their attitude towards advertising for food products in the area of favorable and very favorable attitude on the semantic differential scale (see Fig.1.).



Fig. 1. Attitude towards food products advertising

This fact reveals two encouraging aspects. First of all having an attitude towards this type of commercial implies having knowledge about it, as attitudes are formed in time. Commercials used for the promotion of food products are well known to the Romanian public, being proven by the fact that consumers have an already formed attitude towards such a type of commercials. Second of all, the characteristics of food product advertising are more appreciated than advertising in general, a fact confirmed by the favorable attitude towards such a type of commercials designed for food products are much easier to understand and are appreciated positively by the advertising loving public.

• The second research objective is represented by *determining the extent to which advertising exists in the life of consumers*.



Fig. 2. The frequency with which respondents comment on the impressions about advertising

The frequency with which respondents comment on the impressions about advertising, ("from time to time", as research shows; see Fig.2.) depicts the fact that, to an extent, advertising is significant in their lives, since it is the object of a discussion. At the same time, we can conclude that advertising has the capacity to impress, one way or another, as long as the public feels the need to communicate their impressions regarding commercials.

Also, following the performed analysis, a higher tendency to comment upon the impressions on advertising with the group was registered in the case of women (44% of them comment often or very often on the impressions on advertising), in comparison with men (24% of them comment often or very often on the impressions on advertising), who do this less times than the women.

• *Establishing the degree of attention given to commercials* represented another research objective.

Based on the obtained results, we can say that the attention given to commercials is located at lower levels, a fact revealed by the share of 55% of those that place their attention towards commercials in the "very little attention" and "little attention" areas on the semantic differential scale with five stages, of the modal value, median and appreciation mean.

The research results also reveal the fact that the segment of persons aged above 55 years and those aged between 35-44 years pay more attention to commercials, in relation to the other considered segments. On the other hand, the segment of persons with an elementary level of studies tends to pay more attention to commercials, in comparison with the other segments taken in consideration based on this criterion.

In what regards the attitude towards commercial breaks, 72% of the interviewed persons claim that they try to avoid watching commercial either by leaving the television, or by changing the channel (see Fig. 3.).



Fig. 3. Attitude towards commercial breaks

Of the 28% who stated that they watch commercial breaks, most of them are represented by women (76.5%) and by those that have an elementary level of studies (see Fig.4. and Fig.5).



Fig. 5. The structure by education of those who are watching commercial breaks

The share of those that watch commercials the most is, also, represented by those aged between 25-34 years (29.4% of the total of the segment of those that stated that they watch commercials), followed by those aged between 45-54 years (23.6%) (see Fig.6.).



Fig. 6. The structure by age of those who are watching commercial breaks

• The fourth research objective is constituted by *determining the impact that advertising has on the consumers*.

By identifying the extent to which a negatively appreciated commercial may determine one not to buy a product, we obtain information that increases the understanding of the nature of attitudes that back the respective decision up. Since we considered that this information could reveal details about the actual attitude towards advertising, we waited for the result to be useful for a pertinent interpretation on this aspect. All in all, the score that was obtained doesn't clarify. On the one hand, the results obtained following the analysis expressed by the calculated weighted arithmetic mean (with a value of -0.18), after placing the opinions on a Likert scale, and by the modal value, reveal a discrepancy and this supports the fact that commercials that are disliked do not cause the product to be rejected. On the other hand, a part of the results obtained in this study determines us to formulate only a reserved opinion in what regards the receptivity towards the advertising phenomenon, the opinion average not being relevant to this end.

• Through the following objective, *the identification of the image of advertising among consumers, as a psycho-social phenomenon* was pursued.

75% of the public considers it is, more or less, bothered by the advertising invasion broadcast by television. This brings into question a sensitivity aspect existing in TV advertising - interrupting the program with commercial breaks. This causes discontent to the 40% of those questioned, that declare that they feel very bothered by these interruptions (see Fig.7.).



