MEASURES TO IMPROVE ENERGY EFFCIENCY PLATFORM OF A TOURISM COMPANY

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Summary – Energy efficiency improvement program for an organization that consumes a significant amount of energy is an important document, both through fulfillment of obligations and especially through utility of identified measures on improving EnEF. and economic. After evoking the regulatory framework and the usefulness of this concerns, the paper presents the working methodology in making identifications MIEnEF for a TC and the results for Turism Felix.

Keywords: energy efficiency, measures, tourism company, program, objectives

1. INTRODUCTION

The necessity to increase energy efficiency (EnEF) is well known [1, 2]. Currently, this necessity, vital to the existence of human civilization, was translated into a number of commitments, strategies and international and European directives [3, 4, 5], with general and operational objectives, very concrete targets.

Conversion processes, transport, distribution and use of energy are responsible for most emissions of greenhouse gases, for which attention is directed first of all on these processes and the main sector of energy use: industry, transport, residential.

Along with expanding exploitation of renewable energy resources (RES) and clean technologies to exploit fossil fuels, increasing EnEF is an essential direction for the implementation of sustainable development strategies. If in terms of capitalization RES, Romania occupies a leading position in the UE28 [6], in the other two directions Romania has a lot to do [7, 8, 9].

An essential indicator for characterizing EnEF is energy intensity (IW) defined at national level, as the ratio of energy consumption to gross domestic product [10]. During the application of this indicator, diversification as can be seen [11, 12]: IW Primary (IWP), IW final (IWF), IW relative to purchasing power parity (IWPPP). If the first two ways of applying the indicator (IW) are particularly useful for assessing EnEF in the primary stage, the final stage and the interim losses. Third way evoked the economy (IWPPP) can induce confusion about the energy performance of a national economy on the global or European level, for example, for Romania in 2013, published the following values [11]:

- I_{WF} = 0,335 toe/1000€ (2005) - a value that is 2.36 times higher than the average UE28 [0,143 toe/1000€ (2005)];
- I_W^{PPP} = 0,112 toe/1000€ (2005 PPP) –a value which is less than the average UE28 [0,123 tep/1000€ (2005 PPC)].

To avoid confusion on the level of EnEF, is recommended to use the indicator "specific energy consumption". [13]

Tourism is an important sector for national economies. Although, Romania is placed last in the UE28 total contribution of tourism to Romania's GDP in 2015 was 5.1%, the growth potential is high. By buildings they own (hotels, treatment centers and leisure, etc.) tourism companies (TC) are important consumers of thermal energy (TE) and electricity (EE). As in other industries in tourism sector, in Romania are still many things to do for EnEF at the peak of the UE28 [14]. For this reason the national legislation on EnEF, recently became more rigorous [15, 16, 17], TC aims and scope, which consume at least 1000 toe / year. These TC are required to develop programs to improve energy efficiency (PIEnEF) in accordance with the model established at national level [18].

This paper presents the methodology and content PIEnEF for a TC (PIEnEF - TC) a complement to the work [19] which was the synthesis of the facts of TC, synthesis designed to underpin the objectives and measures PIEnEF. Concretization is the same TC [19], respectively S.C. Turism Felix S.A. (TF), TC who owns seven hotels, two bases leisure, administrative office and household group (Figure 1).

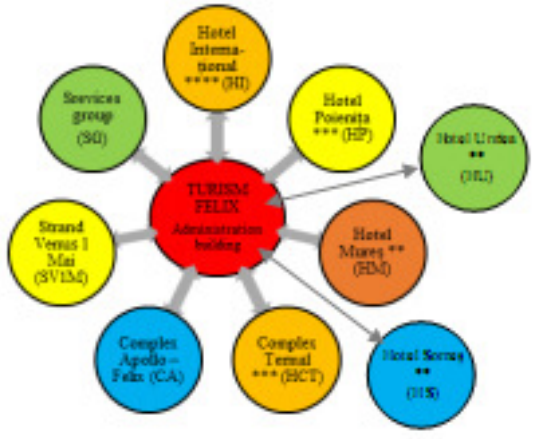


Fig. 1. Structure of TF [15] (HU and HS doesn't working)

