

Analysis of the “Orhei Hospital Complex Energy Audit”

ENERGY AUDIT, Part II: Electricity



IMPRESSUM:

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Contractor: Kommunalkredit Public Consulting GmbH (KPC)
Türkenstrasse 9, 1092 Vienna, www.publicconsulting.at
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Project team: Norbert Pehersdorfer, Markus Niedermair

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Executive Summary

The objective of this report is an analysis of the "Orhei Hospital Complex Energy Audit", which has identified a list of measures to reduce the electricity consumption at Orhei Hospital. The project was carried out with the help of GIZ and the hospital administration. In the Orhei Energy Audit 3 major areas of efficiency measures have been analysed (transformer, lighting, smart meters). Improved lighting and a substitution of transformers would result in immediate savings after year one of 23.740 lei/year (1.450 Euro). This figure will be rising to 39.000 lei/year after year 7 when the efficient use of transformers finally pays off. In order to detect further measures, the installation of 45 smart meters is suggested. The evaluation of the overall quality of the energy audit is shown in table 1.

Deliverables according to TOR	Evaluation	Comments
Evaluation of current electricity consumption	Incomplete	Total consumption missing, some consumer groups too
Evaluation of electrical equipment in place	Incomplete	Some consumer groups missing
Evaluation of transformer units	Good	Measurement conducted
Evaluation of energy losses	Good	Measurement conducted
Identification of possible savings	Incomplete	Fuel switch measures not included
Technical possibilities to install smart metering	Good	Further evaluation needed
Action plan	Incomplete	Basic components available but not put together. Needs to be combined with heating action plan ¹

Table 1: Assessment of deliverables

The two measures concerning lighting and transformers seem reasonable, given the information in the report. Concerning the smart meters which come with costs of 343.770 lei¹, we believe a more detailed cost-benefit analysis should be conducted based on the annual electricity bill for the Hospital.

In a second energy audit that is being conducted in parallel² two efficiency measures have been assessed for Orhei Hospital (replacement of electric water heaters and replacement of electric stoves) which can potentially save a total of 177.299 kWh of electricity per year. This amounts to more than 70% of the energy demand of the largest consumers mentioned in this study. Both these measures haven't been mentioned in this report. Given the huge impact of fuel switch measures in the context of the heating system, the action plans of both energy audits definitely need to be combined.

¹ Most prices are reported in lei, some are in Euro. For a better understanding, we try to provide both values, using the exchange rate of 16,97 lei/Euro.

² "Feasibility study regarding the efficiency of using the thermal energy in the complex of Orhei hospital buildings", prepared by Maximuk E.P. PhD as part of the GIZ Moldova Project, Chisnau, 2011

1 Background

This report is a review of the document:

"Analysis of Orhei Hospital Complex Energy Audit" ("Orhei Energy Audit").

The document was prepared by Iurii Ghies as part of the GIZ Moldava Project

This review includes:

- Recommendations regarding the reviewed study
- Recommendations for improvement

Basis for this evaluation report were the following documents:

- Orhei Hospital Complex Energy Audit
- Terms of reference for a short term consultancy "Feasibility Study for determining the energy efficiency measures needed to improve the situation in Orhei hospital"

2 Analysis of the current situation at the hospital

2.1 Energy Audit

2.1.1 Summary energy audit

An on site energy audit was conducted on April 4th of 2011. According to the "Orhei Energy Audit" the following areas are the largest consumers of power. Together these areas consume about 250 MWh of electricity per year:

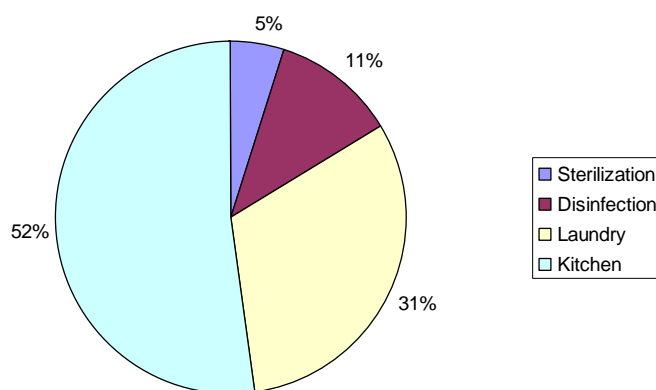


Figure 1: Share of power consumption of the largest consumer groups.

Key findings of the audit were:

- the 2 transformers only run at 5-8% of their capacity;
- emergency lighting uses fluroscent bulbs;
- kitchen uses electric energy (this topic is also dealt with in the "Orhei Feasibility Study")
- laundry equipment is old;

- further analysis would need the installation of new energy meters for each of the units;

2.1.2 Evaluation energy audit

- Identification of main consumers is incomplete
- Share of largest consumers in figure 1 is unknown
- No historical development provided
- Analysis of load profile (diagramme 1 in the original report) is missing: Load profiles don't have consistent time scales. Load peak jump at hour 4 is not explained

2.1.3 Evaluation energy audit

- Add summary of the total electricity consumption at the hospital according to energy bills;
- Detailed comments concerning the installation of smart meters and the conducting of further measurements are given in chapter 2.2.3 Energy Consumption Structure;

3 Analysis of Energy Efficiency Measures

In the "Orhei Energy Audit" 3 mayor areas of efficiency measures have been analysed (transformer, lighting, smart meters), each of which will be assessed in an own chapter. Additionally, some managerial actions and some smaller efficiency measures where reported as well. These will be discussed in the 3.4 "Additional Measures".

