



IMPULSE Testing report:

Deliverable D3.8.1

Work Package: WP3-Testing

Activity A3.8: System trial applications for SEAP's 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

Submission date: 31st October 2019

Status: Final



July 2019



Dissemination le	Dissemination level								
Target group	Local public authority; Regional public authority; Sectoral agency; Business support organisation; Other								
PU	Public	PU							
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)								
СО	Confidential, only for members of the consortium (including the MA/JS Services)								
Submitted by	Reviewed by	Date submitted to MA/JS							
CRES	IVE	31 st October 2019							

Editors								
Name (Organisation) e-mail								
Leading participants	Ravenna Municipality	sirossi@comune.ra.it sulazzi@comune.ra.it						
Contributing participants	As above	As above						
WP Leader (WPL)	IVE	vvalero@five.es						
Lead Partner (LP)	CRES	gstavr@cres.gr						

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 (see CoM objectives).

Keywords	Energy, Retrofit





Table of contents

Tabl	e of contents	2
1.	Introduction	3
2.	Reminder of the assumptions defined for the study	3
3.	Results of the base case simulation with performance indicators for the pilot city of Ravenna	3
4.	Results of renovation plan with a define priority	5
4.1.	Renovation plan with minor retrofit priority	5
4.2.	Renovation plan with major retrofit priority	7
4.3.	Renovation plan with deep retrofit priority (optional)	9
5.	Comparative results from the simulation and the reality case	. 11
6.	Integrated results to the "Covenant of Mayors" impacts matrices	. 12
7.	Conclusion	. 13





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 (see CoM objectives).

This report presents the results of the simulation to create a planification plan for building renovation for the pilot city of Ravenna realised by Ravenna Municipality – Section Environment and Territory Protection.

2. Reminder of the assumptions defined for the study

The evaluation criteria and assumptions have been defined in Deliverable D.3.5.1.

This part of the report presents the Gradually Renovation Plan for the city of Ravenna, got automatically from the implementation of the plug-in developed by EIHP on the base of D.3.4.1: Simulated results and hierarchy of retrofitting measures, KPIs processing tool. Along with the renovation plan comes the financial plans, got automatically from the implementation of the financial excel tool developed by AREA PACA on the base of the D3.5.1 excel tool plug in.

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

			Weight factor	Measures
54. Total investmen	t cost per total ann	ual energy saved - Nati	25	National Currency/(kWh of energy saved
21. Estimated Inves	tment cost - Nation	nal Currency/m²	25	National Currency/m2
12. Annual CO2 emi	ssions from electri	city consumption - kg/y	0	kg/yr
6. Annual consump	tion of fossil fuel - I	kWh/yr	0	kWh/yr
53. Simple Payback	period - yr		50	yr
				<u>. </u>
	Option	Penalization (± 30%)		
Building Typology	PBT1	0%		
Building Typology Type of Retrofit	PBT1 Deep retrofit	0%	-	

3. Results of the base case simulation with performance indicators for the pilot city of Rayenna

APPs will apply the IMPULSE IT system towards:

- Drafting of the relevant sections for municipal buildings in SEAPs.
- Drafting action and financial plans for gradual renovation (3% floor-area annually) of municipal buildings

TPPs have supported APPs in the use of the IT system.







It is important to remember that for the pilot city of Ravenna, is mainly focus on their educational buildings in priority for their renovation projects. So, for this scenario of renovation plan for the city of Ravenna, only the PBTs 1, 2, 3, 4, 5 and 6 are considered, being all educational typologies, or Gym for an educational building.

Also, all types of retrofit are considered, except the Minor retrofit scenario.