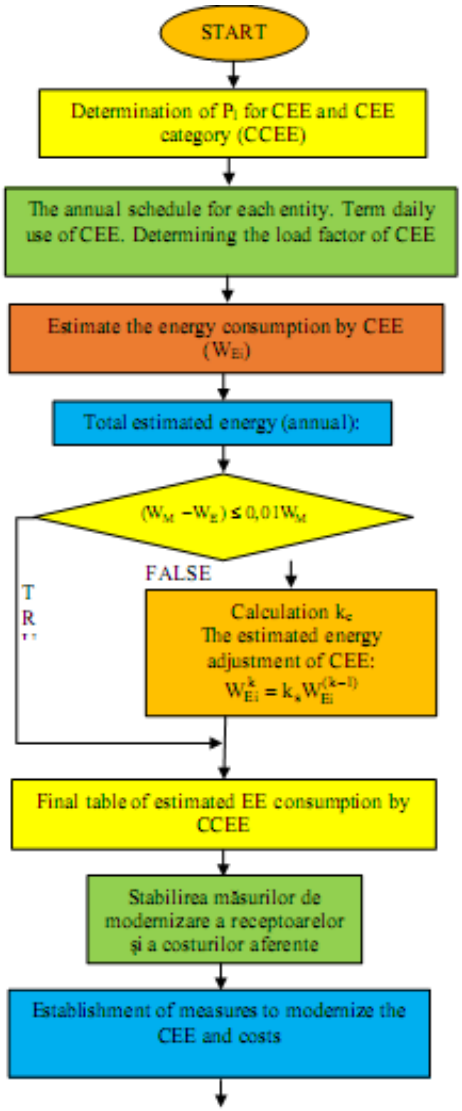
2. METHODOLOGY OF WORK

After analyzing the current situation, the recent evolution of energy consumption, comparison by benchmarking, in PIEnEF setting targets and applicable measures to improve EnEF (MIEnEF). For a correct substantiation of MIEFEn need to estimate energy consumption for every subunits (S-TC).

In the S-TC and TC there are many consumers of EE (CEE), depending on the scope of these units, CEE which are grouped, usually on the following categories / processes (CRP)

- CEE for heating, ventilation and air conditioning (HVAC);
- Lighting (L);
- Pumps (P);
- Kitchen equipment (KE);
- Medical equipment (ME);
- Laundry equipment (LE);
- Elevators (EL);
- Information technology equipment (ITE);
- Others (OTH);

For estimating consumption of EE on CRP, to identify MIEnEF in TC, we will pass through the flowchart of Figure 2.



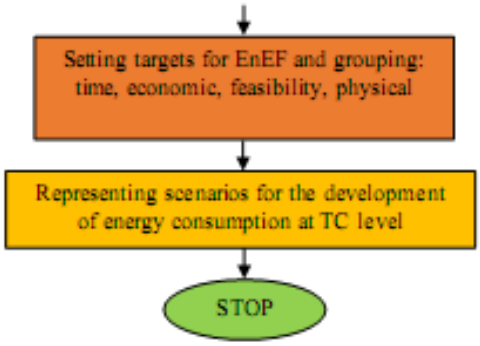


Fig. 2. Flowchart for working methodology of MIEnEF at TC

The quantities shown in the Fig. 2 is determined with the following relations:

- Load factor of CEE:

$$k_I = \frac{I_m}{I_n} \qquad (1)$$

I_m – measured value of electrical current [A];
I_n – nominal value of electrical current [A];

- Yearly usage of CEE:

$$t_{ua} = N_{za} \cdot t_{uz} \qquad (2)$$

N_{za} –number of operating days in the year of analysis;
t_{uz} – daily operating time [hours];

