



PROJECT

PRO-ENERGY - PROMOTING ENERGY EFFICIENCY IN PUBLIC BUILDINGS OF THE BALKAN MEDITERRANEAN TERRITORY

Work Package:	3. Joint Regional Analysis, Strategy and Framework
Activity:	3.5 Joint Regional Analysis, Strategy and Framework - Energy audits in pilot public buildings
Activity Leader:	Cyprus Energy Agency- CEA
Deliverable:	3.1.5. Energy audits in pilot public buildings

Version:	Draft 1.0	Date:	31/05/21
Type:	Report		
Availability:	Confidential		
Responsible Partner:	Region of Epirus - Regional Unit of Thesprotia		
Editor:	TREK Development S.A.		

Interreg EUROPEAN UNION

Balkan-Mediterranean

PRO-ENERGY



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IDENTIFICATION SHEET

Project Ref. No.	BMP1/2.2/2052/2019
Project Acronym	PRO-ENERGY
Project Full Title	'Promoting Energy Efficiency in Public Buildings of the Balkan Mediterranean territory'

Security (distribution level)	Confidential
Date of delivery	06/05/21
Deliverable number	3.1.5. Energy audits in pilot public buildings
Type	Report
Status & version	Draft 1.0
Number of pages	21
ACTIVITY contributing to the deliverable	3.5 Joint Regional Analysis, Strategy and Framework - Energy audits in pilot public buildings -
Responsible partner	Region of Epirus - Regional Unit of Thesprotia
Editor	TREK Development S.A.

INTRODUCTION

PRO-ENERGY is a transnational cooperation project, co-financed by the Cooperation Programme “Interreg V-B Balkan Mediterranean 2014-2020”, under Priority Axis 2, Specific Objective 2.2 Sustainable Territories. The project aims at promoting Energy Efficiency in public buildings in the Balkan Mediterranean territory and to create a practical framework of modelling and implementing energy investments interventions, through specific ICT monitoring and control systems, as well as through energy performance contracting (EPC). The specific objective of PRO-ENERGY is to reduce by more than 20% the energy spending in public buildings of the participating entities in one year after the implementation of pilot actions.

Based on the above, Work Package 3 (WP 3) “Joint Regional Analysis, Strategy and Framework” aims at formulating a Joint Strategy and Action Plan for the whole Balkan Med area regarding energy efficiency through behavioural change based on the analysis of the existing situation regarding energy efficiency in participating territories incorporating mapping of policies, initiatives and interventions, and the selection of good practices and benchmarking of participating authorities.

More specifically, Activity 3.5 “Energy audits in pilot public buildings” aims to establish a benchmark for the pilot actions.

1. Purpose and Scope of the Energy Audit

The purpose and scope of the current activity of the Energy Audit is summarised as follows:

- Collection of energy data,
- Energy certification of the building,
- Issue of Energy Performance Certificate, and
- the implementation of the Recommendations included in energy efficiency improvement Proposal, towards to the achievement of a nZEB building and the fulfilment of minimum energy performance requirements.

2. The building

2.1 General Information

The building was constructed before the year 1955 and in the year of 1980, it was extended with the addition of the second floor. With regard to the energy performance, the existing building is Energy Class C. It is about an emblematic Administration building, at the sea-front of the city, which services a lot of people and houses important departments of Thesprotia Regional Unit. Cultural Value: 8

2.2 Facilities, Building description

The Public building selected to promote energy efficiency is the Administrative center of Thesprotia Regional Unit. It is about a 3-floor building with external walls of stone masonry, windows of PVC frames with double glazing and roof made by concrete slab and wood structural framing system covered with tiles.

Use of the building and number of Users/Staff:

- Use of the building (as per the Directive 2002/91/EC): Office Building
- Number of staff:105
- Number of total users: 200
- Number of users per shift (for buildings with 24h operation): n/a
- Operation program (working hours): 07:00 to 16:00
- Environmental Education Activities: Yes, education of Technical and Environmental Department personnel
- Active and sensitized staff: Yes

Heating system: Two central Boilers, two-pipe system and conventional radiators.