Relative retrofit area annualy	V	3%	%	1				
Total floor area 105.76								
Retrofit area annualy		3.173	m²					
Combination		Year		1	2	3	4	5
Minor	15%	Floor area retrofited	m ²	3.539,66	3.936,30	4.184,48	3.277,45	4.969,64
Medium	30%	Anualy investment	NC	215.522	239.673	254.784	418.816	587.454
Major	90%	Savings - currency	NC/a	27.995	31.132	33.095	46.038	57.177
Deep		Savings - CO2	tCo2/a	87	96	102	138	133
		Savings - kWh	kWh/a	324.469	360.828	383.577	566.969	594.480
			1	PET4 - Scuola Secondaria di primo grado M. Montanari - Medium Re	PGT4 - Scuola Secondaria di primo grado S. Pietro in Vincoli R. Gessi	PBT4 - Scuola Primaria lighal Masih - Medium Retrofit	PBT4 - Scuola Secondaria di primo grado Ricci-Muratori - Medium	PBTS - Palestra Scuola Secondaria di primo grado Don G. Minooni - I PI
			2	PET4 - Scuola Secondaria di primo grado Don G. Minzoni - Medium I	PBT4 - Scuola Secondaria di primo grado Guido Novello - Medium R	PBT4 - Scuola Secondaria di primo grado S. P. Campiano V. da Feltre	POTG - Bacino Canottaggio Standiana - Medium Retrofit	PBTS - Palestra Scuola Primaria A. Torre - Medium Retrofit
			3	PST4 - Accademia Di Belle Arti - Medium Retrofit	PBT4 - Scuola Primaria A. Torre - Medium Retrofit	PBT4 - Scuola Secondaria di primo grado C. Viali - Medium Retrofit	PBTG - Polisportivo Darsena - Medium Retrofit	PBTS - Palestra Plangipane - Medium Retrofit
			4		PBT4 - Scuola Primuria Goffredo Mameli - Medium Retrofit	PBT4 - Scuola Primaria V. Randi - Medium Retrofit	PBTG - Palestra Scuola Secondaria S. Pietro in Vincoli R.Gessi - Medi	PBTS - Palestra Scuola Media Statale C. Viali - Medium Retrofit
			5	<u> </u>			POTG - Palestra Scuola Secondaria di primo grado Guido Novelio - N	PBTS - Palestra Scuola Elementare Riccardo Ricci - Medium Retrofit
			- 6	<u></u>			PBTS - Palestra Scuola Secondaria di primo grado M. Montanari - M	PBTS - Palestra Scuola Frimeria V. Randi - Medium Retrofit
			7	_				PBTS - Palestra Scuola Secondaria di primo grado Ricci-Muratori - N
			٤					PBTS - Palestra Scuola Dell'Infanzia Garibaldi - Medium Retrofit
			9	<u>_</u>				PBTS - Palestra Scuola Scuola Primaria G. Garibaldi - Medium Retro
			10	<u>_</u>				PBT4 - Scuola Secondaria di primo grado M. Montanari - Major Retr
			11					
			12					

