

Masat e EE dhe Implementimi - Programi i trajnimit për Kompanitë Ndërtimore dhe Inxhinierët e Mbikëqyrjes

**Rezultatet e analizave të ndërtesave publike dhe
masat tipike të indentifikuara**

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10/11/2016

Përmbajtja

- › Masat e ndërmarra ne konsiderim të EE dhe masat e RE
- › Në lidhje me auditimin e energjisë...
- › Masat tipike të identifikuara të EE
- › Përmbledhje e rezultateve të auditimit të energjisë

Masat e marra në konsiderim të EE & masat e RE

› MASAT E KONSTRUKSIONIT

- › Izolimi i mureve të jashtme
- › Izolimi i kulmit
- › Izolimi i dyshemesë (mbi sipërfaqen e tokës) – raste të posaçme
- › Ndërrimi i dritareve dhe i dyerve

Masat e marra në konsiderim të EE & masat e RE

- › MASAT E INXHINIERISË MEKANIKE
 - › Përmirësimet e sistemit të nxemjes
 - › Instalimi i TRVs
 - › Zëvendësimi i pompave
 - › Zëvendësimi, rregullimi dhe pastrimi i sistemit të distribuimit të sistemit ekzistues
- › Lëshuarja në punë e karburantit – nxemja qendrore publike, biomasa pompat e nxemjes – sistemi solar termik

Masat e marra në konsiderim të EE & masat e RE

- › MASAT E INXHINIERISË ELEKTRIKE
 - › Sistemi i ndriçimit
 - › Përmirësimet e sistemit ekzistues të ndriçimit
 - › Ndërrimi i sistemit ekzistues të ndriçimit
 - › Paisjet tjera elektrike
 - › Pompat , aparatet, etj. (në varshmëri nga situata)
 - › Heqja e nxemësve elektrik

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› Një auditimi i energjisë është:

...një inspektim, shqyrtim dhe analizë e rrjedhjes së energjisë, për konzervimin e energjisë ne ndërtesë, proces apo sistem për zvogëlimin e sasisë së nevojshme të energjisë pa ndikim negativ në prodhim.

wikipedia

› Për përgatitjen e auditimit të energjisë nevojitet:

- › Informatat e përgjithshme për ndërtesën
- › Informatat rreth modeleve të përdorimit të ndërtesave
 - › Përdorimi i ndërtesës
 - › Regjimi i nxemje/ftohjes
 - › Modelet e Sistemeve elektrike të përdorura

Në lidhje me auditimin e energjisë...

- › Bazat e situacionit të ndërtesave dhe dizajni
 - › Ndërtimtaria/Arkitektura
 - › Inxhinieria Mekanike
 - › Elektro Inxhinieria
 - › Tjetër (sipas nevojës)
- › Informatat rreth shpenzimit të energjisë në ndërtesë
 - › Bartje e energjia për nxemje dhe çmimi
 - › Shpenzimi i elektricitetit dhe çmimi
- › Informatat/konfirmimi për paisjet e montuara në ndërtesë
 - › NVKA
 - › SHW sistemi
 - › Shpenzuesit e elektricitetit

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› ECURIA E PUNËS

› Pregatitjet

- › Mbledhja e informatave në dispozicion në lidhje me ndërtesën/ndërtesat

- › Dizajni, përdorimi i modeleve, shpenzimi, çmimi etj...

- › Planifikimi i vizitave

- › Marrëveshjet për vizitat në teren

› Vizita në teren

- › Mbledhja e informatave në teren në lidhje me paisjet e ndërtesës

- › Mbledhja e informatave nga personeli teknik

- › Konfirmimet/vërtetimet gjatë fazës pregatitore

- › Mbledhja e informatave të tjera me rëndësi

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› ECURIA E PUNËS

› Puna në zyrë

- › Pregatitja e të gjitha informatave për raport
 - › ... karakteristikat e mbështjelljes
 - › ... karakteristikat e sistemit NVKA
 - › ... karakteristikat e sistemit elektrik
- › Pregatitja e analizave për shpenzimin e energjisë
- › Pregatitja e analizave për çmimin e energjisë
- › Pregatitja e modelit të energjisë së ndërtesës
- › Formimi i vijave themelore
- › Identifikimi i masave për EE
- › Vlerësimi i ndikimit potencial të masave të EE
 - › Shpenzimi i energjisë
 - › Çmimi i energjisë

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Energy Audit Report 077
Building – Dormitory men

CES
07.12.2013

5. BUILDING STATE DESCRIPTION

The following chapter details the existing condition of the building including envelope constructions, mechanical and electrical systems, and general condition. The energy consumption data, both reported and calculated, are presented in Chapter 6.

5.1. BUILDING LOCATION

The building is located in the center of Vushtri with good access for pedestrians and vehicles. It is surrounded with other buildings with different characteristics in architecture and period of construction. According to interviews with the staff and according to the list of buildings with historical value issued by Ministry of Culture, the Dormitory for Men building doesn't have any historical value and therefore no restrictions for renovation work.



Figure 2 – Building location

5.2. GENERAL CONSTRUCTION DESCRIPTION

Audited building	Dormitory Men		
Date of auditing	15.11.2014		
Interviewed person	Majlis Jexh		
Year of construction	1939		
Type of construction	Massive concrete		
No of floors	4 (basement, ground floor, 2 floors)		
Gross area [m ²]	5,350.2	Heated area	5,007.5
Volume [m ³]	11,355.5	Heated volume	10,654.1
Construction	500	Heating system	13 Pipes, 13 Radi.

Table 2 – General description

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Waktuim - Dëshirë e re

Edo.
07.12.2013

The floor usage is similar for all other floors which are mostly residential rooms. The basement comprises the substation, storage and training rooms.

Building Floor	Space types	Height m	Framed area m ²	Non-framed m ²	Total area m ²	Framed volume m ³
Basement	Substation, storage, training room.	2.6	220.0	250.0	560.0	560.0
Ground floor	Rooms, offices.	3.5	955.6	275	960.0	3,345.1
First floor	Rooms, offices.	3.5	955.6	275	960.0	3,345.1
Second floor	Rooms, offices.	3.5	955.6	275	960.0	3,345.1
TOTAL			2,027.2	525.6	2,552.8	10,635.3

Table 3 - Usage by floor

5.2.1. Building layout

The building layouts were obtained. The building is spread along the main axis. The shape of building is simple as it only has one central corridor and rooms concentrated on both sides of the corridor.

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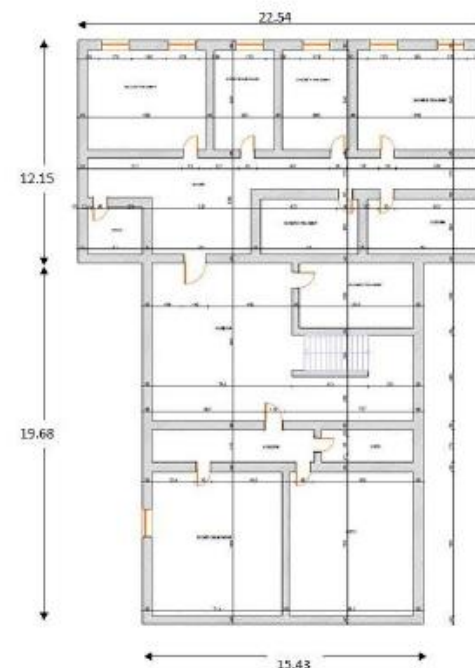


Figure 3 - Basement layout

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5.2.2. Building Physical Characteristics

All building elements were examined during the site visit. During the examination, certain deficiencies which cause large thermal losses were found. The following tables present the characteristics of each building element including:

- year of renovation
- existing layers of the element (where applicable)
- overall element thicknesses (where applicable)
- assessment of the element condition in order to evaluate whether construction measures are necessary prior to application of energy efficiency measures
- visible damage on each building element

The most important aspect part from the condition assessment, is the elaboration on building element areas, orientations and U-values of each element.

5.2.2.1. Walls

Building was constructed during 1936, structurally it consists of walls made out of full brick and concrete with a thickness of 33 cm and plaster from both sides. Outside walls are assessed to be in quite a good condition from the structural point of view with some minor damages in plaster. It is recommended to install the thermal insulation on the facade but minor damages have to be treated prior to EPS installation.

The existing layers are presented in Table 3. Existing wall can be seen in photos, Figure 6.

Type	Description	Area (m ²)					Existing "U" value		Proposed "U" value	
		h	W	S	E	Total	(W/m ² K)	(W/m ² K)	(W/m ² K)	(W/m ² K)
Wall type 1	Plaster, brick, plaster	266.6	512.1	229.2	466.2	1492.1	1.059	0.202		
Total wall		266.6	512.1	229.2	466.2	1492.1				

Table 4 - Walls summary

Wall type 1 1492.1 m²

Baseline				
Layer name	d (mm)	λ (W/mK)	R (m ² W/K)	R _s (m ² W/K)
Plaster	25	0.80	0.001	
Brick	200	0.81	0.270	
Plaster	25	0.80	0.001	
U-value (W/m ² K) 1.059				

Renovated				
Layer name	d (mm)	λ (W/mK)	R (m ² W/K)	R _s (m ² W/K)
Plaster	25	0.80	0.001	
Brick	200	0.81	0.270	
Plaster	25	0.80	0.001	
EPS	100	0.034	2.500	
Plaster de plaster	5	0.30	0.006	
U-value (W/m ² K) 0.202				

Table 5 - Wall U-value calculation

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Vatër: - Durrës - Më 1

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Figure 6 - Walls

5.2.2.2. Windows and External Doors

In 2000, most of the old metallic frame windows were replaced with new PVC windows. New windows are double glazed with PVC frame but some minor deficiencies were noticed during inspection since some PVC windows cannot be closed properly. It is recommended to fix the closing mechanism on windows. This measure is considered to have a slight improvement in reducing the infiltration heat losses. It is also recommended to replace the remaining old windows. The table below describes the window area and U-value.

Type	Description	Area (m ²)		Existing "U" value		Proposed "U" value	
		South	North+East	(W/m ² K)	(W/m ² K)	(W/m ² K)	(W/m ² K)
Windows 1 - PVC frame	Double glazing	20	268.9	1.000	1.000		
Windows 2 - Metal frame	Double glazing	67.8	0.0	4.500	1.400		
Total windows		44.6					

Table 6 - Windows description

Doors were also inspected. Doors were replaced during 2000 when new aluminum frame and double glazed doors were installed. According to the visual inspection doors are assessed as good materials and it is not recommended to replace them.

The table below describes door characteristics.

Type	Description	Area (m ²)		Existing "U" value		Proposed "U" value	
		South	North+East	(W/m ² K)	(W/m ² K)	(W/m ² K)	(W/m ² K)
Doors 1 - Aluminum	Double glazing	0.0	25.5	1.000	1.000		
Total doors			25.5				

Table 7 - Doors description

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Project Audit Room x 077
Materiality: De minimis =

Cool
07.2.2013

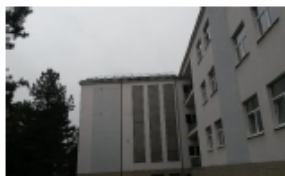


Figure 7 – Windows/doors



5.2.2.3. Floor

The floor is in a relatively good condition, but it has bad thermal properties. Despite that it is not recommended to insulate the floor since this measure is in general expected to have a large investment for a small benefit compared to other elements of the envelope. However if a renovation is going to take place in future then it is recommended to implement EE measures along with other refurbishment work.

The basement floor U-value and areas are presented in Table 8 and Table 9.

Basement type 2
Basement

Layer name	d [mm]	λ [W/m·K]	R [m²·K/W]
Concrete	20	1.80	0.015
Concrete	30	1.80	0.030
Wood joists	20	0.13	0.155
Hydro-insulation	10	0.05	0.005
Concrete slab	130	2.80	0.030
U-value			0.20

Table 8 – Basement floor U-value calculation

Basement floor	Area [m²]	Existing U-value [W/m²·K]	Proposed U-value [W/m²·K]
Basement	333.3	1.875	1.875

Table 9 – Floor description

Project Audit Room x 077
Materiality: De minimis =

Cool
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5.2.2.4. Roof

According to the visual inspection, the roof has a solid wooden structure forming a regular geometric shape. Roof is assessed to be structurally sound. However, it is covered with asbestos corrugated plates which need to be removed and handled carefully by professionals. New covering should include wooden planks, vapor barrier and metallic corrugated sheets. It is recommended to install thermal insulation on the roof with a rock wool layer to be laid on the slab and covered with a protective layer of screed, but only after construction works are completed.

The layers and U-value calculation for the existing and proposed roof are presented in Table 10 and Table 11.

Roof type 1
Basement

Layer name	d [mm]	λ [W/m·K]	R [m²·K/W]
Plaster	20	0.80	0.025
Concrete slab	200	2.6	0.08
U-value			0.125

Roof type 2
Basement

Layer name	d [mm]	λ [W/m·K]	R [m²·K/W]
Plaster	20	0.80	0.025
Concrete slab	200	2.6	0.08
Rock-wool	150	0.04	3.60
Screed	50	1.80	0.025
U-value			0.305

Table 10 – Roof U-value calculation

Type	Roof	Area [m²]	Existing U-value [W/m²·K]	Proposed U-value [W/m²·K]
Roof type 1	Asbestos roof	333.3	4.124	0.305

Table 11 – Roof description



Figure 8 – Roof

5.3. SANITARY HOT WATER

A solar thermal heating system was investigated and study of a solar thermal system for SHW preparation was done in order to assess the currently installed system.

Sanitary hot water is produced in the Main heating plant with a diesel boiler and is supplied to buildings according to demand. However, currently it is not functioning and SHW is prepared locally in each building.

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Shkup, - Doornik, 10.11.2013

Case
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In addition to this, Dormitory for men has installed solar panel with a total of 22 panel (1.2x2 m) and 4 water storage tank of 1000l each. The tanks are also connected to the electrical system for water preparation when solar panel are not supplying full requirement, but currently they are turned off due to high energy expenses. SHW substation is located in the basement of the Dormitory and no major deficiencies were noted.

Sanitary hot water consumption is estimated to around 13.14 m³/a, meaning 77 MWh energy [calculated with 10°C average annual cold water temperature and 60°C desired SHW temperature].

