

## Energy concept summary

Title of the energy concept: **Implementation of Energy Data Management System in the public library**

Topic area choice and topic marking in blue:

- ( ) **Building** e.g. Insulation, change of windows, Low-energy-buildings
- ( ) **Electrical energy** e.g. Light, Compressed air, Electrical drives, Cooling machines, Load management
- ( ) **Heat** e.g. Heating, Process heat, Heat recovery, Air conditioning, Combined heat & power
- ( ) **Renewable energy** e.g. Solar technology, Wood-fired plants, Biogas, Geothermal energy
- (X) **Management** e.g. Energy buying, Contracting, Emission trade, **Energy data management systems**



**Company:** NUB “Kliment Ohridski” (National and University Library)  
**Branch and NACE-Code(s):**  
**Products/Services:** Library services (national library)  
**No of employees:** 90  
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**NUB – National University Library “St. Kliment Ohridski”** is a cultural institution of national interest. The building where this institution is placed is composed of two parts:

-The central building, built about 40 years ago, stocks the largest library’s fund of books. Here are also the public reading rooms with different purposes. The majority of the staff, displaced in separate working rooms (offices, laboratories, etc.) are also placed in this building.

- The second one is the so called “New building”, completed in 2007. This facility primarily serves for protection and archiving of the library collections. In this part are also placed some offices and specialized reading rooms where visitors can have the specialized and unique editions of books and publications.

After the completed analysis and insight of the condition of the buildings and the equipment, and the detailed study of the available technical documentation and also the conducted interviews with the staff responsible for maintenance of the heating, cooling and air-conditioning system, the following facts and conclusions were drawn:

- On average, NUB pays in total 20.000 EUR per month for consumed energy (5.500 EUR for electrical and 14.500 EUR for thermal energy), or in total 240.000 EUR per year without VAT.

- In the construction of the new building were used construction materials and technologies that provide good isolation level. While the central building (the old one, built in 1975) is facing with significant energy losses, primarily because of the large glass surfaces (glass outside walls and large plexiglas areas in the roof construction), and glass windows with quite low isolation features (generally all over the building).

- The equipment for heating, cooling and air-conditioning (HVAC), especially the one placed in the central building, quite often is out of order and rarely is used in a full capacity. Due to these frequent breakdowns and also because of the increased cost of the energy, couple of years ago NUB has started using thermal energy form external suppliers (BEG).

- In certain premises, due to problems with the HVAC equipment (mostly with the cooling equipment), installed are additional units of standalone air conditioners (split systems, about 10 in total).

- During the winter period, usually it happens some of the employees to use additional mobile heaters (electrical heaters) in their offices.

- The technical staff, who manages (switch on/off) the HVAC equipment on working days, has no possibilities for central monitoring of the working environment (temperature and humidity). That means, they have no opportunity for monitoring of the status and the efficiency of the equipment in regards to the consumed electrical and thermal

energy, neither as an overall HVAC system nor as separate units.

- In general, the self-awareness and initiatives of the employees for energy saving is not on a satisfactory level.

After the overview and presentation of the findings to the NUB technical staff and the managing team, we proposed implementation of an Energy Monitoring System (EMS, also known as EDMS or "Energy Data Management System"). Proposed EMS system will provide significant savings for the organization and huge advantages in the management of the HVAC system in the NUB.

The proposed EMS/EDMS solution will include at least 50 control points (each one based on micro controller unit with appropriate sensors) distributed in all premises of the NUB in order to provide real-time measurements and data acquisition. The data are collected in a central database and include various physical parameters like electrical and heating energy, temperature, humidity, light intensity, etc.).

Besides the measured data, each record in the database is accompanied by additional attributes like time, location and equipment where the measurement was taken. These additional attributes are valuable assets for in-depth analysis of the overall HVAC system and working environment in the NUB, but also for creation of various useful reports.

The proposed EMS solution will bring following benefits and advantages for the client:

- Significant savings in the consumption of electrical and thermal energy per year (according to the international practice, the implementation of an EMS/EDMS system will provide energy savings of 5-20%).

- Fast Return on Investment (Pay-back period):

- \* 8 months (for savings 20%, best case)
- \* 10 months (for savings 15%)
- \* 15 months (for savings 10%)
- \* 30 months (for savings 5%, worst case)

- Complete insight into the consumption of the electrical and thermal energy. Monitoring of the energy consumption by buildings and premises (real-time measured consumption, consumption over a period of time like day, month, year or other selected period); tabular and graphical data presentation of the data for quick comparison of the results.