Annualy retrofit plan									
6	7	8		9	10	- 11	12		
4.134.22	4.010.64	3.861.9	6	3.390.17	4978.782	3509.316	3328.308		
116.945	113,450	109.244		95.898	140.836	99,269	582,945		
946	918	884	·	776	1.139	803	42.057		
4	3	3		3	4	3	83		
25,494	24.732	23.815		20.906	30.702	21.641	374,989		
	Major Re PUTA - Scuola Secondaria di primo grado S. Pietr				4 - Scuola Secondaria di primo grado C. Viali - Major Retrofit	PBT4 - Scuola Secondaria di primo grado Ricci-Muratori - Major Rei			
PBT4 - Accademia Di Belle Arti - Major Retrofit	PET4 - Scuola Secondaria di primo grado Guido I	ovello - Major Reti PUTA - Scuola Primaria Goffredo Mare	ell - Major Retrofit PBT4 - Scuola Secondaria di	primo grado S. P. Campiano V. da Feltra PETG	4 - Scuola Primaria V. Randi - Major Retrofit		PBT2 - Scuola Dell'Infancia Sergio Fusconi - Medium Retrofit		
							PBT2 - Scuola Dell'Infancia Felici Insieme - Medium Retrofit		
							PBT2 - Scuola Dell'Infancia Mario Pasi - Medium Retrofit		
							PBT2 - Nido Dell'Infanzia Pavinani - Medium Retrofit		
							PBT2 - Scuola dell'Infanzia i Dellini - Medium Retrofit		
Į.							PBT2 - Scuola dell'Infanzia Osteria Peter Pan - Medium Retrofit		
·							PBT2 - Scuola Dell'Infancia Larnetta - Medium Retrofit		
							POT2 - Scuola Dell'infancia Garibaldi e Nido dell'infancia Garibaldi -		
							PST2 - Scuola Dell'Infancia Freccia Azzuma - Medium Retrofit		
							PBT2 - Scuola Dell'Infancia Peter Pan - Medium Retrofit		
							PBT2 - Scuola Primaria A. Ceci - Medium Retrofit		
							PB12 - SCLISS PRYTISHS A. CHO - MINGSER HISTORY		
				-					
13	14	15	36	17	38	19	20		
3487,4604	3318,8922	3589,068	3185,496	3246,798	3213,6206	3284,103	3299,6297		
3487,4604 564.823	3318,8922 519.360	3589,068 281.148	3185,496 185.951	3246,798 454.034	3213,6206 3.669.693	3284,103 669.036	3299,6297 3.191.083		
3487,4604 564.823 28.129	3318,8922 519.360 20.411	3589,068 281.148 8.840	3185,495 185,951 4,846	3246,798 454.034 18.733	3213,6206 3.669.693 167.072	3284,103 669.036 27.197	3299,6297 3.191.083 66.699		
3487,4604 564.823 28.129 76	3318,8922 519,360 20,411 47	3589,068 281.148 8.840 33	3185,496 185,951 4,846 25	3246,798 454.034 18.733 62	3213,6206 3,669,693 167,072 412	3284,103 669,036 27,197 64	3293,6297 3.191.083 66.699 176		
3487,4604 564,823 28,129 76 354,461	3318,8922 519.360 20.411 47 196.368	3589,068 281.148 8.840	3185,496 185,951 4,846 25 124,234	3246,798 454.034 18.733 62 281.279	3213,6206 3.699.693 167.072 412 1.997.174	3284,103 669,036 27.197 64 146.660	3299,6297 3.191.083 66.699 176 736.718		
3487,4604 564.823 28.129 76 354.461 PRIZ: Souda Privario A. Guitriviti: Medium faturiti	3318,8922 519,360 20,411 47	3589,068 281.148 8.840 33 154.699	3185,496 185,951 4,846 25 124,234 FWZ - Souds 64f Tribruik Chicar Peter Pan - Major Retrifit	3246,798 454.034 18.733 62	3213,6206 3.669,693 167.072 412 1.907.174 PSIS - Palacina Sequentura di prima grada M	3284,103 669,036 27,197 64 146,660 determant: Der (PET) Source Secretaria in priva grade F. Cimaño: Major Ret	3299,6297 3.191.083 66.699 176 736.718 mill locals Primaria Fazzacian Marior del Masterne - Major Rando		
3487,4604 564.823 28.129 76 354.461 PRIT2 - Sonala Printral A. Guistraid - Medium Ratinifit PRIT2 - Sonala Printral A. Guistraid - Medium Ratinifit PRIT2 - Sonala Printral A. Guistraid - Medium Ratinifit PRIT2 - Sonala Printral A. Sonala - Medium Ratinifit	3318,8922 519.360 20.411 47 196.368	3589,068 281.148 8.840 33 154.699 PRITS - Probents Scarle Golffenson Gardant - Major Retroffs	3185,496 185,951 4,846 25 124,234 FWZ - Souds 64f Tribruik Chicar Peter Pan - Major Retrifit	3246,798 454.034 18.733 62 281.279 PET2 - Soucia Primaria A. Carl - Major Ratmosti PET2 - Soucia Primaria A. Carl - Major Ratmosti	3213,6206 3.699.093 167.072 412 1.907.174 PRIS - Palestra Scales Secondarie al press grads W	3284,103 669,006 27,197 64 64 determan: Det (PET) South International Performance of the Conference of	3299,6297 3.191.083 66.699 176 736.718 mill locals Primaria Fazzacian Marior del Masterne - Major Rando		