3.1 Power transformer replacement and efficient use

3.1.1 Summary power transformers

As the fastest and simplest option, the substitution of a 630 kVA transformer with a 160 kVA model and connecting this model with a 0,4 kV cable to the existing 400 kVA transformer is suggested. Historical developments, which are described in the introduction to the "Orhei Energy Audit", led to a situation, where the existing transformers are oversized. The cost of 160 kVA transformer and replacement services makes 54.000 lei (VAT included). The payback period was calculated to be 6,5 years.

3.1.2 Evaluation power transformers

- We assume that the measurements conducted at the Hospital for the two transformers and the derived measures are correct;

3.1.3 Recommendations power transformers

- None;

3.2 Lighting

3.2.1 Summary lighting

The report mentions the difficulties associated with changing lights in hospitals (according to Moldavian standard: СНиП П-Л.9-70 health providers should use incandescent lamps). After an analysis of the lighting situation, the "Orhei Energy Audit" comes to the conclusion that in accordance with the lighting requirements for hospitals in the Republic of Moldavia 41 emergency and stand-by lamps should be

replaced by LED-lights. The rest of the lighting should remain the same. Total costs of this measure would be 512 Euro³ for the lamps plus 250 Euro for the installation. This measure would save about 10.000 kWh/year (respectively 945 Euro per year).

3.2.2 Evaluation lighting

- Calculation correct;
- Measure reasonable;

3.2.3 Recommendations lighting

- Lighting is typically one of the top 3 users of electricity in hospitals; thus it seems reasonable to examine this field very closely;
- Whereas a change of lamps in many cases is not a viable option, the use of motion sensors and the time switches which can be applied at rooms which don't need to be lightened often, could be a potential field of further examination;

3.3 Energy consumption structure – installation smart meters

3.3.1 Summary smart meters

In order to gain a better understanding of the electricity consumption patterns of the Orhei Hospital complex the Orhei Energy Audit suggests the installation a total number of 49 smart meters. Total costs of this measure would amount to 21.000 Euro (figure was only provided in Euro).

3.3.2 Evaluation smart meters

- The installation of smart meters is a necessary precondition to identify further saving measures, but the aim of this measure is not clear (how many savings can be expected);
- Total consumption of electricity and saving potential of smart meters is missing;
- In a second energy audit that is being conducted in parallel⁴ two efficiency measures have been assessed for Orhei Hospital (replacement of electric water heaters and replacement of electric stoves) which can potentially save a total of 177.299 kWh of electricity per year. This amounts to more than 70% of the energy demand of the largest consumers mentioned in this study. These two measures would definitely have a large impact on the smart metering concept and thus should be integrated into the assessment;
- Smart metering must be part of an overall energy monitoring system;
- Smart meters are only a basis for the identification of further measures but do not themselves save energy;

³ Prices were provided in Euro.

⁴ "Feasibility study regarding the efficiency of using the thermal energy in the complex of Orhei hospital buildings", prepared by Maximuk E.P. PhD as part of the GIZ Moldava Project, Chisnau, 2011

3.3.3 Recommendations smart meters

- The handling of a large amount of smart meters should be accompanied by a comprehensive data monitoring system;
- An energy manager, who is responsible for energy monitoring etc., should be appointed;

3.4 ADDITIONAL MEASURES

3.4.1 Summary additional measures

A set of measure is exemplarily described in the "Orhei Energy Audit", but is not further discussed. These include:

- To use the appliances rated A+ or A++ in terms of energy efficiency classes;
- To use variable frequency power transmission drives in balanced ventilation systems and other motors used throughout hospital buildings;
- To reduce stand by losses;
- A plan to renovate 31 light poles is mentioned but not in detail;

3.4.2 Evaluation additional measures

- Additional measures from the energy audit that focuses on heating need to be integrated. See 3.3.2
- Equipment labelling should take into account Council Directive 92/75/EEC;

3.4.3 Recommendations additional measures

- Improving laundry equipment (e.g. efficient washing machines with heat recovery)
- Electricity consumption of fans or stand by losses are typically not negligible factors which would deserve a closer examination;

4 Analysis of action plan

We assume that an action should comprise of a list of identified measures which meet the technical and economical requirements of the hospital. Furthermore the plan should include the costs, the savings, the pay back time and the implementation schedule for each measure. Regarding the above definition, the action plan described in the chapter "Conclusions" is incomplete.

5 Final recommendations

The saving measures that have been found by the "Orhei Energy Audit" seem rather marginal in comparison to the total demand for electricity. Based on a consumption of the 4 largest consumers of

250.000 kWh/year respectively costs of 399.000 lei/year (24.374 Euro), the immediate savings after year one are 23.740 lei/year, which is about 6% of the consumption of those largest consumer groups (see table 1).

Savings immediately (after year 1)	[lei]	[Euro]
Transformer replacement	8.270	505
Lighting	15.470	945
Total	23.740	1.450

Table 1.

After year 7, an additional 15.350 lei/year can be saved by an efficient use of transformers (see table 2).

Savings after year 7	[lei]	[Euro]
Efficient use of transformers	15.350	938

Table 2.

In a second energy audit that is being conducted in parallel⁵ two efficiency measures have been assessed for Orhei Hospital (replacement of electric water heaters and replacement of electric stoves) which can potentially save a total of 177.299 kWh of electricity per year. This amounts to more than 70% of the energy demand of the largest consumers mentioned in this study. These two measures would definitely have a large impact on the findings of this report – especially on the smart metering concept – and need to be taken into account.

⁵ "Feasibility study regarding the efficiency of using the thermal energy in the complex of Orhei hospital buildings", prepared by Maximuk E.P. PhD as part of the GIZ Moldova Project, Chisnau, 2011