Cooling system: Split-type air conditioners.

Lighting: LED tube lamps T8.

2.3 Area and Volume

The pilot building area and volume of each floor are being referred as follows:

- Ground floor: 709.20 m² with Volume: 3226.86 m³
- 1st floor: 1350.90 m² with Volume: 5876.42 m³
- 2nd floor: 1350.90 m² with Volume: 5876.42 m³

3. General Information for the Area

3.1 The Location

The pilot building is located on the downtown of Igoumenitsa, the capital of Thesprotia Regional Unit.

3.2 Climate and Temperature Data

The below table presents data with regard to temperature of the pilot building for the months of January to December.

Month	Average Monthly Temperature
JAN	9.6
FEB	10.3
MAR	12.1
APR	15.1
MAY	19.6
JUN	23.8
JUL	26.4
AUG	26.1
SEP	22.7
OCT	18.4
NOV	14.2
DEC	11.1

The climate of the pilot building is characterized as coastal.

4. Building Envelope U values

The current section presents data with regard to the building envelope U values as follows:

Thermal Conductivity U (W/m² oK): Maximum values of the heat conductivity coefficient U (W/m² oK)

Windows: 3.00 (80% of the total windows area) and 4.10 (windows to atriums)

External Walls: 2.33 (average)

Roof: 3.70

Ground floor to the soil :3.10

5. Energy Systems

5.1 Heating

The pilot building has two (2) steel central heating Boilers. Nominal Thermal Power: 930kWth and 814 kWth, Combustion efficiency: 91%.

The system operates by means of timer, without an automation system, about four (4) hours per day. The two old Boilers serve the first and the second floor of the building.

5.2 Cooling

With regard to cooling system, it is distributed, mainly old, with split type Air Conditioning units (Total cooling capacity: 83.29kWc).

Hours of operation: about six (6) per day

Efficiency: Low (EER ≈2.20)

Automation system:Yes (Split units)

5.3 Ventilation

There is no central ventilation system in the pilot building.

5.4 Hot Water System

With regard to hot water system this is not required.

5.5 Lighting

With regard to lighting the pilot bulding has 1020 LED tube lamps T8, with power :9-18-22 W, ~100Lm/W, and total power:12.54 kW

Hours of operation: nine (9) per working day-about 2300 hours per year in full power

The efficiency of installed LED lamps is low

Automation system:No

6. Integration of Renewable Energy Sources

In the pilot building there is integration of Ground Source Heat Pump (open-loop system completed for the whole building and one GSHP 71 kWth for ground floor).

7. Description of Electrical Installation

The power factor of electrical installation is about 1.00 (very good)

Because of the building's oldness, the state of the electrical installation is in bad situation, despite the high-power factor ($\cos \varphi$).

8. Energy Consumptions (available energy data)

The current section presents data with regard to electricity and diesel oil consumption for the year of 2019.

Table 1: of electricity consumption (Reference Year:2019)

THESPROTIA REGIONAL UNIT MAIN BUILDING				
TABLE OF ELECTRIC ENERGY CONSUMPTION				
YEAR: 2019				
MONTH	CONSUMPTION (kWh)	POWER DEMAND (kW)	COS ϕ	TOTAL COST VAT INCLUDED (€)
JANUARY	14.240,00	95,10	0,9842	2.659,00
FEBRUARY	10.800,00	74,70	0,9994	2.026,00
MARCH	9.800,00	62,00	0,9997	1.841,00
APRIL	8.920,00	128,00	0,9998	1.768,00
MAY	9.200,00	53,70	0,9998	1.623,00
JUNE	9.360,00	136,00	0,9989	1.747,00
JULY	12.480,00	74,40	0,9987	2.180,00
AUGUST	11.200,00	173,60	0,9986	1.980,00
SEPTEMBER	8.760,00	52,00	0,9980	410,00
OCTOBER	7.320,00	28,90	0,9998	1.324,00
NOVEMBER	7.920,00	48,00	0,9999	1.447,00
DECEMBER	10.240,00	57,90	0,9997	1.852,00
SUM	120.240,00			20.857,00