Fig. 7. Attitude towards commercial breaks

From another angle, the obtained results show that the public considers that advertising influences us in ways of which we are not aware and that there is no correlation between what is promised through it and what is actually offered. However, on the other hand, there is a relatively neutral general attitude towards the

introduction of restrictions in this domain. Adding, by contrast, the negative appreciations on the credibility and loyalty of advertising which, logically, would have determined the approval of certain possible restrictions, we are faced with a paradox. The natural question that we ask ourselves is why did the interviewees that said they were unsatisfied or bothered by the "advertising invasion" not create an opinion flow favorable for the introduction of restrictions for advertising? Which is the cause that could explain this disparity? Since we limited the research area only to aspects related to attitudes towards advertising, the results prove that the restrictions are not the ones that would improve the attitude towards advertising, but other mechanisms related to the advertising image among the consumers.

• The last objective of the study *involves identifying the main features that a commercial or a food product should possess in order to achieve a high impact advertising promotion*. First of all, the obtained results determine us to say that commercials that promote brands with a positive image and with tradition are more attractive in comparison with the rest of the commercials, in the opinion of the respondents (see Fig.8.).



Fig. 8. Average scores that show the respondents' appreciation towards food products advertising that emphasize the attributes mentioned

Also, consumers consider that the commercials that would be the most attractive to them are those which promote healthy products, products having the best price and delicious products.

However, in what regards the characteristics of commercials with a positive effect on consumers, the results obtained at the level of the investigated sample place "relaxing" commercials on the first rank. The results also reveal the fact that respondents pay more attention to observing ethics and social morality in advertising. Common sense is an attribute that gives an image of trust on the marketed product/brand, its violation causing severe deformations, even irretrievable, of the image.

The care for the commercial to be easily memorized belongs more to the advertising creator than to its auditor. Advertising is not an objective presentation of reality, but the product of a creation process, therefore it is an intentionally subjective representation. Even though people do not want to be lied to, they are aware of the impossibility to keep a correspondence between reality-commercial.

Among the characteristics of commercials that are considered negative by the respondents, lying commercials are on the first place, this attribute being clearly detached from the others, the results reflecting a majority agreement on the fact that this practice is condemnable.

Entertainment, a good mood and the pleasure arising from following a commercial are sought by the public and it is obvious that it manifests a negative attitude towards "insipid" commercials, this experience of viewing/hearing having an important impact on its attitude system. Aggressive commercials are not liked because they invade the mental intimacy of the consumer, intimidating him and increasing his sense of insecurity.

5. Conclusions

The study which is the object of this article was organized, starting from the formulation of objectives and hypotheses of the research until the conception and structuring of the questions from the questionnaire, so that the operator can tell not only how advertising is regarded, but how it should be performed so that the public not only does not avoid it, but it also views it and, eventually, acts accordingly, respectively takes an interest in the products that these commercials try to promote.

Summarizing the aforementioned findings, we could conclude that advertising is still regarded with reluctance and skepticism in Romania, it is attributed with a limited utility and it is usually regarded as annoying. However, on the other hand, with respect to the food product advertising, the situation is slightly different, in the positive sense of the word, but, due to the fact that the interest and acceptability of the public are at the same level, because of homogenization, with the commercials for other types of products, the reaction of the viewer will always be: Commercials again?

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An overview of higher education at the European level

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Abstract

Higher education has a key role in the new knowledge society. In Europe there are over 4,000 higher education institutions of which 3300 are in EU27 countries and over 20 million students. EU countries' governments and higher education institutions are in a continuous process of finding ways to create better conditions for studies considering the very important role that higher education plays in the economic development of a country. This article presents an overview of the main statistical indicators which monitors achievements in higher education in EU27 countries during 2011 and 2012, revealing large differences still exist between the EU27.

Keywords: higher education, educational statistics, Europa 2020 education strategy.

