Completed SEAPs' sections of public buildings – Croatia, Osijek

Deliverable D3.8.1

Work Package: WP3-Testing

Activity A3.8: IMPULSE-system trial applications for SEAPs' development

Integrated Management Support for Energy efficiency in Mediterranean PUblic buiLdings/ IMPULSE

Project ref.: 1MED15_2.1_M2_178

Priority Axis 2: Fostering low-carbon strategies and energy efficiency in specific MED territories: cities, islands and remote areas

Objective 2.1: To raise capacity for better management of energy in public buildings at transnational level

Status: Final

July 2019

Project co-financed by the European Regional Development Fund

Dissemination level		
Target group	City of Osijek	
PU	Public	RE
PP	Restricted to other programme participants (including the MA/JS Services)	
RE	Restricted to a group specified by the consortium (including the MA/JS Services)	
CO	Confidential, only for members of the consortium (including the MA/JS Services)	
Submitted by	**Reviewed by**	**Date submitted to MA/JS**
CRES	*EnvirobatBDM, IVE*	*31 October 2019*

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Executive summary	
The purpose of this activity is to further test the applicability of the system for the preparation of SEAP's sections of public buildings. APPs will undertake the trial applications and complete the relevant SEAPs sections accompanied with full reports of gradual renovation plans, monitoring plans and financial opportunities to implement planned projects in the future, with evident accomplishment of the ultimate goal of at least 20% energy savings of their public-building stock by 2020 (as prescribed by CoM objectives).	
Keywords	Public buildings; City of Osijek SEAP; IMPULSE trial applications.

Contents

1. Introduction

The purpose of this activity is to further test the applicability of the system for the preparation of SEAP's sections of public buildings. APPs will undertake the trial applications and complete the relevant SEAPs sections accompanied with full reports of gradual renovation plans, monitoring plans and financial opportunities to implement planned projects in the future, with evident accomplishment of the ultimate goal of at least 20% energy savings of their public-building stock by 2020 (as prescribed by CoM objectives).

2. SEAP trial applications' methodology and assumptions

The evaluation criteria and assumptions for the City of Osijek were defined by the deliverable D3.5.1 which shows the Gradual Renovation Plan and the financial plans for the City of Osijek that was automatically created from the implementation of the Plug in tool developed by EIHP, which was based on D.3.4.1: Simulated results and hierarchy of retrofitting measures, KPIs processing tool.

The following criteria has been chosen with the corresponding weight for the pilot city Osijek:

	Weight factor	Measures
54. Total investment cost per total annual energy saved - National Currency/(kWh of energy saved)	30	HRK/(kWh of energy saved)
16. Annual total energy-related operational cost - National Currency/yr	20	HRK/yr
24. Total annual primary energy savings - kWh/yr	10	kWh/yr
28. Annual electricity savings - %	30	%
37. Total annual avoided CO2 emissions - %	10	%

Typology number 10 is prioritized because it represents educational buildings – kindergartens, as well as the Deep retrofits and usage of renewable energy sources:

	Option	Penalization (± 30%)
Building Typology	PBT10	30%
Type of Retrofit	Deep retrofit	30%
RES	RES	30%

According to priorities, typologies 1, 3 and 5 have been eliminated (buildings under protection as cultural heritage, sport halls and offices), but all types of retrofits were considered, from minor to deep:

	Minor retrofit	Medium retrofit	Major retrofit	Deep retrofit
PBT1	✗	✗	✗	✗
PBT2	✓	✓	✓	✓
PBT3	✗	✗	✗	✗
PBT4	✓	✓	✓	✓
PBT5	✗	✗	✗	✗
PBT6	✓	✓	✓	✓
PBT7	✓	✓	✓	✓
PBT8	✓	✓	✓	✓
PBT9	✓	✓	✓	✓
PBT10	✓	✓	✓	✓
PBT11	✓	✓	✓	✓
PBT12	✓	✓	✓	✓
PBT13	✓	✓	✓	✓
PBT14	✓	✓	✓	✓
PBT15	✓	✓	✓	✓