AVERAGE COST: 0,17346 €/kWh

TARIFF: Γ22

TOTAL DISCOUNT FOR IN-TIME PAYMENT (2019): 1344,01€

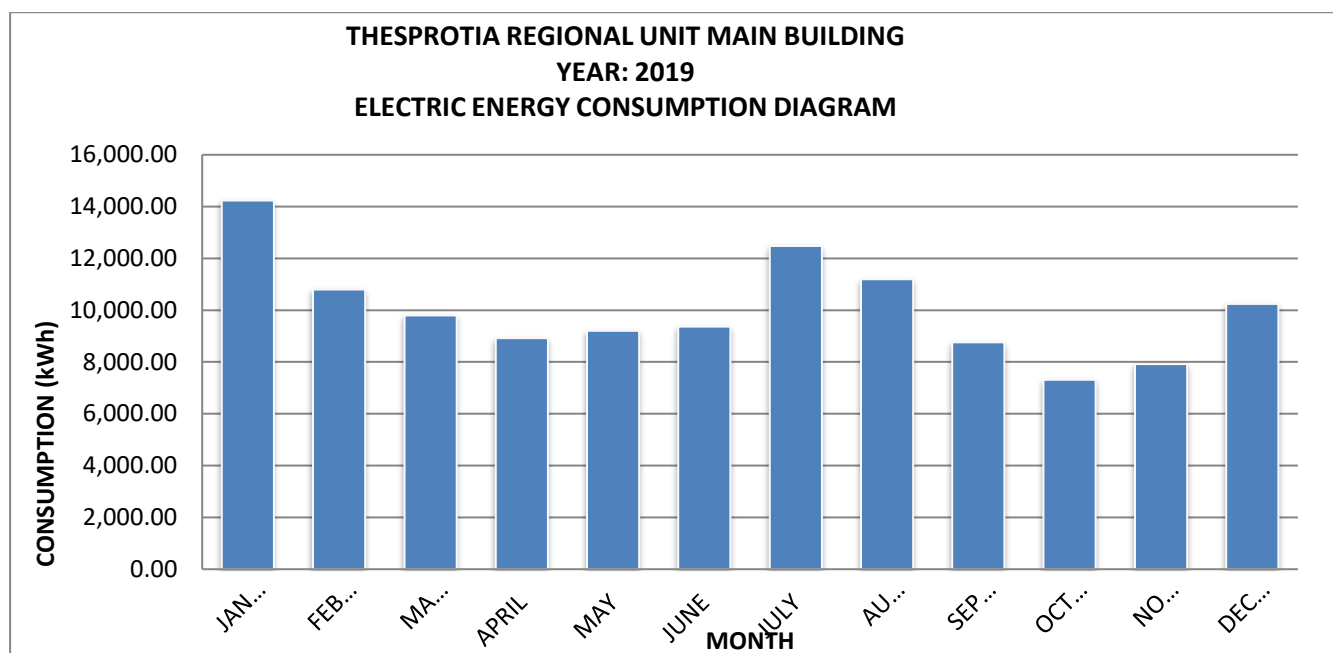


Table 2: Heating oil consumption - Diesel oil consumption (Reference Year: 2019)

THESPROTIA REGIONAL UNIT MAIN BUILDING		
TABLE OF HEATING OIL CONSUMPTION		
YEAR: 2019		
DATE	COSNUMPTION (lit)	COST VAT INCLUDED (€)
24/1/2019	1.000,00	1.079,10
31/1/2019	2.000,00	2.158,20
15/2/2019	1.000,00	1.079,10
20/2/2019	1.000,00	1.079,10
22/3/2019	2.000,00	2.197,80
13/12/2019	1.100,00	1.277,00
SUM	8.100,00	8.870,30