1. Introduction

Higher education plays a very important role in economic and social life [1], [2]. The opening that EU offers to its citizens to study and work in other countries play a decisive play a key role in harnessing the economic potential of the EU. Higher education is the main provider of highly skilled human capital because of the close ties that it has with research and innovation. In the technological progress era the lack of highly qualified human capital can be a serious impediment to development and economic growth. In this article we present an overview of the higher education in EU27 countries in terms of number of students, public expenditure on education, participation rates in education and population education level in various EU27 countries. The importance of higher education is emphasized in the Europa 2020 Strategy, one of the main indicators chosen to be used to monitor the strategy on education being the tertiary educational attainment.

2. Higher education statistics

The higher education attainment depends on a number of factors such as the age structure of the population, availability of resources for education, cost of education, the level of the economic development of each country.

Figure 1 shows the distribution of the number of students in the EU27 countries in 2011. There was a total number of 20,129,248 students (ISCED 5 and 6) in 2011 in Eu27 countries, the highest proportion belonging to Germany with 13.73% of the total number of students in EU27 countries followed by the UK with 12.78%, France with 11.22% and Poland with 10.36%. Regarding the number of students, four countries - Germany, France, Poland and the UK - registered over 2 million students while Italy and Spain had 1.96 million and 1.95 million students, these six countries holding over 67% (13,513,233 students) of the total number of students in EU27 countries. In Romania there were 4.33% of the total number of EU27 students, that is 871,842 students. During 2011, in EU27 countries there were over 4000 universities.

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Data source: author's own calculations using EUROSTAT data

Fig. 1. The distribution of the number of students (ISCED 5 and 6) on the EU27 countries

Analyzing the data presented in figure 1 one can note that the big EU27 countries (regarding the total population number) have the largest share of the number of students However, the number of students per 100,000 inhabitants, which is represented in Figure 2 shows that countries such as Greece, Lithuania and Finland which have a low share in the total number of students in the EU27 recorded high values of this index: 5940 for Greece, 6130 for Lithuania and 5736 for Finland.

The distribution of the number of students on the field of study during 2011 in EU27 countries is shown in figure 3. One can note that the highest percentage belongs to the social sciences, business and law with 33.7% of the total number of students. At the opposite pole we can find the agriculture and veterinary field with a share of only 1.8%. In Romania the situation is similar: 49% of all students are enrolled in the social sciences, business and law field of education while the lowest percentage is in agriculture and veterinary field with 2.2%. The share of students in social sciences, business and law field in Romania is the largest share in EU 27 countries. Table 1 shows the complete data on the distribution of the students by the field of study in EU27 countries during 2011.



Data source: author's own calculations using EUROSTAT data



Fig. 2. The number of students per 100,000 inhabitants in 2011.

Data source: EUROSTAT

Fig. 3. The distribution of the number of students by the field of study in EU27 countries

	Education field	Humanities and art field	Social science, business and law field	Science, mathematics and computing field	Engineering, manufacturing and construction field	Agriculture and veterinary field	Health and welfare field	Services field
EU27	8.4	12.2	33.7	10.4	15.2	1.8	14.2	4.2
Belgium	12.2	11.2	31.5	5.6	11.2	2.6	23.9	1.9
Bulgaria	6.0	8.1	42.4	5.4	19.3	2.5	7.5	8.7
Czech Republic	12.4	9.1	32.9	11.5	14.0	3.8	11.0	5.4
Denmark	9.8	12.8	33.6	8.5	10.6	1.5	20.8	2.5
Germany	7.4	13.3	25.8	14.3	17.8	1.5	17.2	2.7
Estonia	7.4	13.7	33.8	11.2	14.4	2.3	9.3	8.0
Ireland	6.1	14.3	27.2	15.8	12.9	1.7	17.4	4.7
Greece	6.3	13.7	31.9	14.5	18.1	4.8	7.8	2.9
Spain	10.7	11.0	31.2	9.8	17.7	1.6	12.7	5.3
France	2.5	13.7	37.1	12.4	13.4	1.2	16.2	3.4
Italy	7.0	13.0	35.1	8.2	17.8	2.3	13.2	3.4
Cyprus	9.0	10.4	48.6	8.7	10.8	0.5	7.6	4.5
Latvia	6.8	8.9	46.0	6.1	13.8	1.2	10.2	7.0
Lithuania	9.6	7.4	46.4	5.2	16.7	1.9	9.6	3.0
Luxembourg	16.8	12.1	47.3	11.2	8.1	-	4.5	-
Hungary	6.5	9.3	39.8	7.2	14.9	2.4	9.4	10.4
Malta	10.1	17.2	32.7	11.1	9.6	0.2	17.8	1.3
Netherlands	11.9	8.7	39.7	6.3	7.7	1.1	18.0	6.6
Austria	13.7	12.9	36.6	11.0	14.5	1.3	7.6	2.4
Poland	13.5	9.1	38.3	8.0	14.0	1.8	8.1	7.3
Portugal	5.6	9.3	31.8	7.2	21.6	1.8	16.2	6.4
Romania	2.0	8.1	49.0	5.2	20.1	2.2	9.2	4.2
Slovenia	7.7	8.5	34.7	7.0	19.5	3.2	10.0	9.5
Slovakia	12.3	7.3	31.0	8.5	15.2	2.2	17.2	6.2
Finland	5.0	14.1	23.0	10.1	23.9	2.2	16.2	5.4
Sweden	12.9	13.5	27.0	9.2	16.7	1.0	17.3	2.5
United Kingdom	9.3	16.9	29.2	14.2	8.9	1.1	18.5	1.8