Type	Description	Quantity
Solar panel	- 22 x 1.2x2.0 m	22
Hot water tank	- 4 x 1,000 l each	4
Expansion vessel	- 1 x 100 l each	2
Pumps	- 2 x 1/2" 1/2" 350/10	1

Table 12 - Installed equipment for Sanitary Hot Water production and distribution



Figure 9 - SHW preparation

5.A. SPACE HEATING

Kosovo Academy for Public Safety campus has a centralized heating system with one heating plant serving all buildings within campus. Heating plant runs on diesel boilers. Entire heating system was refurbished during 2000-2002. The water is distributed through an underground pipeline system. Site visit revealed that the underground piping system was recently replaced (in 2014) [Dormitory men, Dormitory women, Administration, New Dormitory, and Range shooting]. The old pipes were replaced with new pipes insulated with glass wool and laid into concrete trenches. The interview revealed that second phase of the project is expected to be finalized during 2015 when pipes that supply Sports Hall and School building will be replaced with new. This was already implemented in the second half of 2013 according to information that was received. Every building (besides Stave Benet building, Healthcare building and Building 14) has its own substation, where the hot water enters into the hot water headers and then through the circulating pumps to upper floors.

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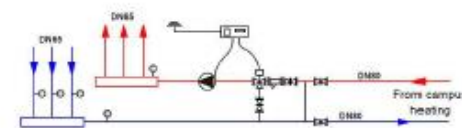


Figure 10 - Technological scheme of heating

5.A.1. Hot Water Preparation and Distribution

Substation is located in the basement covering an area of 10 m², which is sufficient for the current heating system and storages around it would allow placement of potential additional equipment.

Heating substation has been renovated in 2000 when new pumps, valves and piping were installed. Heating hot water is circulated with one Wilo pump without VFD. A three way valve is installed and working properly. The distribution pipes within the substation are well insulated with some minor deficiencies caused during some construction works. However, personnel didn't report any leakages in the system.

The installed equipment for heating preparation and distribution is listed below:

Type	Description	Quantity
Pumps	- 1 x 340/7, type Wilo	1

Table 13 - Installed equipment for heating preparation and distribution



Figure 11 - Substation

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Shkup, -Dokument

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07.12.2013



Figure 12 – Radiators installed in the building

Radiators

Baseline

TRP	Diameter	No.	Capacity kW	Total kW
PCCP	900x1000	21	2,239	47.0
PCCP	900x1200	30	2,239	173.9
PCCP	900x1400	20	5,126	62.3
PCCP	900x1600	3	5,371	23.9
PCCP	900x1800	5	4,017	12.1
PCCP	900x1200	2	5,704	7.4
	Total	101	336.64	336.6

Table 14 – Specification of radiators

Internal temperature was measured in different places and the results show 18-22°C in most of the rooms. However there was a higher fluctuation in hallways where the measured temperature range was between 12-18°C.

The calculated system power for the baseline scenario is 422 kW (see Annex 2 for calculation details) which is above the total installed radiator capacity of 336 kW, and the comfort conditions are not met due to low capacity of radiators compared to heat losses.

After introducing EE measures, heat demand will drop significantly (200 kW) which means radiators capacity will be oversized. Therefore, it is recommended to install TRVs on each radiator.

5.5. AIR CONDITIONING

There is no central cooling system in the building.

5.6. SPACE VENTILATION

There is no central ventilation system installed.

5.7. ELECTRICAL SYSTEM

There are no data regarding the internal electricity distribution network. In general, the lighting is in a poor condition in terms of EE and there are no replacement parts

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available. Fixtures are T8 linear fluorescent lamps operated by conventional control gear (CCG) which has placed under reflecting grill for soft light distribution and Incandescent 100 W lights. Lighting measurements accounted for 150-200lux in most of the rooms and approximately the same in hallways. It is recommended to replace the lighting system with a more efficient one which will also ensure higher lighting level which will meet the national standards. A lighting simulation of one characteristic room is provided on the figure below.

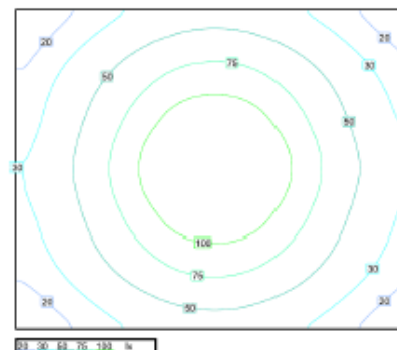
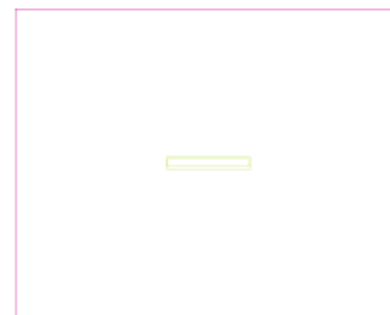


Figure 13 – Lighting simulation of one characteristic room

Since the baseline is calculated for the condition where all the lamps are in place and operating, the new lamps to be installed are only included in the Table of the Investment.

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Yllkuhi - Dormitory 077

Code
071.2.2013

Table below describes identified lighting fixtures and their rated power.

Lighting					
Type	No.	Bulbs	Watts	Ballast	WVA/a
121 Fluorescent 200W	4	2	50	13%	531.1
121 Fluorescent 100W	127	1	50	13%	3,375.5
121 Fluorescent 200W	11	2	50	13%	963.4
Incandescent 100W	25	1	100	0%	2,430.0
TOTAL	167		200		9,527.0

Table 15 - Lighting specification



Figure 14 - Lighting fixture

Electric equipment is mostly PCs, TV, and technical equipment.

Equipment				
Type	No.	Watts	WVA/a	
PC	10	330	3,393	
TV	1	330	742	
Cable	2	2,000	5,130	
Power	2	330	702	
Laundry	6	1,300	5,310	
TOTAL		4,040	15,669.0	

Table 16 - Electric equipment specification

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Yllkuhi - Dormitory 077

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6. ENERGY CONSUMPTION

The dormitory buildings are a part of a larger academy center campus including three dormitories, School, Administration building, logistic building, Steve Beret Building 54, Sport hall, Healthcare building, Kitchen. According to the interview there is no energy meter (heat or electrical) for each separate building. In order to obtain an orientation figure for metered consumption of each building, the total consumption is distributed according to ratios of total calculated consumption. The results are presented in the following section.

The results are presented in the following section.

6.1. REPORTED/MEASURED ENERGY CONSUMPTION

The results are presented in the tables below.

Audit no.	Total measured consumption	Calculated consumption	%	Ratio
	kWh	kWh	%	kWh
070-Yllkuhi-CAPS_School	2,654.7	970.7	36.5%	389.0
071-Yllkuhi-CAPS_Dormitory_077		625.5	23.6%	251.1
072-Yllkuhi-CAPS_Dormitory_078		513.8	19.3%	205.5
073-Yllkuhi-CAPS_Healthcare_Building		24.6	0.9%	9.2
074-Yllkuhi-CAPS_Sport_Hall		127.0	4.8%	50.4
075-Yllkuhi-CAPS_School_Hall		319.6	12.0%	125.3
076-Yllkuhi-CAPS_Healthcare_Cafeteria		3.0	0.1%	1.2
077-Yllkuhi-CAPS_School_Beret_Building		39.0	1.5%	15.7
Measured Yllkuhi-CAPS_Sport_Hall		30.2	1.1%	12.2
Measured Yllkuhi-CAPS_Cafeteria		105.0	4.0%	41.8
Measured Yllkuhi-CAPS_School_077		93.4	3.5%	37.1
Measured Yllkuhi-CAPS_School_078		47.6	1.8%	19.2
Measured Yllkuhi-CAPS_School_079		3.6	0.1%	1.4
Measured Yllkuhi-CAPS_School_080		55.0	2.1%	22.2
Measured Yllkuhi-CAPS_School_081		70.3	2.6%	28.4
TOTAL		3,161.2	100%	1,254.7

Table 17 - Estimated measured consumption divided

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Kosovo - Pristina
07.12.2013

Audit no.	Total measured consumption	Calculated consumption	%	Information
	kWh/a	kWh/a	-	kWh/a
075-YUB-GRPS_Deckel		180	27.15%	180.0
075-YUB-GRPS_Distributary_line		25	5.15%	22.1
075-YUB-GRPS_Distributary_line		52	4.43%	51.1
075-YUB-GRPS_Deckel_Nearest_Building		15	2.00%	14.0
075-YUB-GRPS_Supplying_Building		30	0.20%	40.5
075-YUB-GRPS_Deckel_Hall		47	0.20%	44.0
075-YUB-GRPS_Deckel_Hall_Technical_office		40	0.47%	50.5
075-YUB-GRPS_Deckel_Building		20	0.20%	26.0
Not audited YUB-GRPS_Deckel_Hall_1A		0	1.00%	7.7
Not audited YUB-GRPS_Deckel_Hall_1B		140	19.20%	150.0
Not audited YUB-GRPS_Deckel_Hall_1C		20	2.00%	18.0
Not audited YUB-GRPS_Deckel_Hall_1D		54	1.20%	90.1
Not audited YUB-GRPS_Deckel_Hall_1E		5	0.40%	5.1
Not audited YUB-GRPS_Deckel_Hall_1F		0	1.00%	7.7
Not audited YUB-GRPS_Deckel_Hall_1G		20	2.70%	19.2
TOTAL		751	100.00%	701.0

Table 13 - Estimated measured consumption of electricity

Year	Consumption (kWh/a)	Price (€ / kWh)	Total (€)	% total required
2012	62,436.6	0.09	5,619.3	19.20%
2013	48,249.7	0.09	4,342.5	19.20%
2014	31,443.9	0.09	2,830.0	19.20%
Average	47,376.7	0.09	4,263.9	19.20%

Table 14 - Summary of diesel consumption

Year	Consumption (kWh/a)	Price (€ / kWh)	Total (€)	% total required
2012	20,832.3	0.11	2,291.6	5.13%
2013	22,848.8	0.11	2,513.4	5.13%
2014	22,848.8	0.11	2,513.4	5.13%
Average	22,848.8	0.11	2,427.8	5.13%

Table 15 - Summary of electrical energy consumption

As it can be seen in tables above, diesel consumption has a falling trend from 2012 to year 2014. The reason behind this is of financial nature, since there was an imposed budget cut in 2012 and ongoing, leading to imposed savings in fuel by turning off the heating plant for several hours a day.

It was noted by the facility management and occupants that a standard level of comfort was not always achieved during the heating season.

Since the building is heated with a central heating it was necessary to verify the heating energy demand obtained with calculation, therefore the following methodology was applied:

- metered diesel consumption is recalculated to kWh

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In the table below the column "Baseline - METERED" shows the situation with the reported heating system consumption. The next column shows the situation when heating system losses were taken into account, but this case is treated in detail in the Heating Plant report.

	Baseline - METERED kWh/a	Baseline - Calculated (with boiler losses) kWh/a
Diase 1	521,141.9	625,289.0
TOTAL	521,141.9	625,289.0

Table 16 - Baseline heating consumption (metered)

6.2. CALCULATED ENERGY CONSUMPTION - BASELINE

6.2.1. Energy Consumption for Heating

The heating calculation was based on EN ISO 13790 where the building heating consumption was calculated by taking into account physical properties (U-values and areas) of windows, doors, walls, roof and floors. The calculation is based on heating degree days. Apart from that the calculation includes infiltration losses and solar and internal gains. The final energy demand figure is obtained when building heating demand is increased by heating system losses. A detailed calculation is presented in Annex 2. In addition to the baseline scenario, the recommended envelope efficiency measures are presented in the following chapters, showing a significant decrease in annual heat demand. The calculation of energy used for heating according to EN 13790 takes into account boiler losses and distribution system losses. The energy consumption for heating according to EN 13790 takes into consideration only one heating source - central heating system.

The total calculated heating energy demand of the building amounts to 625 MWh/a, while the metered energy demand amounts to 521 MWh/a.

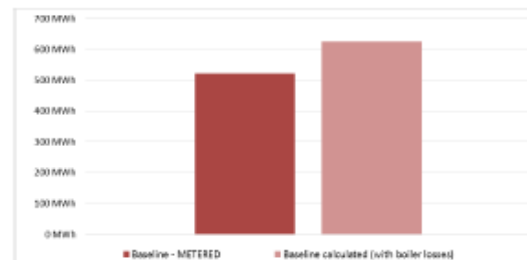


Figure 15 - Comparison of reported and calculated heating energy consumption

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The calculated baseline is approximately 104 kWh/a higher than the reported baseline value. As discussed above, the heating comfort inside the building is not always met.

6.2.2. Electrical Energy Consumption

The calculated electrical energy for the baseline scenario was consumed for lighting, cooling and office equipments as presented in Table 22. The calculation is derived from a count of all electrical devices in the building and an estimate of usage throughout the year.

Area	Usage	Reported	Total
kWh/a	9,327.8	15,989.8	25,317.6
kWh/a	9.3	15.7	25.0

Table 22 – Calculated electrical energy usage

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7. ENERGY EFFICIENCY MEASURES

7.1. BUILDING ENVELOPE

Table 23 summarizes the above renovation cases for the entire building envelope. The UA value is the U value of each element multiplied by the area of each element, indicating how much heat is transferred per unit of temperature difference between the external and internal air. Implementing the above measures increases the envelope performance (as measured by the total UA value) by 63%.

	Baseline		Renovated		Improvement
	U (W/m²K)	A (m²)	U (W/m²K)	A (m²)	%
Walls	1.859	1,492.1	0.307	1,492.1	86.61%
Windows 1	1.800	372.8	0.710	1,800	61.1%
Windows 2	1.500	67.8	0.305	1,400	79.6%
Roofs	1.800	25.5	0.305	1,400	83.1%
Floors	0.134	955.8	0.305	955.8	56.61%
Total	1.375	955.8	0.305	955.8	77.6%

Table 23 – Envelope efficiency improvement

This increased envelope performance leads to savings in the heat load which is to be met by the heating plant. The heat load by element for the baseline and renovated envelope is presented in Table 24 and Table 25 (absolute and specific per meter squared values respectively), showing a 62% decrease overall in the ideal calculated heating load due to increased thermal performance and reduced infiltration.