AVERAGE COST:

1,095€/lit

THERMAL ENERGY:

80.595kWh

9. Energy Upgrade Scenarios

The current section presents a number of scenarios/measures in relation to energy upgrade of the pilot building on the basis also of the feasibility study conducted. More specifically, such measures are being presented as follows:

- Integration of Ground Source Heat Pump (GSHP) system for 1st and 2nd floor (Completion of Geothermal Air Conditioning System, with two (2) Geothermal heat pumps, power 130 kWc each, 110 FCU, pipe network, etc)
- Construction of a new roof and addition of thermal insulation material under the roof
- Installation of a building integrated (roof) Photovoltaic (PV) system, power 89.20 kWp (Net Metering)
- Building Management System (BMS) installation
- Energy consumptions Metering, Monitoring and Management System
- Installation of new windows (Aluminium frames with thermal break system and glazing Low-e covering)
- Replacement of part of the current frames with 'energy' frames (~119 m²)
- Replacement of obsolete boilers with a new cast iron boiler (power 630kW) and two stage burners, operating progressively, including the total renovation of plumbing and electrical boiler room facilities.
- Total Cost (VAT included): ~1,350,000 €
- Estimated amortization: ~20 years

By applying a discount of approximately 40% to the initially estimated cost, it is expected that the final cost of the Project will be about 700,000.00€ (VAT included).

Attached NPV analysis, which demonstrates that, on the basis of the expected final cost of the Project (after the Contractor's discount), NPV is positive.

Since the Net Present Value is positive, the investment is acceptable.

10. Legislative Framework, Bibliography

- Energy Efficiency Directive (EED) 2012/27/EU (Law: 4342/2015)
- Energy Performance Building Directive (EPBD) (Law: 4122/2013)
- Greek Regulation of Building Energy Performance (KENAK) (Official Government Gazette 2367/B' /12-7-2017)
- Technical Directives of TCG: 20701-1,2,3,4 (Off. Gov. Gazette 4003/B' /17-11-2017)

11. Conclusions and Suggestions

According to the Energy Audit carried out, the building is classified to the Energy Class C (Γ), mainly due to the replacement of fluorescent lights. Nevertheless, the energy performance and the situation of the installations of the building doesn't satisfy modern requirements. Thus, it is necessary to improve the energy efficiency, to reduce the consumption of primary energy and to cut the energy and operational cost, by means of an overall energy upgrade Proposal.

With the implementation of the abovementioned Proposal (Par.9) the estimated primary energy saving will be about 87% and the unit price will be 2.00 €/kWh. The budget cost of the energy upgrade Project is 1,350,000.00 €.

The main percentage of the cost comes from Geothermal Air Conditioning System completion, Roof replacement and insulation, BMS and P/V System. It is expected that the final cost of the Project following the contractor's discount will be about 700,000.00€ (VAT included). On the basis of this final amount the NPV is positive and thus the investment is considered acceptable.

Suggestions:

The Proposal must be prepared and submitted in the framework of a Public Invitation (Epirus Region, Ministry of Energy and Environment, European Special Programs etc).

12. References

- Energy Efficiency Directive (EED) 2012/27/EU (Law: 4342/2015)
- Energy Performance Building Directive (EPBD) (Law: 4122/2013)
- Greek Regulation of Building Energy Performance (KENAK) (Official Government Gazette 2367/B' /12-7-2017)
- Technical Directives of TCG: 20701-1,2,3,4 (Off. Gov. Gazette 4003/B' /17-11-2017)
- Energy Invoices
- Maintenance sheets

13. Annexes

- PHOTOS
- ENERGY INVOICES
- MAINTENANCE SHEETS