Table 1. DISTRIBUTION OF THE NUMBER OF STUDENTS BY THE FIELD OF STUDY

Data source : EUROSTAT

Analyzing these data one can note that in most EU27 countries the largest share of the number of students belongs to the social sciences, business and law but the developed countries of Europe recorded a more balanced distribution of students by field of study. For example, Germany has only 25.8% of students enrolled

in the social sciences, business and law area, 14.3% in science, mathematics and computing and 17.8% in engineering, manufacturing and construction field.

Figure 4 shows the median age of the students in the EU27 countries. The median age is influenced by a number of factors such as the duration of higher education studies, delaying the start of higher education studies after graduating the high school for various reasons and the decision to return to university at some point in life. The EU27 average was 22.1 years, the maximum value being recorded for Finland - 24.9 years, followed by Sweden with 24.8 years and Denmark with 24.6 years while the minimum value is 20.4 years recorded in Ireland. In Romania the median age of students in 2011 was 21.9 years.



Data source: EUROSTAT

Fig. 4. The median age of the students in EU27 countries in 2011

Regarding the tertiary education attainment, the Europe 2020 strategy sets a target for this indicator: 40% of the population aged 30 to 34 years has to complete a form of higher education. In 2011, this goal is not yet

reached, the indicator having the value of 34.36% but there is an increase in tertiary education attainment in 2012, this indicator reaching the value of 35.8%. Countries like UK, Sweden, Finland, the Netherlands, Luxembourg, Lithuania, Cyprus, France, Spain, Denmark and Belgium have already exceeded the target value of the indicator, but there are countries with a very low level of tertiary education attainment. These countries include Malta, Italy, and Romania that recorded a value below 22% in 2012. Figure 5 shows the tertiary education attainment for the 2011 and 2012 in the EU27 countries.



Fig. 5. Tertiary education attainment for EU27 countries

The evolution of the tertiary education attainment for Romania and the average value for the EU27 countries for the period 2000-2012 is shown in figure 6. We can note an increasing trend in the percentage of

the population aged between 30 and 34 years who completed a form of higher education, but this percentage values for Romania are lower than the EU27 average. This growing trend reflects the investment policy in higher education to respond to a request of more qualified labor force. Although the number of students has experienced an upward trend, especially after 1995, Romania is still below the target of 26.7% for this indicator.