- Estimated EE for the CCEE (i):

$$W_{Ei} = 10^{-3} \cdot \sum_{j=1}^{M} k_{Ij} \cdot P_{Ij} \cdot t_{uzj} \quad [MWh / year] \qquad (3)$$

- Total estimated EE consumed in a year by a subunit:

$$W_E = \sum_{i=1}^{N} W_{Ei} \quad [MWh / year] \qquad (4)$$

$\overline{i = (1, M)}$ - CCEE "i";

$\overline{j = (1, N)}$ - CCEE belonging to the analyzed entity ;

The assessment is for each entity from TC structure. Estimated total energy (WE) is correlated with the measured total energy (WM) for each sub-unit of society and the correction coefficient (kc) is calculated:

$$k_c = \frac{W_E}{W_M} \qquad (5)$$

The estimated energy adjustment of receivers is done with:

$$W_{Ei}^{(k)} = k_c \cdot W_{Ei}^{(k-1)} \quad [MWh / year] \qquad (6)$$

k – iteration of order "k";

The adjustment process involves making the number of iterations required for the error estimation (WE) to be less than 1% compared with the energy measured by analyzed subunit:

$$(W_M - W_E) \le 0,01W_M \qquad (7)$$

It will consider and satisfy the restriction:

$$k_I = \left(k_{I(i-1)} \cdot k_c\right) \le 1 \qquad (8)$$

Determination of load coefficient (kl) is based on audit studies (AEE) made for CT. AEE made for TF [20, 21, 22] and made estimates, according to the methodology described above, have estimated on the receiving EE consumption and CRP in the TF. Figures 2 and 3 shows the structure and values of EE consumption for categories of receivers, the HI and CA and for other sub-units of TF and details can be seen in [23, 24].

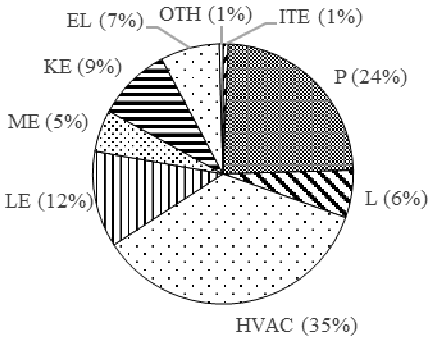


Fig. 3. Structure of EE consumption for CCEE at HI

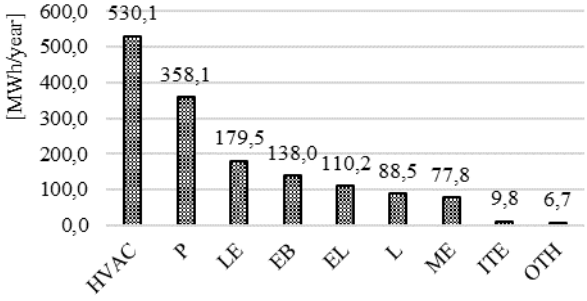


Fig. 4. EE consumption for CCEE at HI

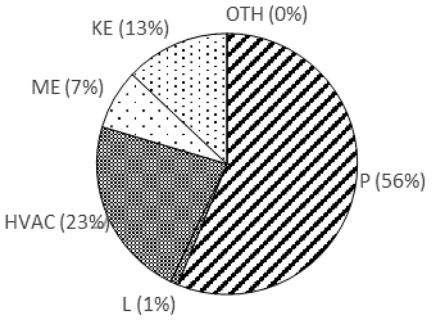


Fig. 5. Structure of EE consumption for CCEE at CA

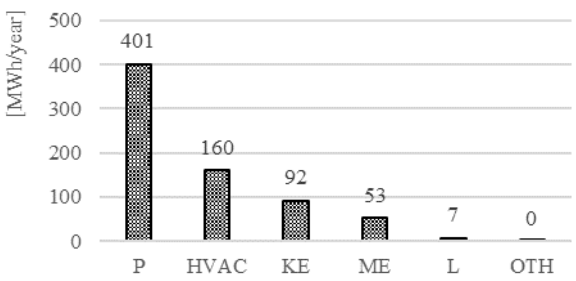


Fig. 6. EE consumption for CCEE at CA

Different categories of S-TF (ie. HI, CA) has different special structure consumption of CCEE.