	Baseline heating load	Envelope upgrade heating load	Savings	Savings
	kWh/a	kWh/a	kWh/a	%
Walls	109,672.2	21,270.6	88,401.6	81%
Windows/doors	45,289.4	35,976.1	9,313.3	21%
Roof	175,057.5	12,942.4	162,115.1	93%
Basement	49,348.9	49,348.9	0.0	0%
Infiltration	102,606.2	78,927.9	23,678.4	23%
Ventilation	0.0	0.0	0.0	0%
Internal gains	-8,746.2	-8,746.2	0.0	0%
Solar gains	-23,019.9	-18,960.2	-4,059.7	-18%
Total heat load	450,208.1	170,739.4	279,468.6	62%

Total savings (kWh/a) 279,468.6
% savings 62.1%

Table 24 – Absolute heating load envelope improvement

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Measure – Description

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	Baseline heating load cW/m ² /a	Envelope upgrade heating load cW/m ² /a	Savings cW/m ² /a	Savings %
Walls	35.4	6.9	28.5	81%
Windows/doors	14.6	11.6	3.0	21%
Roof	56.5	4.2	52.3	93%
Basement	15.9	15.9	0.0	0%
Infiltration	33.1	25.5	7.6	23%
Ventilation	0.0	0.0	0.0	0%
Internal gains	-2.8	-2.8	0.0	0%
Solar gains	-7.4	-6.1	-1.3	-18%
Total heat load	145.3	55.1	90.2	62%

% savings: 62.1%

Table 26 – Space heating load envelope improvement

The final calculated heating load after implementation of energy efficiency measures amounts to 200 kW (see Annex 2 for calculation details) and the annual energy demand due to building losses drops from 430 MWh/a to 171 MWh/a. The drop occurs due to envelope insulation and reduction in infiltration losses due to enhanced window properties. Envelope insulation will serve as the basis for other calculations where various other heating sources will be considered.

7.2. HEATING SYSTEM

According to the baseline, energy demand due to heating system losses amounts to approx. 173 MWh/a with 7.2% heating system efficiency (includes heating distribution and regulation system efficiencies).

The heating demand, by taking into account the envelope renovation case, would amount to 287 MWh/a. If the building stays connected to the Central heating system and the internal distribution system is renovated the overall system efficiency would increase to 81%.

Financial parameters of each project are elaborated in section 8.

7.3. VENTILATION SYSTEM

No measures recommended.

7.4. COOLING SYSTEM

No measures recommended.

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Measure – Description

Cool
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7.5. LIGHTING SYSTEM

A lighting system efficiency project was created as follows:

- Replacement of T8 fixtures 2x36W with HET3 2x28W
- Replacement of T8 fixtures 3x36W with HET3 2x34W
- Replacement of T8 fixtures 2x36W with HET3 2x28W
- Replacement of incandescent lamps with CFL

Lighting renovation proposed replacement of incandescent lamps as the major energy saving measure regarding electrical energy. See Table 29 – Project 2 costs specification for the detailed line items of this project.

Lighting Baseline					
TYPE	No.	Bulbs	Watts	Ballasts	OW/a
T8 1 fluorescent 2x36W	4	2	72	13%	531.1
T8 1 fluorescent 3x36W	127	1	36	13%	3,375.5
T8 1 fluorescent 2x36W	11	2	72	13%	963.4
Incandescent 100W	25	1	100	0%	2,450.0
TOTAL	168		203		9,527.8

Lighting Renovation					
TYPE	No.	Bulbs	Watts	Ballasts	OW/a
T8 1 fluorescent 2x28W	4	2	56	0%	257.4
T8 1 fluorescent 2x14W	127	2	14	0%	5,769.4
T8 1 fluorescent 2x28W	11	2	56	0%	635.0
CFL 28W	25	1	28	0%	955.0
TOTAL	168		98		3,282.8

Table 26 – Comparison of baseline consumption and renovation consumption

7.6. SANITARY HOT WATER

Building is already connected to a SHW solar thermal system which is working properly. The system consists of solar thermal panels and uses electricity as backup. The solar system is currently overheating when there is no SHW demand, therefore it is strongly recommended to change the system to a drain back system, however before installing the system it should be checked whether the collectors are allowed to be emptied. The drain back system automatically drains the solar medium into a special tank and does not heat up the SHW when not needed.

7.7. OTHER ELECTRICAL EQUIPMENT

Electrical equipment within the building is mostly administrative. This equipment is considered necessary for normal operation of the teaching process; therefore the only EE measure in this section is the replacement of the pumps with new VFD pumps.

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Equipment		Resolution					
Equipment	Qty	Unit	Resolution	Qty	Unit	Resolution	Qty
PC	10	PC	3,500 PC	10	PC	3,500 PC	10
Printer	2	Printer	4,000 Printer	2	Printer	4,000 Printer	2
Pumps	2	Pumps	100 Pumps	2	Pumps	100 Pumps	2
For	5	For	1,000 For	5	For	1,000 For	5
Total	19		12,000 Total	19		12,000 Total	19

Table 27 - Other electrical equipment

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2. ENERGY EFFICIENCY PROJECTS

There are also non EE measures identified during inspection which have to be addressed prior to implementation of project. Some of the EE measures are described in chapters below.

2.1. PROJECT DESCRIPTIONS AND ACCOUNTING

EE Project 1 focuses envelope upgrade of wall, roof insulation and new windows. As presented in chapter 7.1, the U-values of respective building elements significantly reduced. The specific costs [€/m²] of each measure include materials and works. The total estimated costs are 100,226 €.

# Description of EE measures	Unit	Quantity	Unit price [EUR]	Subtotal [EUR]
EE Project 1 - Building envelope				
Wall insulation in EPS - 10cm and vertical lined with mineral wool, improvement of roof waterproofing, external thermal new awning/ awning and additional surface with one pane. The materials included additional 10cm glass and mineral wool insulation of the facade.	sqm	1,750.0	25.0	44,750.0
Replacement of old windows with new PVC and "U" - 1.4 Ver 2K, and all the vertical lined with mineral wool, internal painting around windows, sill and parapet for 2 windows in the room 2.	sqm	67.00	125.00	8,375.0
Replacement of old windows and hanging of new window of the existing windows. Works include thorough inspection, replacement of damaged materials and hanging of new windows.	sqm	110.00	30.0	3,300.0
Insulation of the existing roof. External thermal insulation layer, roof structure should be reinforced. Works also include installation of 10cm rock wool, wood plastic, new covering material should be installed, 4 gutters replaced.	sqm	255.75	45.00	11,508.75
TOTAL PROJECT 1				100,226.75

Table 28 - Project 1 cost spread function

EE Project 2 includes replacement of lamps as presented in chapter 7.3. The total number of lamps which are recommended to be replaced is multiplied with a price which includes the cost of the lamp and installation cost in order to obtain the total costs of the proposed project. The cost for new lighting includes labor costs of installation and disposal of old fixtures and bulbs.

# Description of EE measures	Unit	Quantity	Unit price [EUR]	Subtotal [EUR]
EE Project 2 - Electrical system				
1) 100 25W	pc	20	10.0	200.0
2) 100 40W	pc	10	40.0	400.0
3) 100 60W	pc	120	40.0	4,800.0
TOTAL PROJECT 2				5,400.0

Table 29 - Project 2 cost spread function

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EE Project 3 The additional cost in this case is the refurbishment of the existing substation distribution system, installation of TRV on the radiators, as well as replacement of the existing pumps with new ones with VFD. The total costs are approx. 15,570 E.

#	Description of EE measures	Unit	Quantity	Unit price (EUR)	Subtotal (EUR)
EE Project 3 – Heating system renovation					
1	Refurbishing and replacement of radiator valves and radiators (approximate standard and TRV value) (see table 30)	ea	134.0	55.0	7,370.0
2	Partial replacement of substation	ea	1.0	1,000.0	1,000.0
3	Replacement of radiator TRV	ea	2.0	1,500.0	3,000.0
4	Replacement of radiator TRV	ea	1.0	2,500.0	2,500.0
TOTAL PROJECT 3					13,870.0

Table 30 – Project 3 cost specification

S.2. NO FREE MEASURES

A monitoring system is recommended for proper accounting of energy consumption and to provide a baseline for future EE measures.

#	Description of EE measures	Unit	Quantity	Unit price (EUR)	Subtotal (EUR)
Monitoring					
1	Energy monitoring system, data logger software, training	ea	1.0	12,000.0	12,000.0
TOTAL MONITORING					12,000.0

Table 31 – Monitoring cost specification

Further measures include the internal painting, installing drain back equipment, check and fixing possible deficiencies in the solar thermal system.

#	Description of EE measures	Unit	Quantity	Unit price (EUR)	Subtotal (EUR)
Non-EE measures					
1	Internal painting of radiators	ea	1.0	3,285.0	3,285.0
2	Refurbishing drain back equipment in the solar thermal system	ea	1.0	1,500.0	1,500.0
3	Checking and upgrading of the solar thermal system by replacing damaged glass insulation and/or radiators	ea	1.0	2,000.0	2,000.0
TOTAL NON-EE MEASURES					6,785.0

Table 32 – Non-EE measures cost specification

S.3. FINANCIAL VIABILITY

Based on the costs and energy savings, a yearly cash flow analysis was performed. Fuel escalation was applied separately to baseline and proposed projects according to the fuel escalation rate of 2% per year. Table 33 presents an overview of the cash flow analysis, including the financial indicators: net present value, internal rate of return, and the simple payback period.

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		1. Envelope renovation	2. Lighting renovation	3. Heating system renovation *
Fuel savings (EUR/a)		35,288.9	0.0	2,336.6
Electricity savings (EUR/a)		0.0	484.1	42.1
Hot water cost savings (EUR/a)		0.0	0.0	0.0
Total investment cost (EUR)		-100,225.7	-5,910.0	-13,870.0
NPV (EUR)		250,278.6	-2,638.6	10,346.0
Project IRR (Years)		20.0	10.0	20.0
IRR (%)		37.5%	-1.5%	19.1%
Simple payback (Years)		2.8	12.21	5.88

Table 33 – Financial summary

S.3.1. Energy Saving Potential

The table and figure below compare the reported and baseline energy consumption in kWh with the different scenarios of energy efficiency projects.

	Baseline scenario	1. Envelope renovation	2. Lighting renovation	3. Heating system renovation *
Heat consumption				
Average consumption	Base	Base		Base
Heating consumption (kWh/a)	625,389.0	257,163.9		218,214.1
Base elec consumption (kWh/a/m ²)	201.9	79.9		68.1
Heat savings		6.2%		11%
Electricity consumption				
Electricity consumption (kWh/a)	25,029.3	25,029.3	18,992.9	22,975.3
Base elec consumption (kWh/a/m ²)	7.4	7.4	6.1	7.5
Electricity savings		0%	17.3%	2%
Total savings (kWh/a)		388,123.1	36,920.9	26,702.9
Total savings (%)		60%	14.2%	10%

Table 34 – Comparison of energy efficiency projects, baseline and reported energy consumption

* The heating NPV and IRR are calculated based on the new baseline energy savings calculations.
The heating NPV and IRR are calculated based on the new baseline energy savings calculations.

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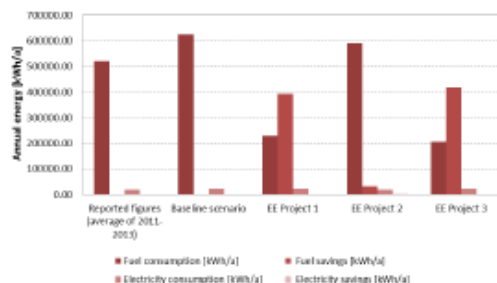


Figure 16 – Comparison of energy efficiency projects, baseline and reported energy consumption

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5.4. RECOMMENDATIONS

5.4.1 EE-Project Summary

From the financial results in Table 33, a summary for each EE project can be drawn based on their highest NPV.

Project	NPV	Investment cost	IRR	Simple PB
	€	€	%	Year
1. Envelope renovation	250,279	100,226	37.8%	2.84
3. Heating system renovation	10,346	13,870	13.1%	5.68
2. Lighting renovation	-2,683	5,810	-1.5%	12.21

Table 35 – Ranking based on highest NPV

In the above Table 35, the envelope project is considered a stand-alone project. The envelope upgrade is a precondition before any heating system upgrades. Therefore, the heating projects (Heating system renovation) are disaggregated as incremental to the envelope. The heating NPV and IRR consider the envelope as the new baseline for energy savings calculations. Heating system upgrade projects are then ranked as to their highest NPV.

5.4.2 Final Recommendations

Table 36 below summarizes the final package of energy efficiency measures and related general building improvements. The most economically feasible projects are selected based on the financial cutoff rate of return, 10%.

The baseline for comparison is the actual construction condition of the buildings and technical systems. The economic feasibility of each identified measure was evaluated based on the estimates of construction and installation. Operational energy savings were calculated using standard calculation methods for heating and electricity demand, and are compared to the baseline conditions.

Project	Heating Savings	Electricity Savings	Carbon Savings	Cash Savings	Investment cost	Simple payback
	kWh/a	kWh/a	tonCO ₂ /a	€a	€	Years
1. Envelope renovation	348,123	0	100	35,594	100,226	2.84
* Multi-measures, incremental energy savings are thermal insulation of wall, replacement windows, etc.						
3. Heating system renovation	26,285	281	8	2,296	13,870	5.68
* Installing air-tightness thermal insulation of pipes in sub-basement, upgrading and repairing the internal network system.						
Monitoring					12,000	
Thermometering						
Total	374,408	281	108	37,890	113,096	3.25
NonEE measures						
* Internal painting of the total area						
* Installing floor heating system or raising radiators thermal system						
* Upgrading and repairing radiators thermal system by replacing emergency pipe, insulation and thermostats						
* Replacement of existing lighting						

Table 36 – Recommended measures

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Frequency: Annual
Initial: 2020-2021

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9.3. PROPOSED HAZARD MANAGEMENT

Referring to the environmental laws and regulations of the Kosovo, the appropriate EU directives and the World Bank requirements, the following mitigation measures are proposed in the course of EEC measures are to be foreseen:

9.3.1. Proposed Hazard Management – Asbestos-Fiber Cement Panels

The general approach while handling this material is that construction avoid crushing/detracting of asbestos plates from the roof and/or from the wall insulation and deposit them in an organized manner on the construction sites.