3487,4604 564.823 28.129 76 354.461 PRIT2 - Sonala Printral A. Guistraid - Medium Ratinifit PRIT2 - Sonala Printral A. Guistraid - Medium Ratinifit PRIT2 - Sonala Printral A. Guistraid - Medium Ratinifit PRIT2 - Sonala Printral A. Sonala - Medium Ratinifit	3318,8922 539,360 20,411 47 196,368 WILL Pakento Scale Scenderio El prino grado Con G. Minano: 5 WILL Pakento Scale Frienzio A. Torro- Algor Revolt.	3589,068 281.148 8.840 33 154.699 PRIS - Paleons Scools Cellifordana Gerbald - Major Satrofili PRIS - Paleons Scools Cellifordana Gerbald - Major Satrofili PRIS - Paleons Scools Scools Scools Primario Gerbald - Major Satrofili	3185,496 185.951 4.846 25 124.234 1872 - Sounds did Yindrai Charle Peter Pan - Major Intereffit 1982 - Sounds did Yindrai Charle In Peter Pan - Major Intereffit 1982 - Sounds did Yindrai Charles Major Intereffit	3246,798 454.034 18.733 62 281.279 PET2 - Soucia Primaria A. Carl - Major Ratmosti PET2 - Soucia Primaria A. Carl - Major Ratmosti	3213,6206 3,669,693 167,072 412 197,774 497,77	3284,103 669,006 27,197 64 64 determan: Det (PET) South International Performance of the Conference of	3299,6297 3.191.083 66,699 276 776 787 786,7187 787 787 787 787 787 787 787 787 787		
3487,4604 564.823 28.129 76 354.461 PR7: South Privatio, A. Guinted I. Modarn Battoff; PR7: South Privatio, A. Guinted I. Modarn Battoff; PR7: South Privatio, A. Guinted I. Modarn Battoff; PRFS: Solven Covering to Technique Major Revorts PRFS: - Polipports Duriners - Major Revorts	3318,8922 519.360 20.411 47 20.411 196.368 196.1689 197. Falvier Scale Indicates in piece granis Cont. Minare'. A WELL Falvier Scale Indicates In piece granis Cont. Minare'. A WELL Falvier Scale Indicates In Terr. Adapt Report WELL Falvier Scale Indicates In Terr. Adapt Report WELL Falvier Scale Indicates In Terr. Adapt Report	3589,005 281,148 8,840 33 154,699 PBS: Falson Social Period Garbell - Major Retroffi PBS: Falson Social Social Period Garbell - Major Retroffi PBS: Assist Definition Control Garbell - Major Retroffi PBS: Assist Soft-Period Carbell - Major Retroffi	3185,495 185,951 4,846 25 124,234 1872 - Sounds mil't Henri in Chaten't Peter Pass Major Interelli 1972 - Sounds mil't Henri in Chaten't Peter Pass Major Interelli 1972 - Sounds Dell'Arthresis Cartains's Major Interelli	3246,798 456.034 18.733 62 62 818.729 PET2 - Souda Primaria A Call-India Ferrolts PET2 - Souda Primaria A Gall-India Ferrolts NPET3 - Souda Primaria A Gall-India Ferrolts NPET3 - Souda Primaria Bariali - Maclum Betrolts	3213.6206 3.666.693 4.67.072 4.12 3.1507.174 395. Nelves Statis Secondard in press grads for our State State State Secondard in press grads for our State St	3284,103 669,036 77,197 64 4444441103 (MTS) South Service of privary gold 17 Countin. Major Farl G Massaci (MTS) South Service of privary gold 17 Countin. Major Farl G Massaci (MTS) South Service of the Gold Service of the Gol	3299,6297 3.191.083 66.6999 176 796,718 orth State Treasure Navastron Marcial 61 Martina - Major Novelle 1971 - Marcia Printensis in Magnetic 61 Martina - Major Novelle 1971 - Marcia Printensis in Martina - Major Novelle 1971 - Marcia Printensis in Marcial - Marcial		
3487,4654 564.823 28.139 78 78 355-461 PRET: Sharek Services & Galverier Medical Retrieval Medical Retrieval PRET: Sharek Services & Galverier Medical Retrieval PRET: Sharek Services & Galverier Medical Retrieval PRET: Sharek Services & Galverier Medical Retrieval PRET: Sharek Services Medical Retrieval PRET: Sharek Services Medical Retrieval R	3318,8922 \$19.360 20.451 47 47 196.368 WILL-Takwee Seale French a French agent Smit Masser-A- French Seale Seale French a French Aller Barbert WILL-Takwee Seale French Barbert WILL-Takwee Seale French Barbert WILL-Takwee Seale French Will-French May Fabrort	3559,065 281,148 8,840 33 31 154,699 PPIT: Falence State Orderfessa General - Stage Fasterill PPIT: Falence State Orderfessa General - Stage Fasterill PPIT: Falence State