Data source: EUROSTAT

Fig. 6. Tertiary education attainment for 2000-2012 period for 30 to 34 aged population

3. Public expenditure on education

Public expenditure on education decisively influences the development of the educational system of a country [3],[5]. Public expenditure on education as a percentage of GDP is considered a measure of the degree to which governments are committed to developing highly skilled human resources. Usually these expenses include current and capital spending of the educational institutions, loans to students or their families, subsidies and transfers to non-profit organizations or private companies that organize activities in education. In 2010 the EU27 average public education expenditure was 5.44 % of GDP, but there are large differences between member states in terms of percentage of GDP allocated to education: while Denmark allocates 8.80 % of GDP to education, Romania has allocated only 3.35% of GDP education in 2010. The percentage of GDP allocated to both total and higher education expenditures for EU27 countries is plotted in figure 7. The higher education public expenditure ranges between 2.18% of GDP for Finland and 0.61% of GDP for Bulgaria. Public expenditure on higher education represents 14.85 % of total government expenditure on education in Bulgaria and this percentage reaches 28% for the Nederlands.

Investments in the education system are essential to fight the economic crisis by boosting economic growth and competitiveness [4].



Data source: EUROSTAT (data for Greece and Luxembourg are unavailable)

Fig. 7. The public expenditure on education as % of GDP for EU 27 countries in 2010

4. Conclusions

Graduating a form of higher education decisively influence the labor market participation. The statistical figures show that the unemployment rate among young people aged between 15 and 24 years with a low level of education was 30.3% in 2012, i.e. about 10% higher than the unemployment rate among young people that graduated a from high school or a form of higher education. Forecasts of the labor market needs by 2020 highlights again the importance of the higher education in the formation of the human capital [6]. In this respect, the Europe 2020 strategy places a particular emphasis on the higher education that should ensure the development of skills required in the labor market.

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Load profiles analysis for electricity market

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Abstract

In the wake of electric power system transition towards smart grids, and the adoption of the electric market schemes, electric utilities are facing the need of a better load profiles understanding for their customers. In this work, some key objectives were addresses, such as definition of the mathematical model for calculating the hourly energy specific, identification of the three target groups for users who have developed consumer profiles, definition of the two types of significant load and assessment of the impact of using consumer profiles on users.

Keywords: Distribution system, electricity market, load profile.

1. Introduction

In the free market of electricity, electricity suppliers need to have information on the customer electricity consumption evolution in order to buy sufficient energy from the wholesale market to cover the hourly consumption at negotiated prices and average periods [1-15].

In the absence of such information, the service provider will be obliged to purchase the electricity wholesale market. The quantities of purchased energy may be smaller than its customer's needs – in which case, the deficit will be covered by purchasing the missing quantities in the market for next day or balancing market at higher prices. Where the supplier will buy power on the wholesale market more energy than is necessary for the customer, will be forced to sell the surplus, balancing market at a price lower than that with which the energy was purchased [16-36].

For those customers that have implemented smart metering devices (which can record consumption at different time intervals, memorize the values and remotely transmit the information), this consumption variation is known [37-42]. For customers that have not installed such intelligent devices, it requires a method by which the total electricity consumption over a period of time to be assigned to time slots [43,44]. Typically, the issue of the load curve profile determination is posed for small users and for users. In their case, the installation of meters with registration of hourly electricity consumption is economically unjustified [45,46].

2. Operational and functional requirements for accurate load profiling - analytical assessment

Average daily consumption which is scheduled by using weights specified in a table which contains data relating to consumer profile (differentiated for working day and non-working day) is defined from the relations detailed in sequel.

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2.1 Monthly energy aggregation

For an average month, some using the data presented in a table that contains the results of the measurements of energy for all hourly intervals (curves, as the average consumer used to establish the data measured consumer profile):

$$Q_{WD} = q_{WD} * N_{ZD} \tag{1}$$

$$Q_{NWD} = q_{NWD} * N_{NWD} \tag{2}$$

$$Q_{WD} = Q_{WD} + Q_{NWD} \tag{3}$$

where:

 Q_{WD} = amount of energy distributed on working days for a month, according to the measured values;