3. SECAP results for the City of Osijek priority municipal buildings

Above-indicated table represents City of Osijek assumptions for the development of SECAP, where the stated criteria with the dynamics of 3% annual surface retrofit will achieve the following results[1]:

Relative retrofit area annualy		3%	%			
Total floor area		114.267	m²			
Retrofit area annualy		3.428	m²			
Combination		Year		1	2	3
Minor	15%	Floor area retrofited	m²	3.463,00	4.178,00	6.415,79
Medium	35%	Anualy investment	NC	5.441.274	6.564.725	8.805.630
Major	83%	Savings - currency	NC/a	246.228	297.066	509.821
Deep	100%	Savings - CO2	tCo2/a	138	167	390
		Savings - kWh	kWh/a	711.637	858.568	1.623.694
			1	PBT10 - Bambi Kindergarten - Deep retrofit	PBT10 - Latica Kindergarden - Deep retrofit	PBT10 - Stribor Kindergarden - Deep retrofit
			2	PBT10 - Vrapčić Kindergarten - Deep retrofit	PBT10 - Jaglenac Kindergarten - Deep retrofit	PBT10 - Pčelica Kindergarden - Deep retrofit
			3	PBT10 - Cvrčak Kindergarten - Deep retrofit	PBT10 - Nevičica Kindergarten - Deep retrofit	PBT7 - Mladost Elementary School - Deep retrofit
			4	PBT10 - Jelenko Kindergarten - Deep retrofit	PBT10 - Sjenčica Kindergarten - Deep retrofit	
			5	PBT10 - Ivančica Kindergarden - Deep retrofit	PBT10 - Sunčica Kindergarden - Deep retrofit	
			6	PBT10 - Tratinčica Kindergarden - Deep retrofit		
			7	PBT10 - Kosjenka Kindergarden - Deep retrofit		

[1] The following 6 tables show three years of savings, with year 2 refering to year 2020.

Relative retrofit area annualy		3%			
Total floor area		114.267			
Retrofit area annualy		3.428			
Combination		Year	4	5	6
Minor	15%	Floor area retrofited	5.375,69	4.854,39	3.845,26
Medium	35%	Anualy investment	6.803.351	5.296.795	4.866.474
Major	83%	Savings - currency	451.348	360.189	322.852
Deep	100%	Savings - CO2	387	270	277
		Savings - kWh	1.498.050	1.195.981	1.071.563
			PBT7 - Antun Mihanović Elementary School - Deep re	PBT7 - Vladimir Becić Elementary School - Deep retro	PBT7 - August Šenoa Elementary School - Deep retro
			PBT7 - Franjo Krežma Elementary School - Deep retro	PBT6 - Višnjevac Elementary School - Deep retrofit	PBT7 - Vijenac Elementary School - Deep retrofit

Relative retrofit area annualy		3%			
Total floor area		114.267			
Retrofit area annualy		3.428			
Combination		Year	7	8	9
Minor	15%	Floor area retrofited	4.130,73	3.564,48	3.607,59
Medium	35%	Anualy investment	3.906.452	3.370.946	3.707.294
Major	83%	Savings - currency	272.875	235.468	254.858
Deep	100%	Savings - CO2	174	150	179
		Savings - kWh	906.459	782.199	846.390
			PBT6 - Josipovac Elementary School - Deep retrofit	PBT6 - Grigor Vitez Elementary School - Deep retrofit	PBT7 - FKF, Frankopanska - Elementary School - Deep
			PBT6 - Ivan Filipović Elementary School - Deep retro	PBT6 - Tenja Elementary School - Deep retrofit	PBT6 - Dobriša Cesarić, Drinska - Elementary School
					PBT6 - Dobriša Cesarić, Neretvanska - Elementary Sc