3. MEASURES TO IMPROVE ENEF FOR TF

Based on the analysis performed in PIEnEF [23] synthesized in [19], TF proposes the following general objective (GO) of PIEnEF: **increasing the energy performance indicator in the next 7 years, at least 10% compared to current levels**. In summary, this Ordinance shall have the meaning reducing specific energy consumption (CSW) and energy intensity (IW) at least 10% at company level.

MIEnEF which will present further details the modalities of implementation of specific objectives (OBS) with reference to structural TF entities.

3.1 Measures to reduce TE consumption

The main directions in which to act to reduce the TE consumption are:

a) it was found on TE distribution network (TEDN) a loss of 29% [14, 15] total energy consumption in 2015. To reduce heat loss through TEDN there are two possible actions:

M0 – deep maintenance of TEDN (repair insulation, substantially reducing leakage);

M1 - Restoration TEDN (total or partial);

Existing data [25], the measure M1 involve specific costs of about 3.411 lei/ml and the losses can be reduce up to 15%. TEDN of the TF has a length of 5600 ml. TF TEDN intended for entire TE economy would be (at the level of consumption in 2015) of about 236 toe / year for the measure M1. The total investment is worth about 19.1016 million lei for the measure M1. It is an investment to be made by TF and SC Termoficare Oradea S.A.

b) thermal rehabilitation of buildings through insulation of exterior surface (M2) is a method to reduce heat consumption by about 22% for existing hotels to TF kind [26]. Thermal insulation of the floor (M3) which estimates a reduction of 2% [26]. Applying these measures could lead, therefore, to reduce heat consumption about 24% in total, for each TF hotel.

3.2 Measures to reduce EE consumption

The main directions in which to act to reduce the EE consumption are:

a) Changing the type of incandescent, halogen and low pressure mercury vapor lighting, to LED for TF subunits. In these halls will be equipped with motion sensor. By this method (M4) could reduce electricity consumption for lighting by about 50% [27].

b) Changing the bad or oversized pumps from thermal units and from substations. The important pumps with very large duration of use, it is recommend frequency inverters (M5). In this way, EE consumption could be reduce by approximately 40% for this group of receivers [28].

c) Replacement of IT equipment (PCs, printers, etc.) equipment with lower power consumption, the estimation of about 50% (M6) reduction of EE consumption in this CRP [29].

d) Improving the quality of EE (M7) respectively: the actual amount of voltage and current harmonics current balance system.

e) Periodically verifications of equipment and facilities, carrying out maintenance works (M8).

3.3 Economical structure of the expected measures

The identified measures will be characterize in terms of economic feasibility, by estimating simple payback period (DR) given by the formula [13]:

$$DR = \frac{I}{V_E} \quad [year] \qquad (9)$$

I – estimated investment value [lei*1000];
VE – the estimated amount of energy savings [lei*1000/year];

To calculate the value of the investment its considered prices of equipment / components proposed for replacement and an estimated value for labor [24]. Energy value (EV) is based on an estimate energy saving (EES) and energy prices, the forecast remains at 400 lei / MWh - for EE and 152 lei / Gcal - for ET. Table 1 presents the summary of expected envisaged measures, characterized as energy and economic aspect.