9.3.1.1. Maintenance

Prohibit any mechanical stress on fiber-cement panels (no drilling, cutting, smashing, cutting, dropping etc.)

9.3.1.2. Removal

Amount:	9 338 m ²
Location:	Roof

The Removal of ACM containing Fiber-Cement Panels ('Eternit' / 'Sakolit' or other) belongs to the removal of so called strong bonded ACM due to the fact that those panels consist of a lesser amount of asbestos, which is firmly embedded in a cement matrix.

However, whenever fiber-cement panels are mechanically damaged or destroyed, ACM dust is set free.

Best practice is to prevent or minimize dust release, resulting from a destruction free removal process.

Main Remediation Work Steps

- Prohibit any mechanical stress on fiber-cement panels (no drilling, cutting, smashing, cutting, dropping etc.)
- Strike un-mounting procedure using lifting devices
- Wear appropriate respiratory protection FFP3 and disposable coveralls
- Mark panels before un-install
- Collect panels without destruction
- Pack them plastic foil (e.g. panel big-bags with Asbestos Label)
- Orderly Store in an interim storage until transport and disposal at appropriate disposal site.

Further hints are:

- Nails/screws shall be removed with sharp tools
- If the fixing can't be released, small sheets can be pried out one by one
- Dismantling of asbestos cement panels shall happen in a work back way, for roofs from the ridge to the eaves, for walls from top to bottom

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Frequency: Annual
Initial: 2020-2021

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- When removing fixation materials, the product has to be secured against sliding off
- Whenever possible, products shall be lifted off rather than quarried out
- Encrustation or plant cover can be scraped off, using a wood scraper
- Broken bits and debris shall be wrapped in dust proof foil or bags
- The contaminated material has to be transported to the ground carefully
- The transportation of asbestos cement products has to take place in a way, that prevent asbestos dusts to be released (packaging)
- For cleaning use Hoses/vacuum cleaners only.
- Storage and transport of material has to happen in sealed, closed containers

To be avoided:

- Breaking, cutting, throwing and milling of sheets
- Drilling, sawing, grinding with fast running machinery
- Cleaning with high pressure cleaners
- Shaking out of masses or under cover sheeting
- Usage of debris chutes

9.3.1.3. Supervision of Asbestos Abatement

Specifically due to the risk that a abatement was performed contrary to above mentioned regulations, it is highly recommended that the mitigation works are to be guided by a specifically trained (certified) independent expert (e.g. chartered civil engineer with asbestos abatement knowledge).

9.3.1.4. Asbestos Transport and Disposal

The Ministry of Environment and Spatial Planning (MESP) is working towards the establishment of an (interim) storage facility for hazardous material.

Contractors should liaise with MESP regarding final disposal and treatment options, licensing requirements and applicable local regulations on this issue.

The contractor has to prepare and to provide a coordinated transport and disposal concept as soon as the contract is signed. This concept has to include, based on the appointment with the MESP, a signed confirmation of the nearest suitable approved landfill to accept construction wastes.

The Contractor shall perform or carry out all transports in fully accordance with the international Statutory and Technical Rules (ADR) and/or corresponding national rules. According to this, the transport containers and equipment require certain danger marks depending on shipped masses. Vehicles and their drivers require specific ADR approval or an ADR license. Each driver has to carry documents, identifying origin and destination, mass and waste type of his way.

The contractor has to prepare and to provide a coordinated transport and disposal concept as soon as the contract is signed. This concept has to include a signed confirmation of the subcontracted transshipping to be a full required licenses.

Removed ACM shall be packed in double-foil of at least 0.2 mm thickness and stored in Big-Bags clearly visibly signed with the Asbestos logo. Whenever transported with fork lifters, Big-Bags have to be set on wooden euro pallet in order not to damage the big-bags by the forks.

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9.3.2. Proposed Hazard Management – Lead-Based Paint

There is no evidence of the presence of Lead-based paint.

9.3.3. Proposed Hazard Management – CFLs

9.3.3.1. Maintenance

Prohibit any mechanical stress on compact fluorescent lamps (no smashing, dropping etc.)

In case lamps are broken, follow the typical instructions¹

Before Cleanup

- Have people and pets leave the room.
- Air out the room for 3-10 minutes by opening a window or door to the outdoor environment.
- Shut off the central forced air heating/air-conditioning system, if you have one.
- Collect materials needed to clean up broken bulb:
 - stiff paper or cardboard;
 - sticky tape;
 - damp paper towels or disposable wetwipes (for hard surfaces); and
 - a glass jar with a metal lid or sealable plastic bag.

During Cleanup

- Do not use the Vacuum cleaner! Vacuuming is not recommended unless broken glass remains after all other cleanup steps have been taken. Vacuuming could spread mercury-containing powder or mercury vapor.
- Be thorough in collecting broken glass and visible powder. Scoop up glass fragments and powder using stiff paper or cardboard. Use sticky tape, such as duct tape, to pick up any remaining small glass fragments and powder. Place the used tape in the glass jar or plastic bag. See the detailed cleanup instructions for more information, and for differences in cleaning up hard surfaces versus carpeting or rugs.
- Place cleanup materials in sealable container.

After Cleanup

- Promptly place all bulb debris and cleanup materials, including vacuum cleaner bags, outdoors in a trash container or protected area until materials can be disposed of. Avoid leaving any bulb fragments or cleanup materials indoors.
- Next, check with your local government about disposal requirements in your area, because some localities require fluorescent bulbs (broken or unbroken) be taken to a local recycling center. If there is no such requirement in your area, you can dispose of the materials with your household trash.
- If practical, continue to air out the room where the bulb was broken and leave the heating/air conditioning system shut off for several hours.

¹For instructions of the U.S. Environmental Protection Agency, see <http://www.epa.gov/lead/pb/pb.cfm>

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9.3.3.2. Recycling of spent CFLs

In Kosovo, spent CFLs, whereas all of them are containing small portions of Mercury and other hazardous materials emittable to atmosphere, water or soil, are currently neither separately collected, nor properly recycled or treated.

Thus, spent CFLs are mainly disposed on regional sanitary landfills in Kosovo. Recently, the only possibility to treat such lamps properly, i.e. to separate Mercury and other gases from glass and scrap metal, is its export to foreign countries, where authorized companies are mainly in CFL recycling centers (e.g. ALBA SRB). For the collection and undamaged transport CFLs have to be stored in certain grid shaped cardboard containers on Euro pallets and wrapped with stretch foil while energy safety bulbs (mainly to be found during EE implementation works) have to be stored in sealable open-top UN bins (poolited).

Method example ALBA SRB²:

Interstar, an ALBA Group company, provides a convenient service aimed at saving consumers a trip to the local recycling plant: the Interstar collection box is designed especially for taking back fluorescent lamps in small and medium quantities. Retailers and managers set up these inexpensive boxes in their sales and storage areas, allowing end users to dispose of used fluorescent lamps when purchasing new ones. In addition to the collection of tubes, bulbs and other lamps, the service also covers their recycling and documentation.

Collection boxes are available for different types of fluorescent lamps. Once a box is full, a quick phone call is all that is needed to arrange for it to be picked up. The entire take-back and disposal process is handled by Interstar, in close collaboration with service partners throughout Germany.

In the future, the residual mercury-containing phosphor powder (1-3 % of CFL weight, rest is recyclable glass and metal scrap) is due to lack of economic methods at least for part disposed as hazardous waste on suitable landfills. In the usual process the gaseous portion goes into the atmosphere.

9.4. COST ESTIMATE FOR ABATEMENT AND DISPOSAL OF SELECTED HAZARDOUS MATERIAL

Costs for the removal of Hazardous material apply in case that the implementation of energy efficiency measures requires the abatement of hazardous material.

Asbestos containing material (ACM)

Based on similar ACM projects the following specific work amount has been estimated:

- Volume amount approx. 9.533 m³ of asbestos cement roof
- Estimated Weight (17 kg/m³): approx. 16,248 kg
- Product: Asbestos Cement (Selenit)

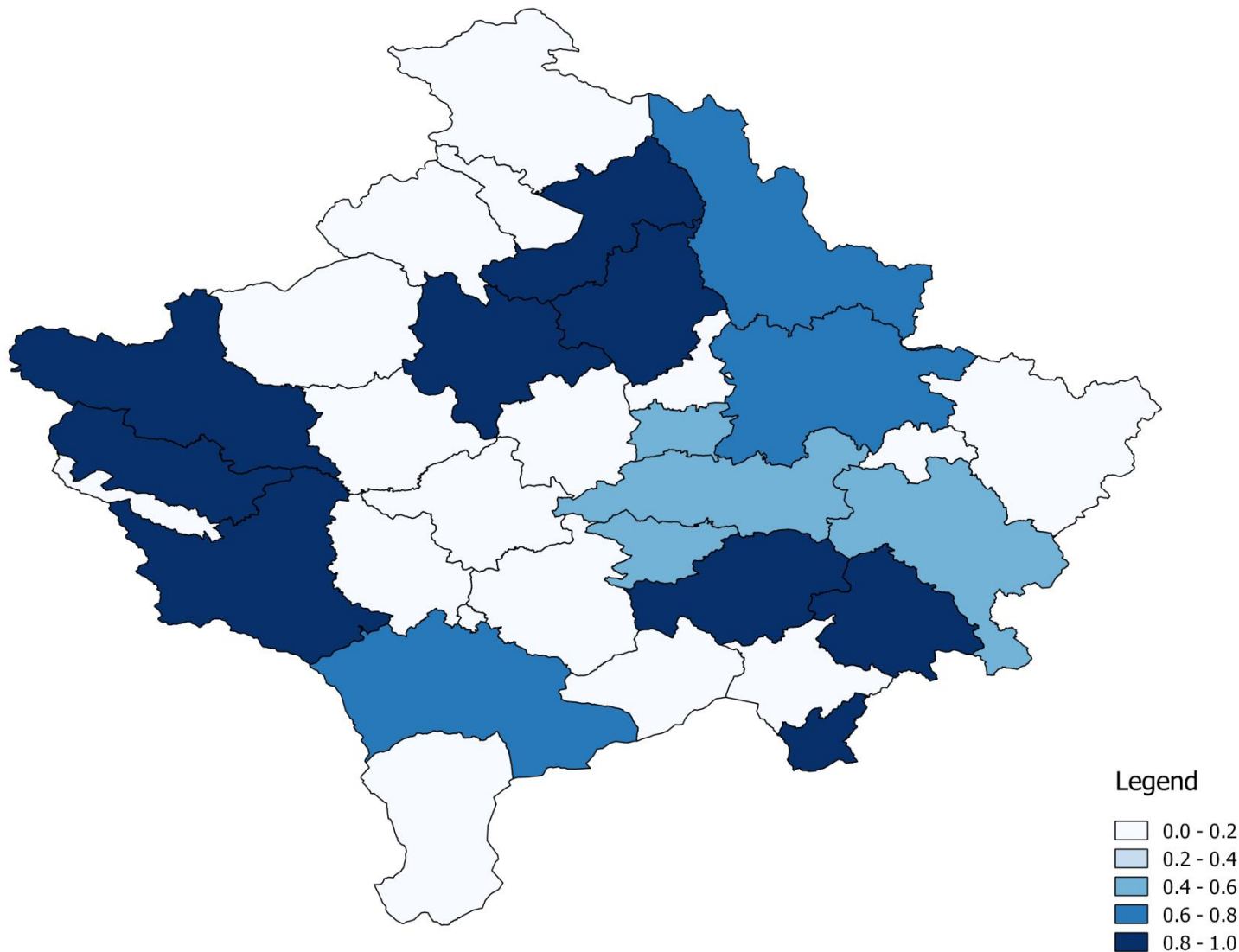
²Source: <http://www.alba-srb.de/interstar/interstar-srbservice/interstar-srbservice.aspx?lang=de>

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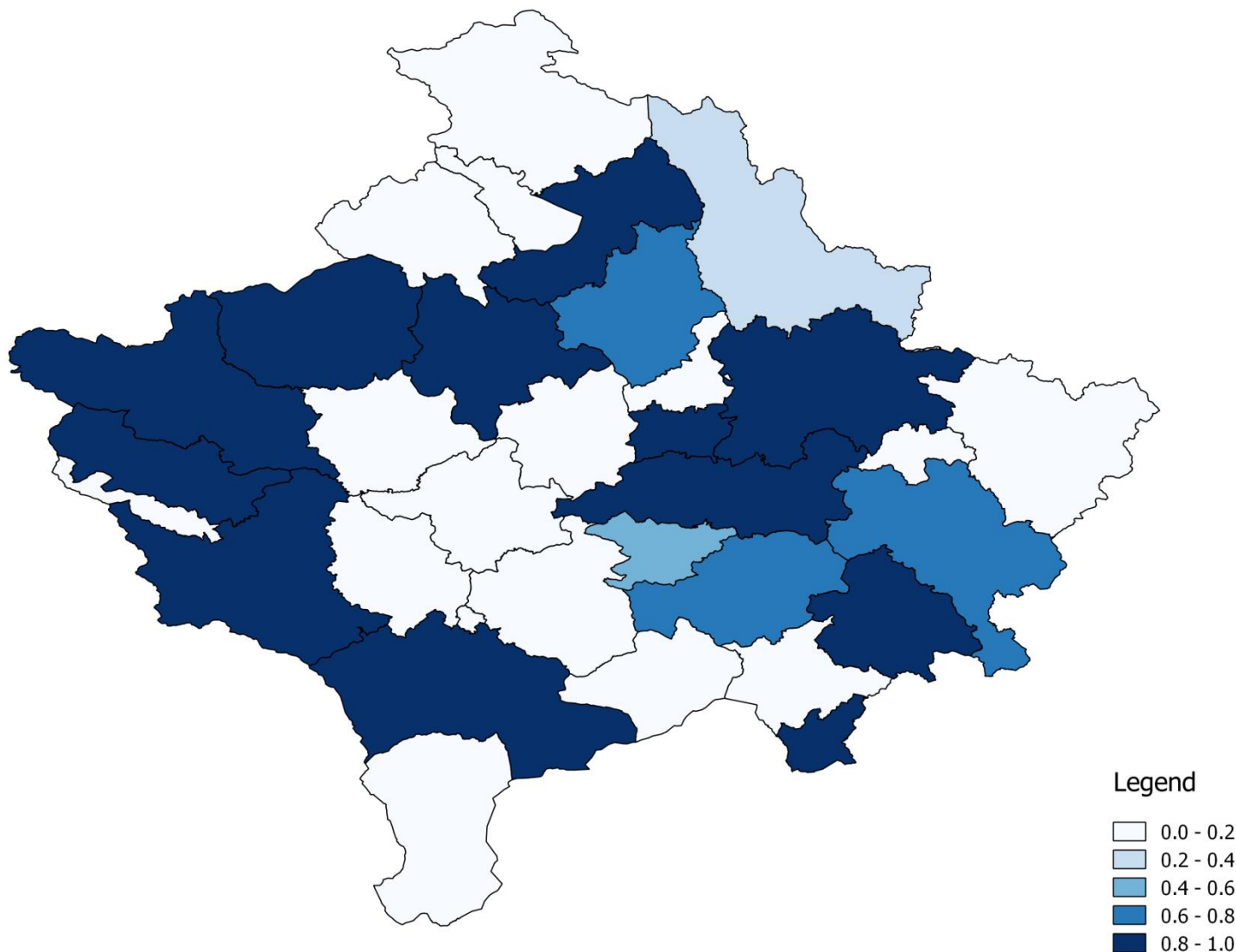
Masat tipike të identifikuara të EE