Relative retrofit area annualy		3%			
Total floor area		114.267			
Retrofit area annualy		3.428	Annualy retrofit plan		
Combination		Year	10	11	12
Minor	15%	Floor area retrofited	5010	3649	3578
Medium	35%	Anualy investment	4.337.121	3.158.913	3.097.449
Major	83%	Savings - currency	126.557	92.177	90.384
Deep	100%	Savings - CO2	79	57	56
		Savings - kWh	437.201	318.432	312.236
			PBT8 - Tin Ujević Elementary School - Deep retrofit	PBT8 - Educational and cultural center of Hungarian	PBT8 - Retfala Elementary School - Deep retrofit

Relative retrofit area annualy		3%			
Total floor area		114.267			
Retrofit area annualy		3.428			
Combination		Year	13	14	15
Minor	15%	Floor area retrofited	3740,36	5430,5004	4097,1682
Medium	35%	Anualy investment	3.238.002	11.349.965	10.180.250
Major	83%	Savings - currency	94.485	532.304	255.497
Deep	100%	Savings - CO2	59	379	151
		Savings - kWh	326.405	1.541.302	762.951
			PBT8 - Sarvaš Elementary School - Deep retrofit	PBT4 - Sports Hall FKF - Deep retrofit	PBT2 - Jagoda Truhelka Elementary School - Deep ret
			PBT8 - Center for Nurture and Education, Ivan Štark -	PBT4 - Ljudevit Gaj Sports Hall - Deep retrofit	PBT2 - Sveta Ana Elementarry School - Major Retrofit
				PBT4 - Višnjevac Sports Hall - Deep retrofit	PBT2 - Sveta Ana Elementarry School - Deep retrofit
				PBT4 - Franjo Krežma Sports Hall - Deep retrofit	PBT2 - FKF, Divaltova- Elementary School - Major Ret
				PBT2 - Radost 1 Kindergarten - Deep retrofit	
				PBT2 - Jagoda Truhelka Elementary School - Major Re	

Relative retrofit area annualy		3%			
Total floor area		114.267			
Retrofit area annualy		3.428			
Combination		Year	16	17	18
Minor	15%	Floor area retrofited	3911,3514	4194	1935
Medium	35%	Anualy investment	9.838.208	9.020.822	4.161.967
Major	83%	Savings - currency	296.780	368.341	169.943
Deep	100%	Savings - CO2	184	226	104
		Savings - kWh	917.423	1.132.038	522.292
			PBT2 - Radost 2 Kindergarten - Major Retrofit	PBT9 - Josipovac Kindergarden - Deep retrofit	PBT9 - Zvončić Čepin Kindergarden - Deep retrofit
			PBT2 - Radost 2 Kindergarten - Deep retrofit	PBT9 - Maslačak Kindergarden - Deep retrofit	PBT9 - Potočnica Kindergarten - Deep retrofit
			PBT2 - Tenja, dvorac Elementary School - Major Retro	PBT9 - Krijesnica Kindergarden - Deep retrofit	
			PBT2 - Vedri dani Kindergarten - Major Retrofit	PBT9 - Jabuka Kindergarden - Deep retrofit	
			PBT2 - FKF, Divaltova- Elementary School - Deep retr		
			PBT2 - Vedri dani Kindergarten - Deep retrofit		
			PBT2 - Tenja, dvorac Elementary School - Deep retrofi		
			PBT9 - Mak Kindergarden - Deep retrofit		
			PBT9 - Bubamara Kindergarten - Deep retrofit		

The baseline for the energy consumption calculated from the Deliverable D3.4.1 is 19.214.888,91 kWh and the percentage of the savings is calculated in relations to the stated value.

The most important KPIs selected for the renovation plans are related to each family of indicators from the project: energy, environmental and cost:

Total investment cost per total annual energy saved (HRK/kWh of energy saved) – selected as the most important KPI and has been ranged with the highest weight factor due to the willingness for achieving high energy-savings with least-cost. The weight given for this criterion is the most important: 30%

Annual electricity savings (%) – due to public buildings which mostly have old lighting systems that cause significant costs regarding annual electricity consumption, this criterion is also given 30%

Annual total energy-related operation cost (HRK/yr) – criterion important for public bodies that have significant expenses in operation costs for their public buildings. Due to technical features of public buildings which mainly refer to old heating systems, those buildings have high energy-related operational costs, therefore the indicators value is 20%.