- Comparison of energy consumption by periods (day/day, month/month, year/year)

- Comparison of delivered energy (measured/paid)

- Insight into the working environment in every room (temperature, humidity, lighting)

- Analysis and planning of energy consumption depending on the measured outside temperature and humidity

- Detection of breakdowns of the system for generation and distribution of the heating energy; sensors placed on the devices for distribution of thermal energy (fans, pumps)

- Ability to map the energy efficiency of each room in the building and ability for planning of future actions for improvement

- Ability for detection of physical presence / absence of employees and visitors in certain premises in order to manage the switching on/off of the local devices for heating/cooling (smart building)

- Possibility for future integration of the EMS/EDMS system with the HVAC systems in the NUB in order to provide precise control of energy consumption (smart building)

In a period of 12-months usage (all weather conditions included), the proposed solution should deliver to the client complete insight of the distribution and consumption of energy per premises. It will also provide detection of the weaknesses of the installed HVAC equipment and mapping of the energy efficiency of all premises and critical points in the buildings.

Based on the results of the real-time measurement, historical data analyses and the new knowledge and experience gathered about the current situation with the energy efficiency in the NUB objects, it is expected that the solution will provide savings in the energy consumption between 10% and 20%.

The savings will be realized through taking corrective actions by the technical staff (mostly based on the real-time data), so that it will provide most appropriate and optimal usage of the energy resources.

The client's management team should also organize training for all employees in the NUB, focused on effective usage of electrical and thermal energy, as soon as possible. This kind of training should be planned as a periodical activity within the organization (annually, be-annually).

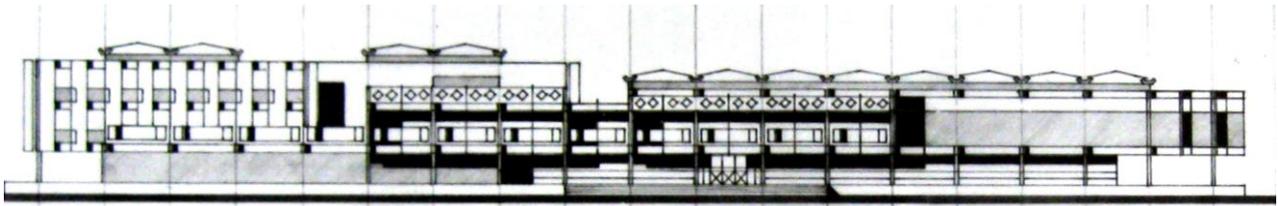
The next steps for improvement of the energy efficiency of the buildings will be oriented towards creation of plans

of activities and investments for additional reduction of the total energy consumption.

\* Reduction of the thermal energy losses of the buildings: replacements of the old generation of windows, glass walls and the ceiling construction in the central building with high energy efficiency products with better performances and lower losses; installation of isolation on the outer walls (where it could be applicable), etc.

\* Feasibility study for implementation of solar photovoltaics panel system as an alternative source of energy to the current electrical energy supply: Taking into consideration the worldwide trend of decreasing prices of the solar photovoltaics, as well as the steady growth of the price of delivered electrical energy, this option is becoming more and more attractive in our areas, even for small and medium enterprises.

**Picture(s) of plant, Base situation etc.**



NUB building



NUB Archive, new building



NUB building (central entrance)



NUB central building (interior)



Books depot



HVAC equipment



Public library area

**Results:**

Energy saving potential [kWh/a]: 71.000 electrical + 209.000 Heating energy

Energy source: Electrical, Heating energy

Cost reduction potential [Euro/year]: 35.630

CO<sub>2</sub>- saving potential [t/a]:

\* Electrical energy: 37.42 (t/a)

\* Heating energy (from gas): 42.43 (t/a)

Investment costs [Euro]: 30.400

Pay-back time [Years]: 0.85

Chance of implementation:

(X) high ( ) middle ( ) low

or date of implementation

Conversion factor:

\* Electrical energy: 0.527 (kg CO<sub>2</sub> / kWh)

\* Heating energy (from gas): 0.203 (kg CO<sub>2</sub> / kWh)