- › Renovimi i mureve
 - › Renovimi i kulmit
 - › Ndërrimi dyerve dhe dritareve
 - › Ndërprerësit e karburantit
 - › Përmirësimi i sistemit të nxemjes
 - › Renovimi i ndriçimit
 - › Solari termik
-
- › Të gjitha figurat e treguara në përqindje:
 - › Numri i ndërtesave ku janë aplikuar masat i pjestuar me numrin total të ndërtesave

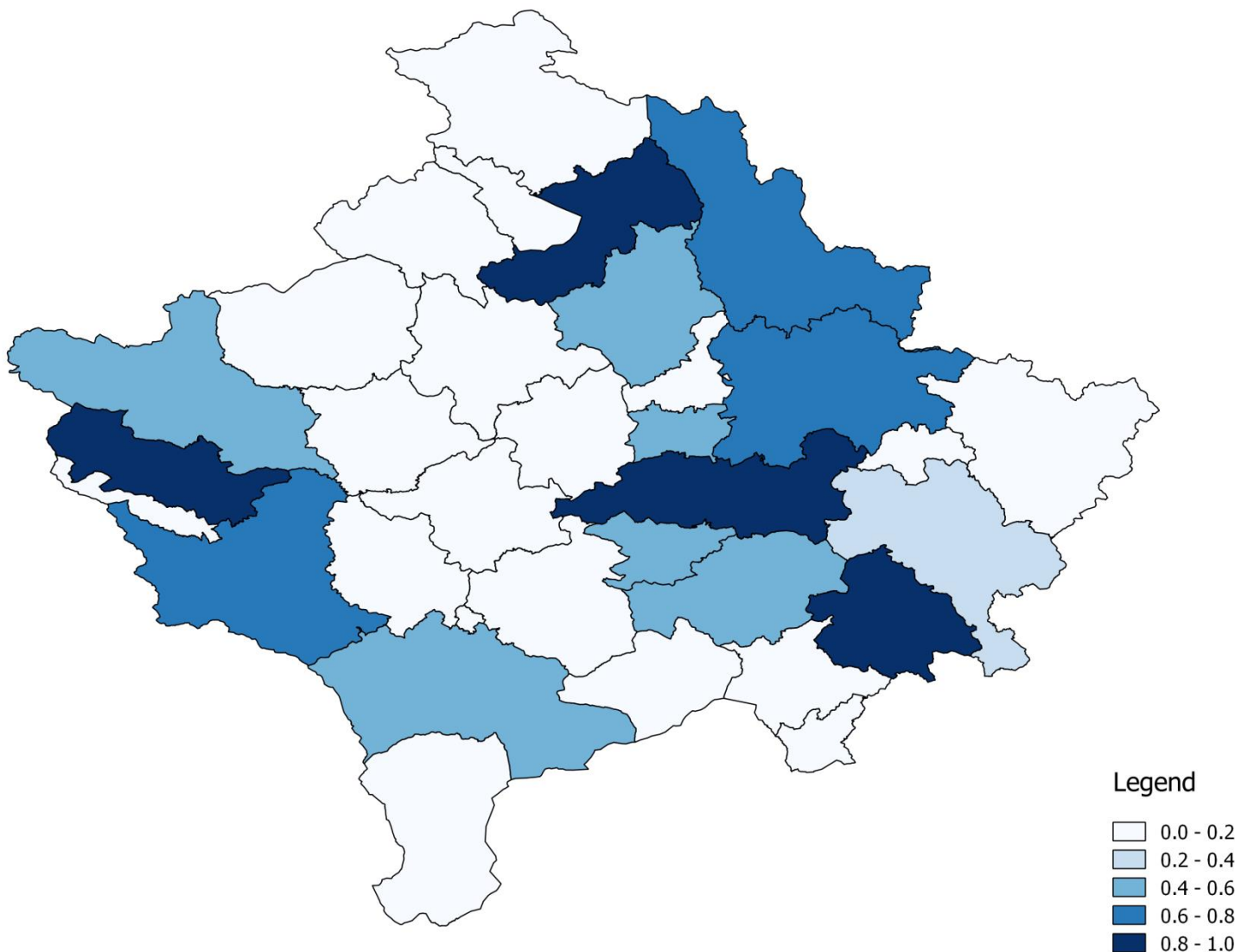
Masat tipike të identifikuara të EE – renovimi i mureve



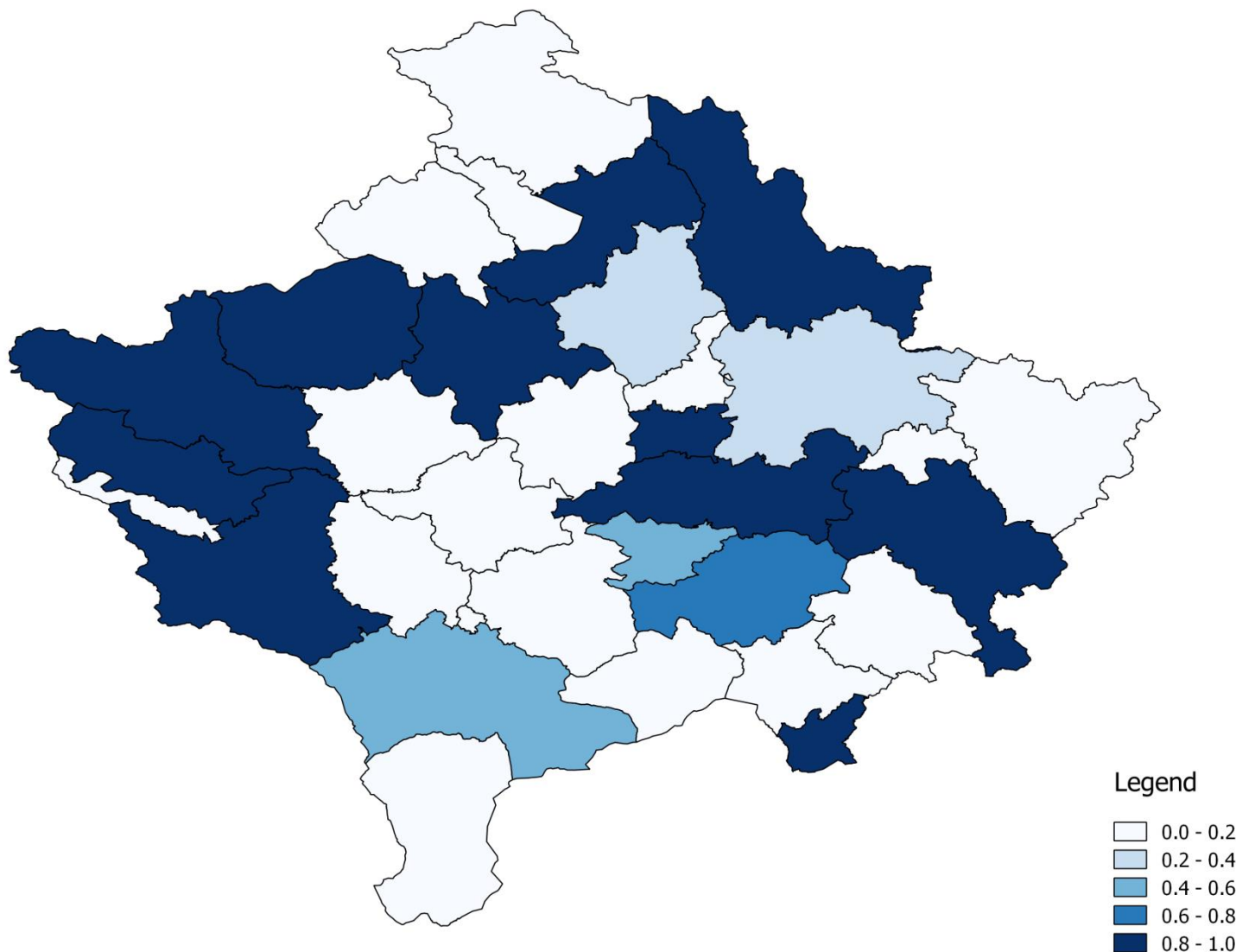
Masat tipike të identifikuara të EE – renovimi i kulmit



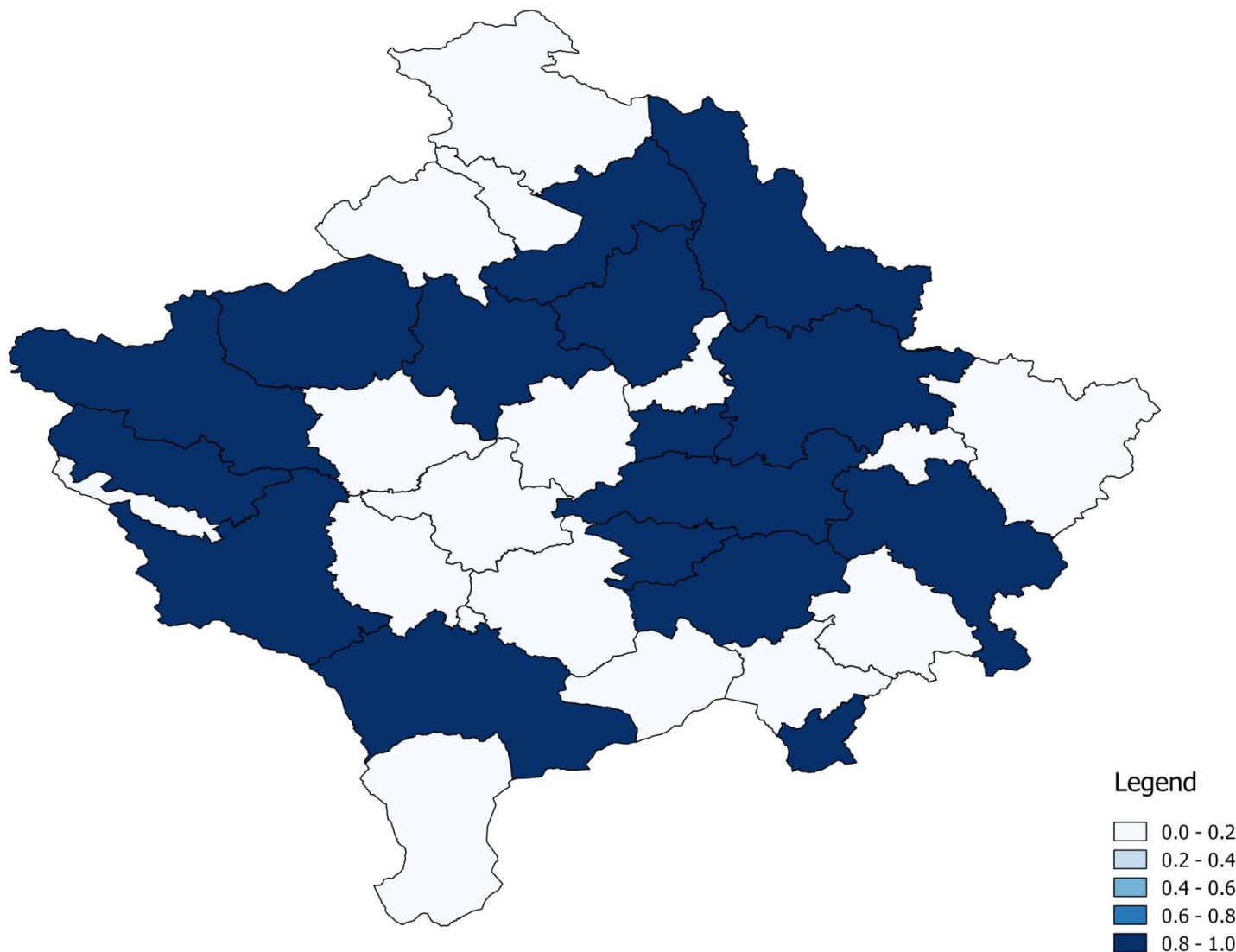
Masat tipike të identifikuara të EE – renovimi i dritareve