 Q_{NWD} = amount of energy distributed in non-working days for a month, according to the measured values;

 q_{WD} = average daily consumption associated with any working days for a month, according to the values given in the table containing the results of the measurements of energy for all hourly intervals;

 q_{NWD} = average daily consumption associated with any non-working days for a month, according to the values given in the table containing the results of the measurements of energy for all hourly intervals;

 \mathbf{Q} = energy distributed within one month according to measured values

 N_{WD} = number of working days in the month;

 N_{NWD} = number of non-working days in the month

2.2 Evaluation of energy weights

$$P_{WD} = \frac{Q_{WD}}{\overline{Q}} \tag{4}$$

$$P_{ZNL} = \frac{\overline{Q}_{NWD}}{\overline{Q}}$$
(5)

where:

 P_{WD} , P_{NWD} is the weight of the energy distributed for one month with respect to working days/holidays, determined accordingly to the measured values which underline the consumer profile, according to the table that contains the results of the measurements of energy for all hourly intervals;

2.3 Monthly energy calculation

Energy distributed in the settlement month, differentiated according to type of day (working/nonworking) shall be established according to the following relationship:

$$Q_{monthWD} = Q_{month} * P_{WD} \tag{6}$$

$$Q_{monthNWD} = Q_{month} * P_{NWD}$$
⁽⁷⁾

$$Q_{monthWD} + Q_{monthNWDZNL} = Q_{month}$$
(8)

where:

 Q_{month} = the amount of energy distributed in the settlement,

2.4 Monthly calculation of energy weights

Daily quantities of energy distributed in paying month must be approved according to profile schedule (using the weights shown in a table containing data relating to consumer profile) is determined according to the relationship presented in sequel:

$$Q_{WD} = \frac{Q_{monthWD}}{N_{WD}}$$
⁽⁹⁾

$$Q_{NWD} = \frac{Q_{monthNWD}}{N_{NWD}}$$
(10)

2.5 Daily/hourly energy calculation

Monthly representation of quantities of energy will be distributed on the basis of the approved profile on differentiated working days / non-working days, according to the following relationship:

a). working day

$$Q_{hourWD} = Q_{WD} * \gamma \tag{11}$$

where:

 Q_{hourrWD} = energy distributed according to a time interval for a working day;

 γ = represents the percentage determined for the characteristic profile of working days, for a given time interval (according to the table containing data relating to consumer profile)

b). non-working day

$$Q_{hourNWD} = Q_{NWD} * \eta \tag{12}$$

where:

$$Q_{hourNWD}$$
 = energy distributed according with a time interval for a working day;

 η = is the percentage determined for the characteristic profile of working day, for a given time interval (according to the table containing the data relating to consumer profile).

Hourly quantities are expressed in, MWh with 3 decimals, so that the difference between the amount of energy distributed monthly and the sum of hourly energies to be less than 1 kWh.

3. System application

The question of determining the load curve profile is very economically-efficient for small users and for users. Under these circumstances, the establishment of hourly values of energy associated with a supplier can realize, for each point of consumption for providing hourly consumption by spreading recorded on a calculation based on a consumer profile.

Within current paper, the following consumers were took under consideration:

- 1. Fuel stations
- 2. Small businesses without cooling
- 3. Small businesses with cooling
- 4. Schools

3.1 Fuel stations

This illustrates loading profile contributions such as lighting, cooling, ventilation and other tasks performed throughout the day. Evaluation of total energy consumption in energy will show a rapid increase during the

morning because of the transitional arrangements of the receivers. Once the systems are started, the demand is relatively constant throughout the day.