Total annual primary energy savings (kWh/yr) - One of the main aims of the project is to reduce the primary energy consumption of the buildings, according to the conditions to establish the different levels of retrofit. This indicator hence is very important for the project but also is important for the public bodies, which have significant expenses in operational costs for their public buildings. Those buildings are often old and work with old heaters, are not insulated and consume a lot of energy. The weight given for this indicator is 10%.

Total annual avoided CO2 emissions (%) - As a major part of the covenant of mayors, the aim to achieve by the signatories is to establish SEAPs which involves reducing by 20% the CO2 emissions by 2020 and by 40% by 2030. This environmental criterion, particularly in the context of the past few years, is more and more important in the choice of the actions to lead for reducing our impact on our planet. The weight given for this criterion is 10%. The weight is less important because the main purpose of Mayors or elected people is still more linked to energy savings, which means money saving.

Taken all that is stated into account, the plan that perceives 3% retrofits annually, the annual savings (as visible in the picture 1) is:

- 2019: 711.637 kWh
- 2020: 858.568 kWh

The total savings (sum of the two years): 1.570.205 kWh, which represents 8,17 % savings from the baseline value.

Methodology for the City of Osijek with which we achieve 20% savings by 2020. Is to simply increase the percentage of retrofit, i.e. retrofit of more surface annually, which for the City of Osijek specifically means that the retrofit percentage must increase from 3% to 6%.

Taking this into account our tool provided the following results for the City of Osijek:

- 2019: 1.570.206 kWh
- 2020: 2.442.374 kWh

Total savings amount to: 4.012.580 kWh, which represent 20.88 % savings from the baseline value as visible in the table below:

Relative retrofit area annualy		6%	%			
Total floor area		114.267	m²			
Retrofit area annualy		6.856	m²			
Combination		Year			1	2
Minor	15%	Floor area retrofited	m²		7.641,00	9.353,59
Medium	35%	Anualy investment	NC		12.005.999	12.523.644
Major	83%	Savings - currency	NC/a		543.294	756.482
Deep	100%	Savings - CO2	tCo2/a		305	601
		Savings - kWh	kWh/a		1.570.206	2.442.374
				1	PBT10 - Bambi Kindergarten - Deep retrofit	PBT10 - Stribor Kindergarden - Deep retrofit
				2	PBT10 - Vrapčić Kindergarten - Deep retrofit	PBT10 - Pčelica Kindergarden - Deep retrofit
				3	PBT10 - Cvrčak Kindergarten - Deep retrofit	PBT7 - Mladost Elementary School - Deep retrofit
				4	PBT10 - Jelenko Kindergarten - Deep retrofit	PBT7 - Antun Mihanović Elementary School - Deep re
				5	PBT10 - Ivančica Kindergarden - Deep retrofit	
				6	PBT10 - Tratinčica Kindergarden - Deep retrofit	
				7	PBT10 - Kosjenka Kindergarden - Deep retrofit	
				8	PBT10 - Latica Kindergarden - Deep retrofit	
				9	PBT10 - Jaglenac Kindergarten - Deep retrofit	
				10	PBT10 - Nevičica Kindergarten - Deep retrofit	
				11	PBT10 - Sjenčica Kindergarten - Deep retrofit	
				12	PBT10 - Sunčica Kindergarden - Deep retrofit	

5. Conclusion

Taking under the consideration the fact that the educational buildings such as kindergartens and schools are priority buildings for the City of Osijek and that the selected criteria are vital as we are striving towards “deep retrofit” options, the IMPULSE-system trial applications for SEAPs' development has indicated that, in order to achieve 20% savings by 2020., the City of Osijek must increase the area retrofit percentage from 3% to 6%.

Annex