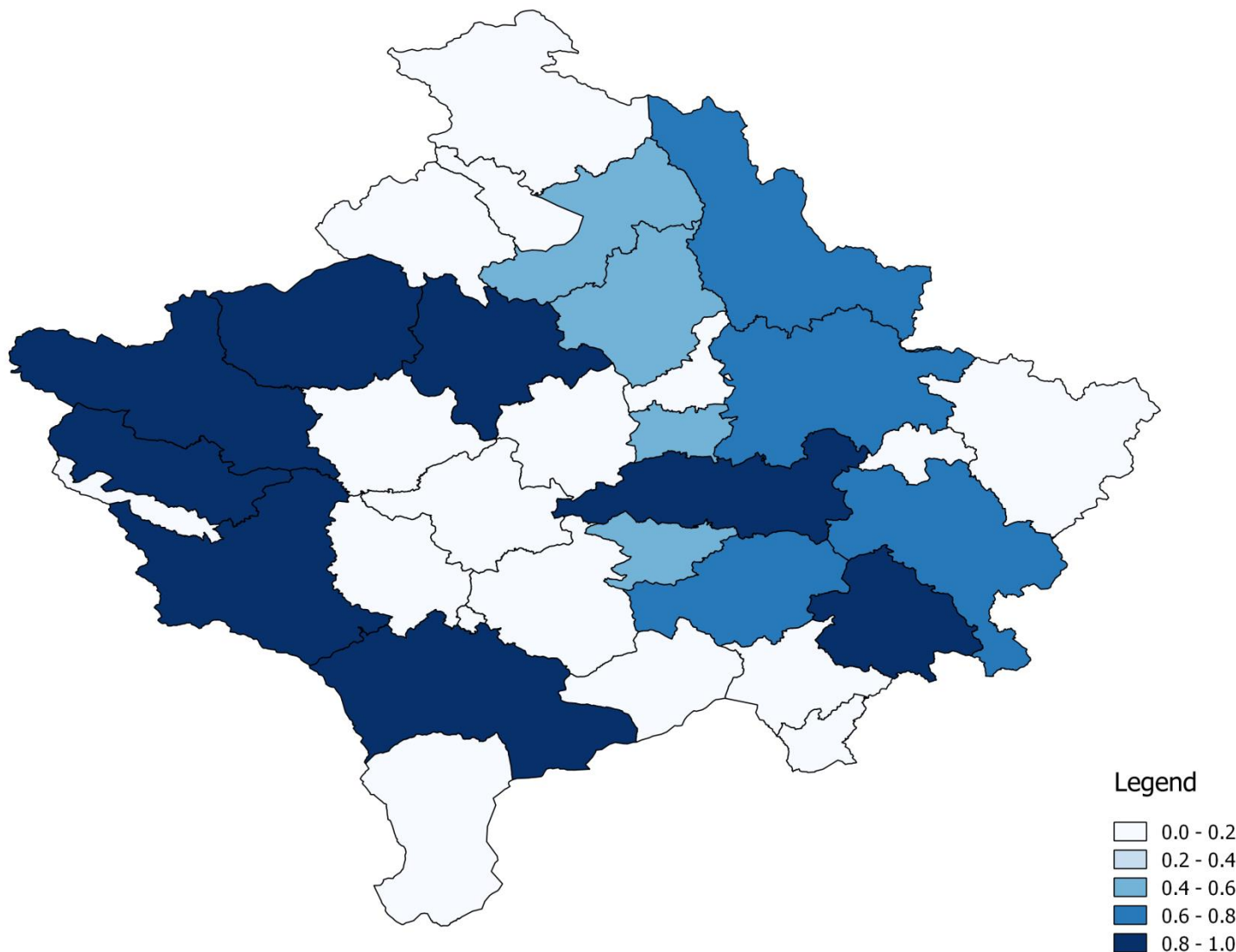
Masat tipike të identifikuara të EE – ndërrprerësi i karburantit



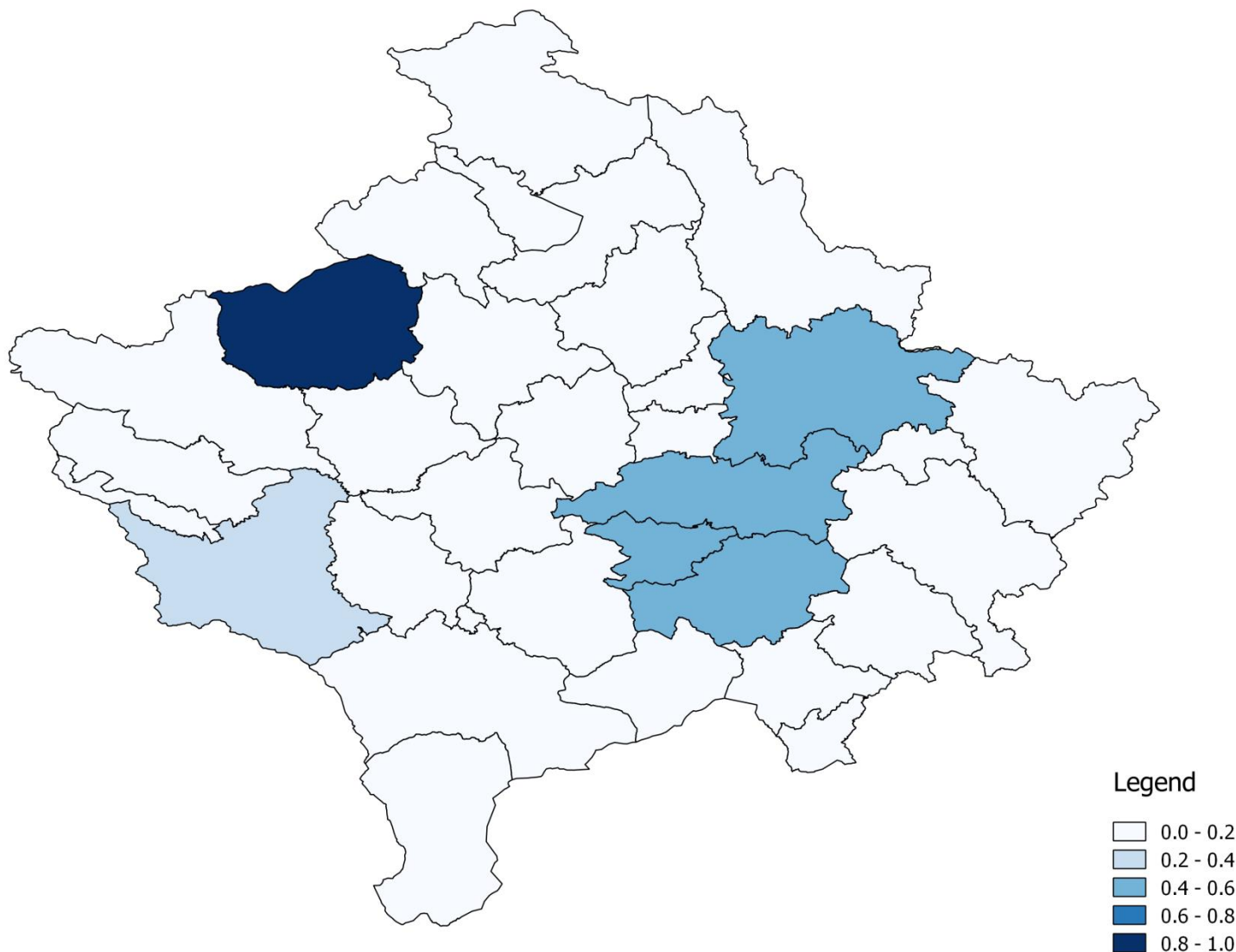
Masat tipike të identifikuara të EE – sistemi i nxemjes



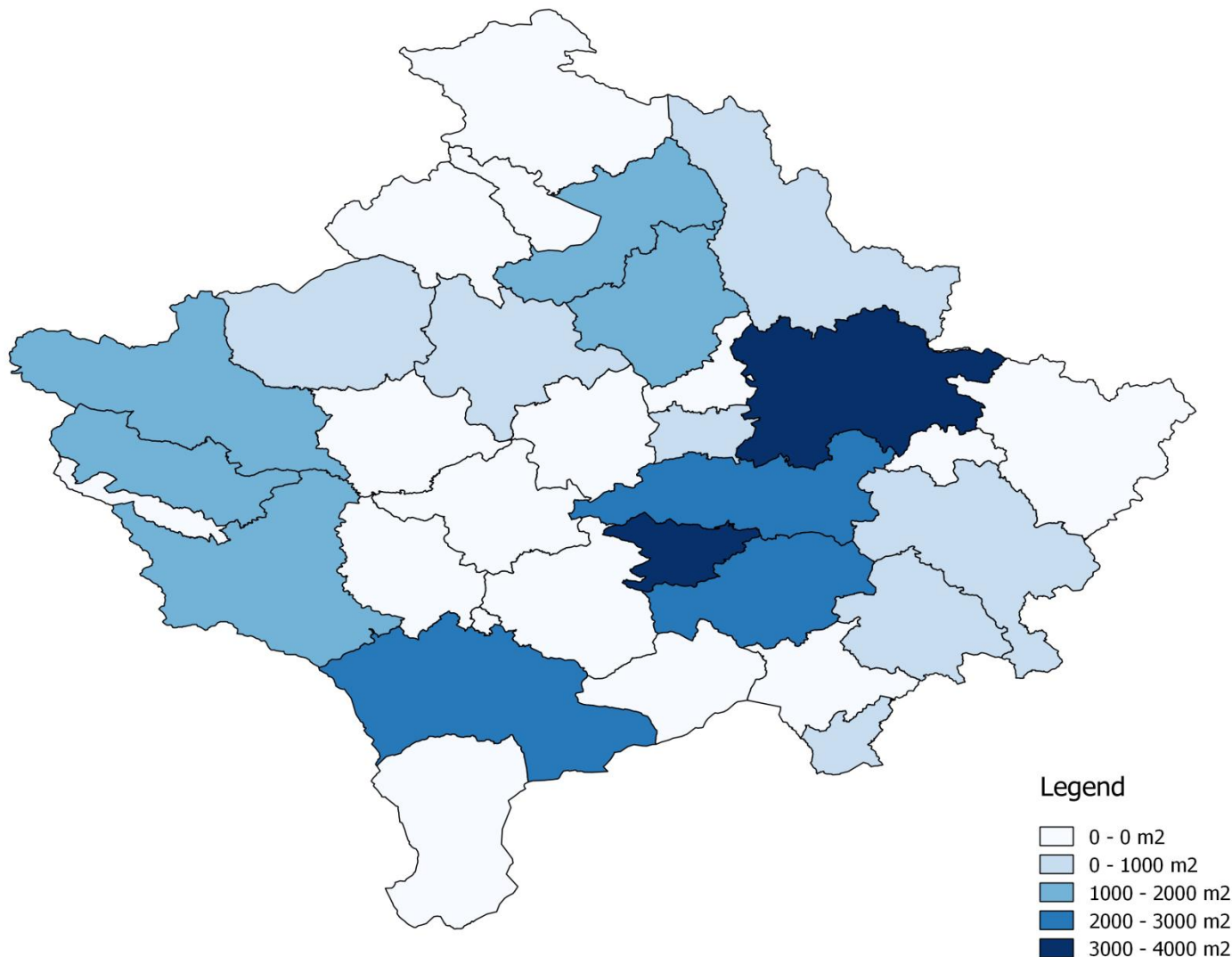
Masat tipike të identifikuara të EE – sistemi i ndriçimit



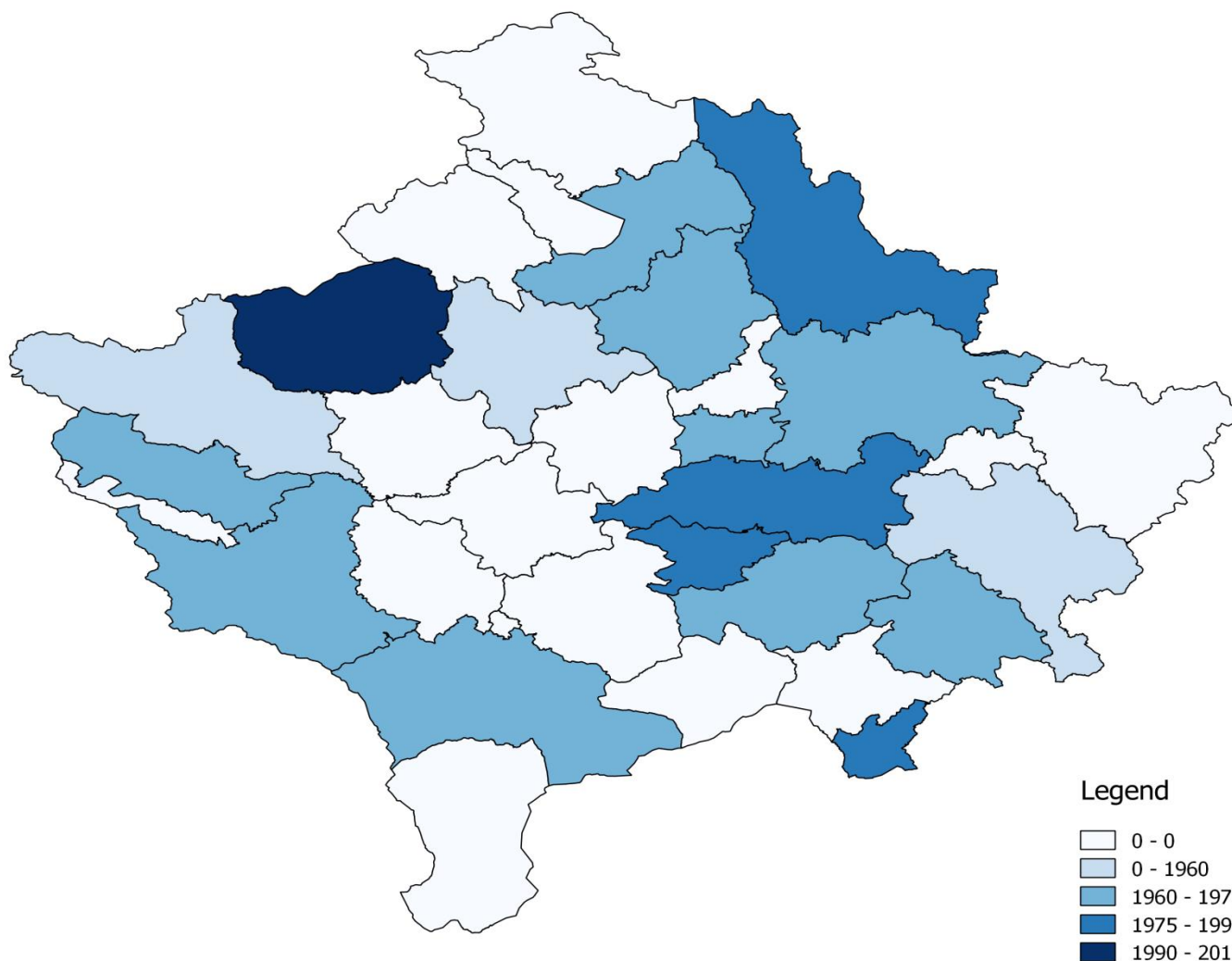
Masat tipike të identifikuara të EE – solari termik