Proposed measures	Subunits	EES [toe/ year]	I [lei* 1000]	DR [year]
Restoration TEDN (M1)	-	236,00	19.102	53,25
Thermal insulation of exterior surface (M2)	Hotel Internațional (5121 mp)	100,68	916,7	6
	Complex Termal (5739 mp)	72,43	872,3	7,92
	Hotel Poienița (2154 mp)	46,13	327,41	4,67
	Administration building (1066 mp)	32,10	162,03	3,32
	Total TF (M2)	251,34	2.278	5,96
Thermal insulation of the floor (M3)	Hotel Internațional (1568 mp)	9,15	84,7	6,1
	Complex Termal (1926 mp)	6,58	104	10,4
	Hotel Poienița (1261 mp)	4,19	68,1	10,7
	Hotel Mureș (1919 mp)	4,17	103,6	16,6
	Services group (1459 mp)	0,70	78,8	74
	Total TF (M3 feasible)	24,79	439,2	9,8
Total TF (M2+M3)		**276,13**	**2.717,6**	**6,3**
Changing the type of incandescent, halogen and low pressure mercury vapor lighting, to LED (M4)	Hotel Internațional	5,03	81,7	3,5
	Complex Termal	3,85	77,7	4,34
	Hotel Poienița	1,44	30,5	4,56
	Hotel Mureș	1,58	65,8	8,95
	Services group	0,14	5,56	8,54
	Complex Apollo	0,49	40,03	17,6
	Administration building	0,22	9,34	9,1
	Total TF (M4)	12,75	310,63	5,23
Changing the bad or oversized pumps from wells and from substations (M5)	Hotel Internațional	7,09	54,28	1,65
	Complex Termal	3,85	31,36	1,75
	Complex Apollo	5,33	83,82	3,4
	Thermal units / drilling	46,88	92,12	0,5
	Total TF (M5)	63,15	261,58	0,9
Replacement of IT equipment (M6)	Administration building	4	249,6	13,42
Improving the quality of EE (M7)	Hotel Internațional	1,71	110	14
	Complex Termal	0,86	60	15
	Hotel Mureș	0,26	18	15
	Total TF (M7)	2,83	188	14,3
Total TF (M4 ÷ M7)		**82,73**	**1.009,8**	**2,62**
Periodically verifications of equipment and facilities, carrying out maintenance works (M8)	EE equipments	10,32	35	0,73
	HVAC	20	50	1,67
	Total TF (M8)	30,32	85	1,08
Total TF (M1 ÷ M8)		**625,18**	**22.914**	

It's considered feasible and proposed to implement by TF [M2 ÷ M8] the measures with DR less than 20 years. Measure M1 will analyze in collaboration with Termoficare Oradea, given the significant environmental impacts of the current status and the possibility of attracting European funds for rehabilitation.

CONCLUSION

Identifying MIEnEF for a TC is a complex process that requires knowledge of recent evolution and distribution of energy consumption and CRP CEE, CEE and performance of existing processes and current status in the field.

Identified MIEnEF for TF (table 1) has two categories:

- MIEnEF applied by the supplier, in this case, the TE supplier (M2);
- MIEnEF applied by TC – TF (M2 ÷ M8);

MIEFEn refers to two essential form of energy they consume TE (M1, M3 and M8) and EE (M4 ÷ M8). Implementation of measures (M2 ÷ M8) would lead diminution of consumption 388.48 toe, which would mean about 24.6% of energy consumption in 2015, but also a financial effort of about 3733.67 lei*1000.

After applying MIEnEF annual energy consumption decreases in the TF values, the company improving its energy rating, as follows:

- Hotel International: 346.27 kWh / sqm total (EE + ET), EE and CS of 84.83 kWh / sqm, up from grade D to C;
- Hotel Poienița: 284,85 kWh / sqm total (EE + ET) at up to C grade D;
- Thermal Complex: 251.71 kWh / sqm total (EE + ET), the D rating climbs to B;
- Hotel Mures: 178.6 kWh / sqm total (EE + ET) with an A;
- Overall hotels: 254.91 kWh / sqm total (EE + ET) with EE CS 36.79, up from grade C to B;
- Administrative building (SA, GG): 187.36 kWh / sqm remain above the European average in both total consumption and consumption of EE to be 17.33 kWh / m, above the European average;
- Complex Apollo: EE consumption is reduced by 13.8%, or 5.82 toe;
- Thermal units and drilling: EE consumption is reduced by 40%, or 46.88 toe;

- Total TF: 216.3 kWh / sqm total (EE + ET), with CS EE 44.64 kWh / sqm;

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