Fig. 1. Load curves for fuel stations

Average consume curve [MWh]					
Interval	Interval	Interval			
00:00:00	0.004292661	0.00403134			
01:00:00	0.004293374	0.004025699			
02:00:00	0.00431324	0.004067442			
03:00:00	0.004339073	0.004211893			
04:00:00	0.0043308	0.004205129			
05:00:00	0.004474134	0.004150411			
06:00:00	0.004486111	0.004113899			
07:00:00	0.004406811	0.00390353			
08:00:00	0.006805816	0.003982609			
09:00:00	0.011768425	0.004847129			
10:00:00	0.012067337	0.004919832			
11:00:00	0.012192786	0.004936485			
12:00:00	0.012029691	0.004917517			
13:00:00	0.012074995	0.004672229			
14:00:00	0.012670302	0.005389044			
15:00:00	0.012493785	0.005340656			
16:00:00	0.012752344	0.005375426			
17:00:00	0.012025259	0.005502721			
18:00:00	0.009438688	0.005893038			
19:00:00	0.006964362	0.005928727			
20:00:00	0.004961839	0.004721399			
21:00:00	0.00419137	0.004045598			
22:00:00	0.004175531	0.004062494			
23:00:00	0.004159727	0.004051396			
Q _{WD}	0.185708461				
Q _{NWD}		0.111295642			

Table 1 Measurements results

 Table 2 Data for fuel stations (hourly weights of energy consume)

	Consume profile					
	Mean WD [%]	Mean NWD[%]				
00:00:00	2.311505444	3.622190662				
01:00:00	2.311889189	3.617122116				
02:00:00	2.322586538	3.654628397				
03:00:00	2.336497257	3.784418488				
04:00:00	2.332042219	3.778340724				
05:00:00	2.40922455	3.729176304				
06:00:00	2.415674017	3.69636986				
07:00:00	2.372972836	3.507352062				
08:00:00	3.664785357	3.578405416				
09:00:00	6.337043236	4.355183359				
10:00:00	6.498000695	4.42050712				
11:00:00	6.565552497	4.435469842				
12:00:00	6.477728882	4.418427075				
13:00:00	6.502124331	4.198033707				
14:00:00	6.82268434	4.842098201				
15:00:00	6.727633712	4.798620693				
16:00:00	6.866862061	4.82986245				
17:00:00	6.475342473	4.944237998				
18:00:00	5.082529611	5.294940665				
19:00:00	3.750158578	5.327007124				
20:00:00	2.671843172	4.242213655				
21:00:00	2.256962489	3.635000816				
22:00:00	2.248433386	3.650182388				
23:00:00	2.239923131	3.640210877				

3.2 Small businesses without cooling

This illustrates loading profile contributions such as lighting, cooling, ventilation and other tasks performed throughout the day. Evaluation of total energy consumption in energy will show a rapid increase during the

morning because of the transitional arrangements of the receivers. Once the systems are started, the demand is relatively constant throughout the day.



Fig. 2. Load curves for SBwC (WD and NWD) Small businesses with cooling

Minimum and maximum limits presents a limited variation of about 2%, which indicates the uniformity of type SBC users consumption. The load curve flattening we can say that it has a high value which indicates that in the case of SBC have a flat load curve.



Fig. 3. Load curves for SBC (WD and NWD)



Fig. 4. Load curves for Schools

The overall purpose of this section is to reach the final economic target of fully describe the customers' behavior by exactly quantifying their consumption patterns, starting from monthly energy aggregation.

4. Conclusions

In this work, some key objectives were completed, such as definition of the mathematical model for calculating the hourly energy specific, identification of the three target groups for users who have developed consumer profiles, definition of the two types of significant load and assessment of the impact of using consumer profiles on users

Also, throughout the whole paper, the authors have tried to create a framework that can be used later by the beneficiary for mathematical models. In sequel are listed the obstacles in the face of improving energy distribution activity and the action required to be taken with a view to the removal of obstacles.

There are a few issues that pose a serious threat to the future development of electric distribution system. A brief collection of these issues are presented in sequel:

- Lack of investment in facilities for low voltage networks, a significant proportion of the consumers having old installations with access to conductors.
- Poor status of the electric distribution power system, namely network areas with great lengths, LV overload, with inadequate insulation.
- Action to raise awareness of the extent of the economic agents who work with very low loads. Actions required in order to mitigate the upper-mentioned issues:
- Continuance of control actions for faulty consumers of electrical energy,
- Recovery and restoration of the electric power system is compulsory for reaching the goal of having a secure system
- Development of electric distribution systems using economic-based strategies

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