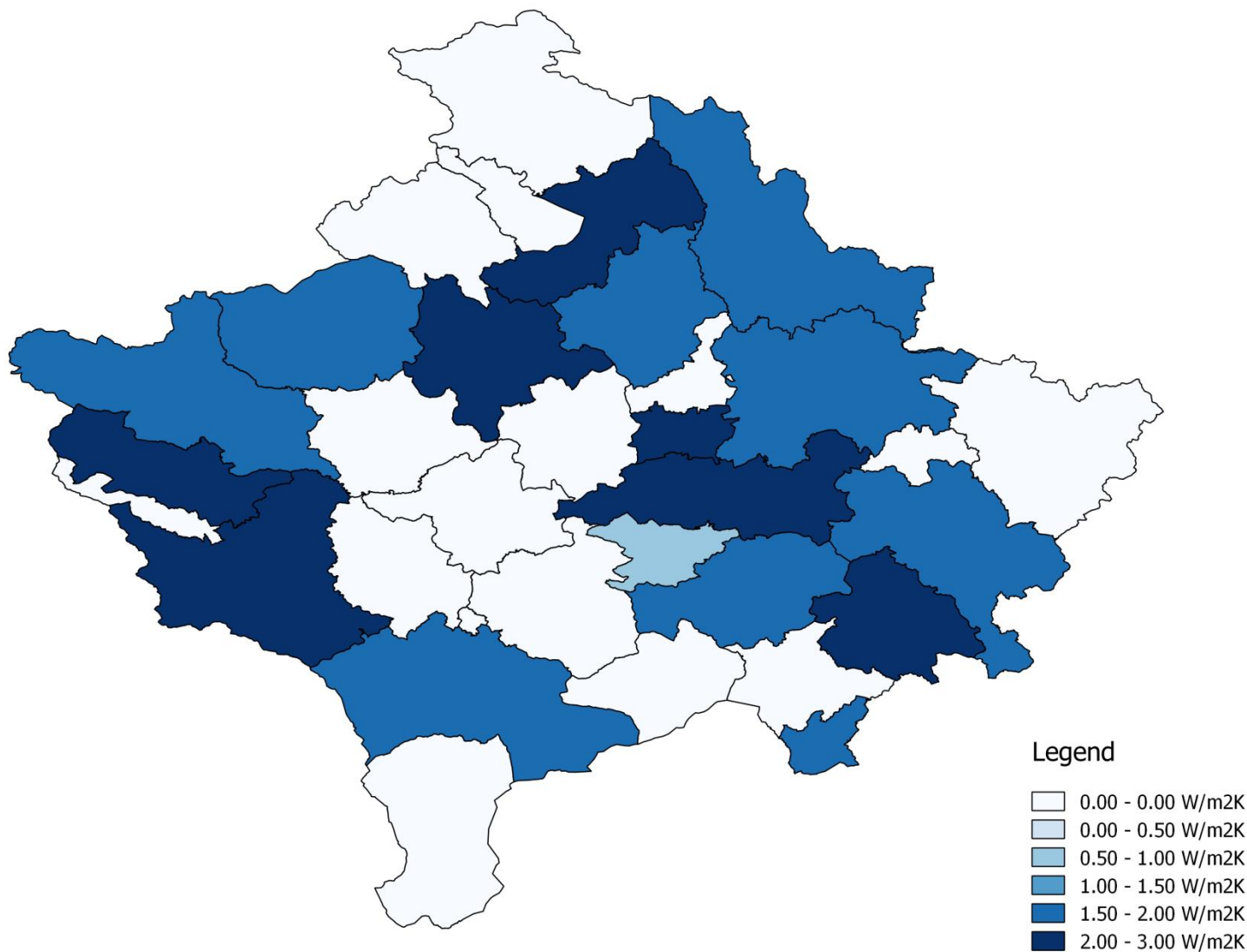
Përmbledhja e rezultateve – sipërfaqja mesatare e nxemjes së ndërtesës



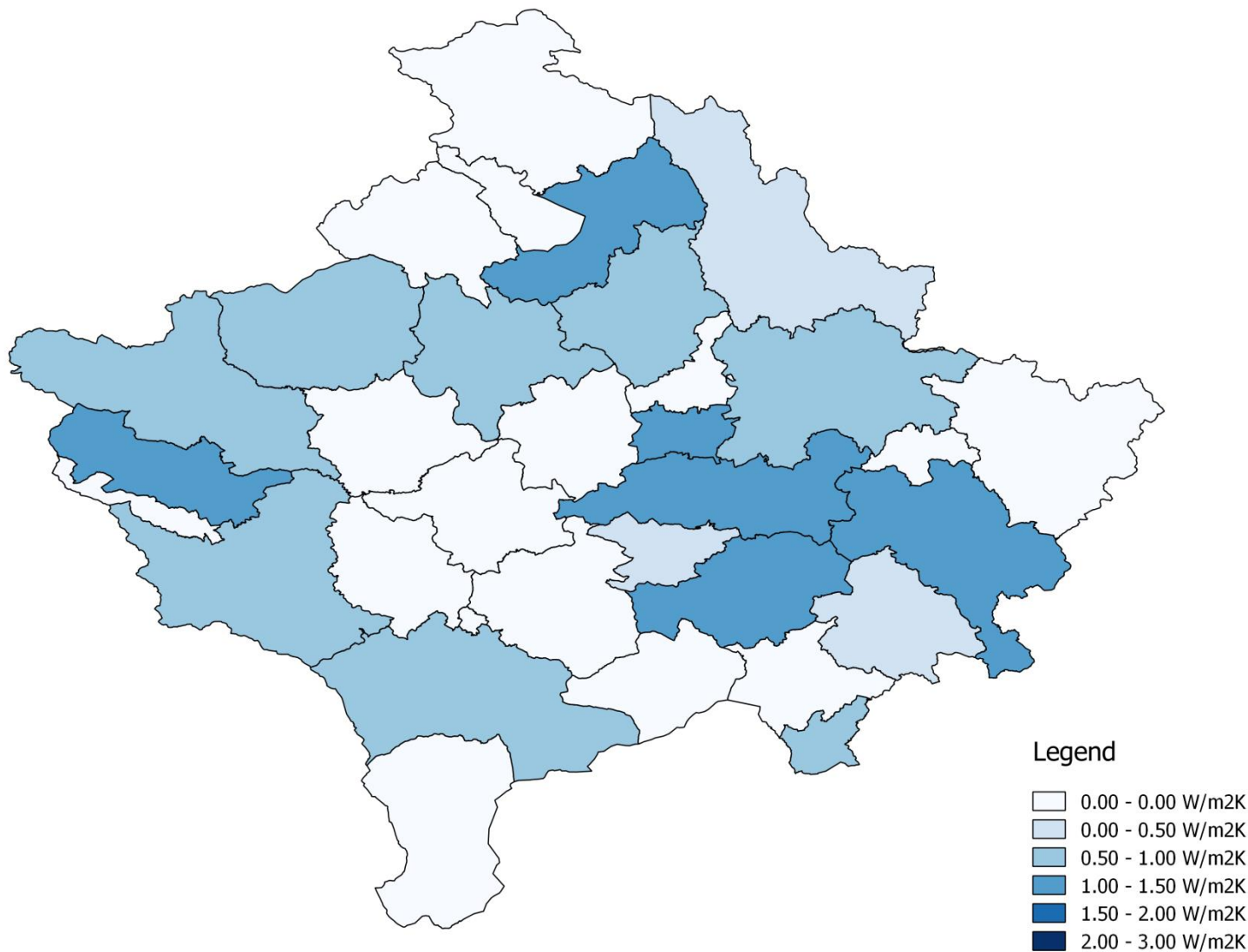
Përmbledhja e rezultateve – mosha mesatare e ndërtesave



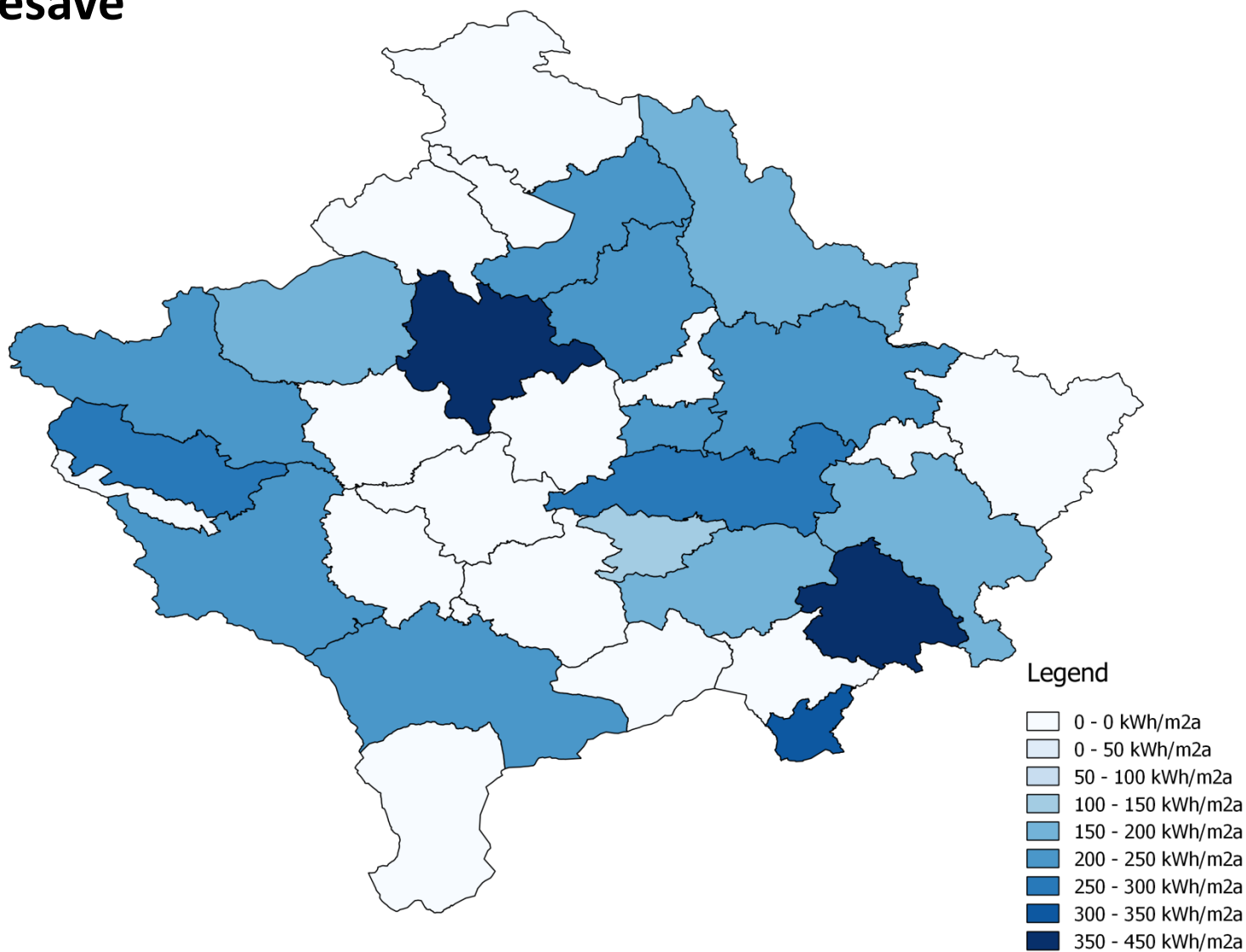
Përmbledhja e rezultateve - U-vlerat e mëparshme



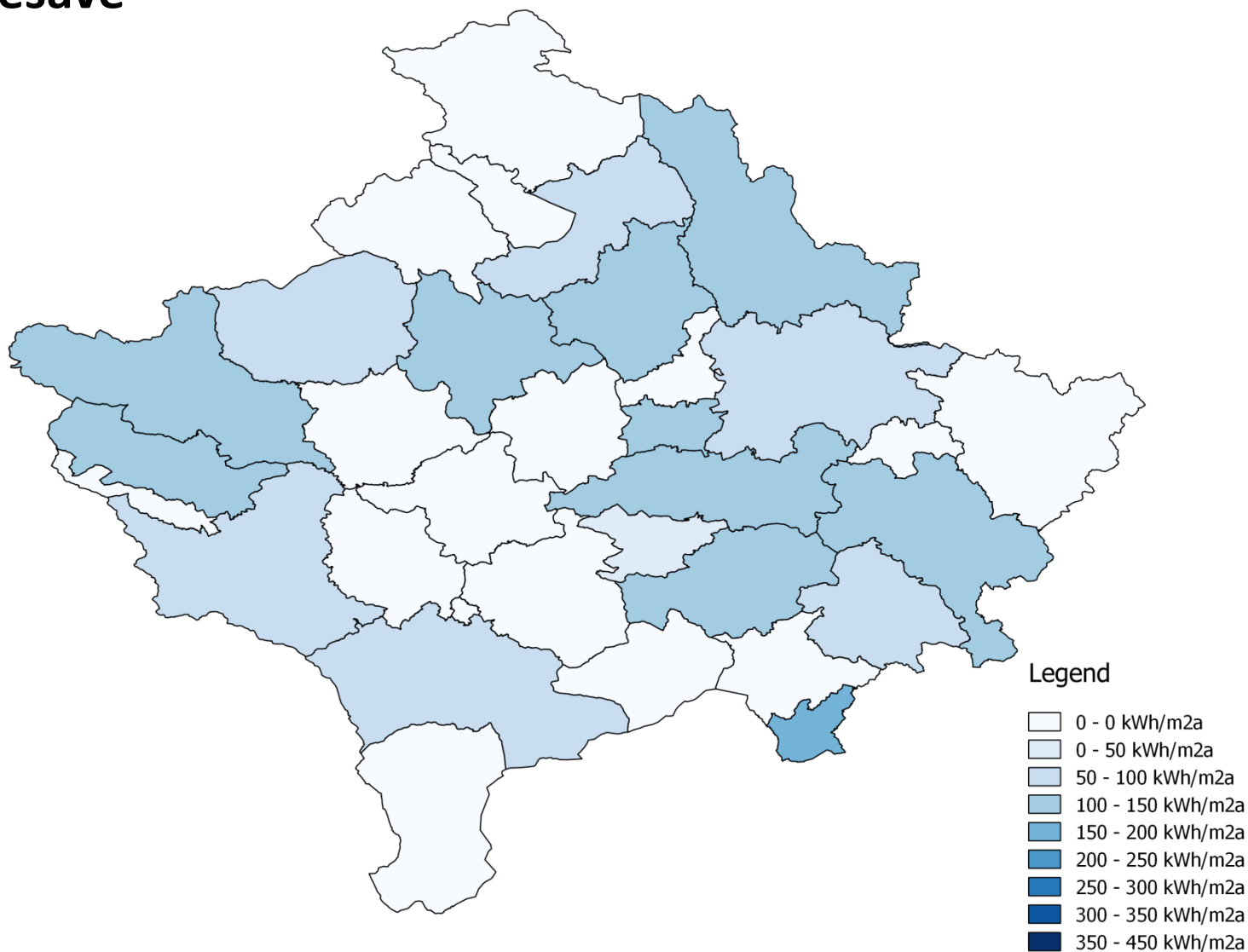
Përmbledhja e rezultateve - U-vlerat e mëpasme



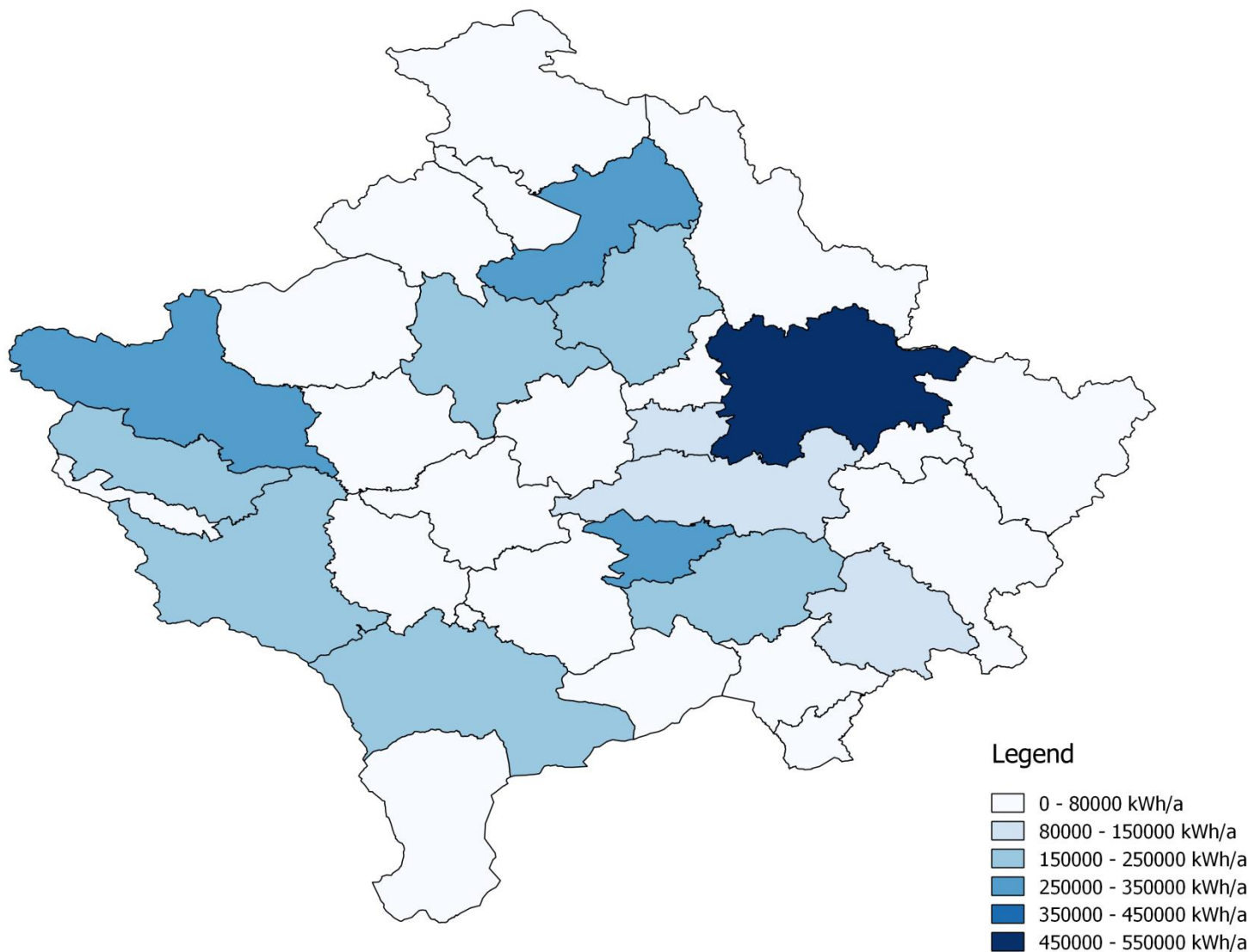
Përmbledhja e rezultateve – nxemja mesatare e mëparmë e ndërtesave



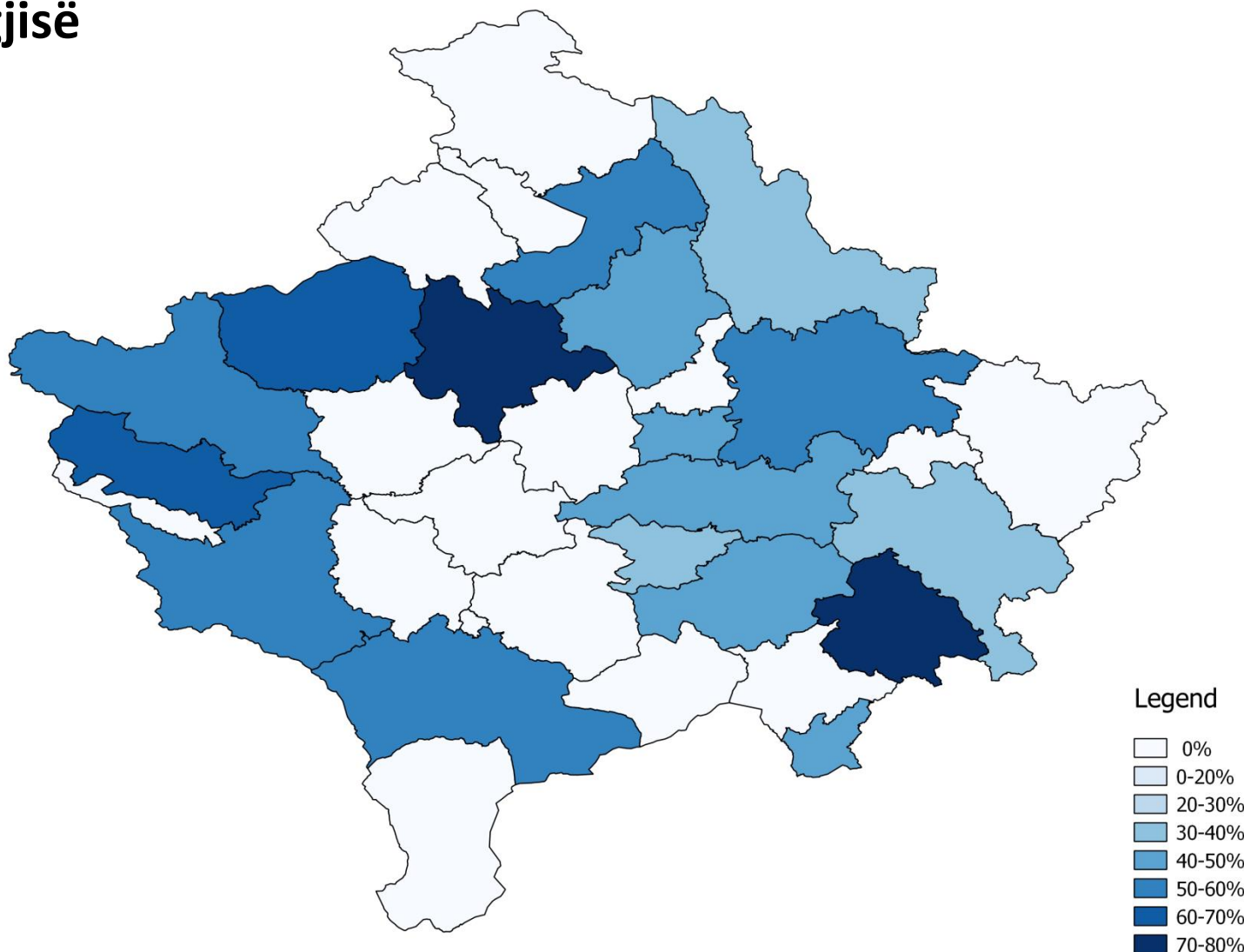
Përmbledhja e rezultateve – nxemja mesatare e mëpasme e ndërtesave



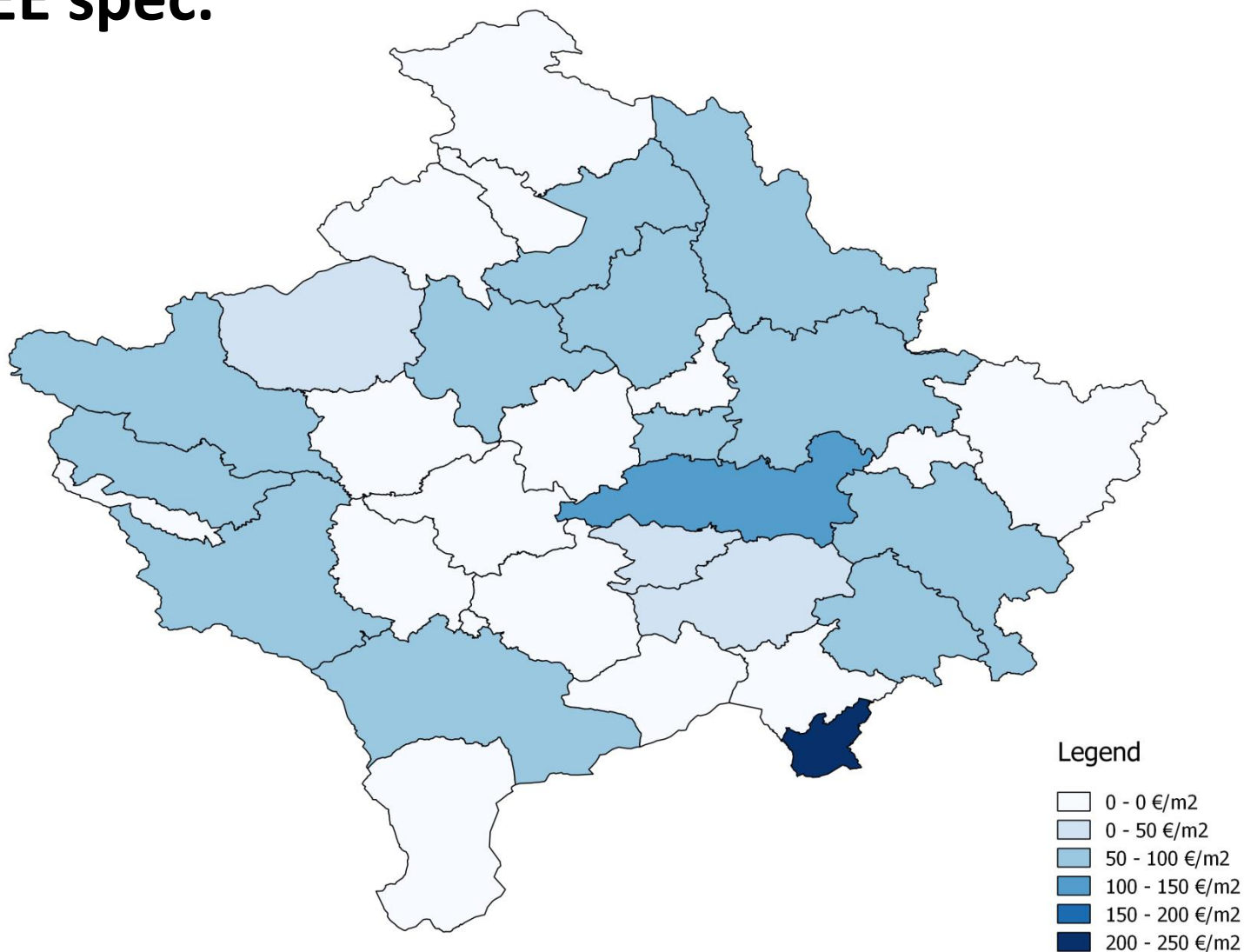
Përmbledhja e rezultateve – kursimi mesatarë i energjisë



Përmbledhja e rezultateve – përqindja mesatare e kursimit të energjisë



Përmbledhja e rezultateve - investimi mesatarë për EE spec.



Profili



z.bacelic@ic-group.org

Zlatko BAČELIĆ MEDIĆ

- › Përvojë në menagjimin e ekipit dhe koordinim të projekteve për eficiencën e energjisë, energjisë së ripërtrishme dhe implementimin e teknologjive të reja
- › Udhëheqës i ekipit për pregatitjen e shkallës së investimeve për auditimin e energjisë në sektorin publik, privat dhe industrial
- › Përvoja në ndërtimin e kapaciteteve në vendet në zhvillim
- › Përvojë ekstenzive në modelim teknik dhe pregatitjen e analizave financiare për eficiencë të energjisë dhe projekte të energjisë së ripërtrishme
- › Përvojë në optimizimin dhe të projekteve të eficiencës së energjisë
- › Përvojë në analizim dhe vlerësim të sektoreve të energjisë përfshirë planifikimet e energjisë
- › Përvojë me projekte nëpër SEE

Vizitonani në internet ...

www.ic-ces.at

**we are looking forward
to the future.
wherever!
whenever!
with you.**



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