Orderfessa General - Stage Fasterill PPIT: Falence State Orderfessa Stage Fasterill PPIT: Falence Stage Fasterill PPIT: Falence Stage Fasterill PPIT: Falence Stage Fasterill PPIT: Falence Stage Fasterill PPIT: F	3185,996 185.951 4.886 25 25 124.234 1972: South Berlinnin Chief Peter Peter Assign Peter	32.65,798 454.034 18.733 62 28.1279 1992 - Sanafa Frivaria A. Guir Majer Harott 1997 - Sanafa Frivaria A. Guir Majer Harott 1997 - Sanafa Frivaria A. Guir Majer Harott 1997 - Sanafa Frivaria Majer Harott 1997 - Sanafa Frivaria Majer Majer Majer Harott 1997 - Sanafa Ger Frivaria Majer Maj	3213.6206 3.666.693 4.67.072 4.12 3.1507.174 395. Nelves Statis Secondard in press grads for our State State State Secondard in press grads for our State St	3284, 103 669, 1036 77, 197 64 164 1659 177, 197 1655 1651 1651 1651 1651 1655 1651 1655 16	3299,6137 3.191,083 66,699 7.76 796,718 outs 971. Nacio Privato Exception Medic Deliver Mayor Reveals outs 971. Nacio Privato Exception Medic Deliver Mayor Reveals 971. Nacio Privato Louder Mayor Mayor Reveals 971. Nacio Privato Louder Mayor Mayor Reveals 971. Nacio Privato Louder Mayor Reveals 971. Nacio Privato Louder Mayor Reveals 971. Nacio Privato Louder Mayor Reveals		
3487,4654 354.823 28.139 76 355.4651 76 355.4651 PRIT: Standa Primorda. Guistrania Valence Removal PRIT: Standa Primorda. Guistrania Valence Removal PRIT: Standa Primorda Seatoria. Major Removal PRIT: Standa Primorda Seatoria. Major Removal PRIT: Standa Primorda Seatoria. Major Removal PRIT: Standa Seatoria. Seatoria. Primorda Seatoria. Major PRIT: Standa Seatoria. Seatoria. Primorda Seatoria. Major PRIT: Standa Seatoria. Seatoria. Major Seatoria. Major PRIT: Standa Seatoria. Seatoria. Seatoria. Major PRIT: Standa Seatoria. Major Seatoria. Major Seatoria. Major PRIT: Standa Seatoria. Major Seator	3318,8922 \$19.360 20.451 47 47 196.368 WILL-Takwee Seale French a French agent Smit Masser-A- French Seale Seale French a French Aller Barbert WILL-Takwee Seale French Barbert WILL-Takwee Seale French Barbert WILL-Takwee Seale French Will-French May Fabrort	\$589,068 281.148 8.840 33 154.699 9701. There's board before desired things benefit (1971) 19701. There's board before desired things benefit (1971). There's board before desired there's board before the part families (1971). There's board before desired there's board begin benefit (1971). The board before desired there's board begin families. 1972. Seals definitional benefit (1972). The board before desired there's board benefit (1972).	3185,996 185.951 4.886 25 25 124.234 1972: South Berlinnin Chief Peter Peter Assign Peter	3246,798 454,034 18,733 62 281,279 1972 - South Frennich Clark Michael Street 1972 - South Frennich Clark Michael Magne Housel 1971 - South Frennich Landis - Magne Manne Housel 1971 - South Frennich Landis - Manne Manne Housel 1971 - South Frennich Landis - Manne Manne Landis - Manne Housel 1971 - South Street Housel A Sanot - Manne Landis - Manne 1971 - South Frennich Text - South Frennich Manne 1971 - South Frennich Text - South Frennich Manne 1971 - South Frennich Manne 1971 - South Frennich Manne 1971 - South Frennich Landis - Manne 1971 - South Frennich L	\$213,6206 \$160,699 \$10,077 \$422 \$122 \$197,734e South International Principles South Internati	3284, 103 669, 1036 77, 197 64 64 64 64 64 65 67, 105 64 64 64 64 64 64 64 64 64 64 64 64 64	329,629 . 3.191.083 66.699 176 7786.718 with 9071 South Primaria Security Sugar Security 1071 South Primaria Security Security Sugar Security 1071 South Primaria Security Security Sugar Security 1071 South Security Security Security Security Security 1071 South Security Secur		
3487,4654 354.823 28.139 76 355.4651 76 355.4651 PRIT: Standa Primorda. Guistrania Valence Removal PRIT: Standa Primorda. Guistrania Valence Removal PRIT: Standa Primorda Seatoria. Major Removal PRIT: Standa Primorda Seatoria. Major Removal PRIT: Standa Primorda Seatoria. Major Removal PRIT: Standa Seatoria. Seatoria. Primorda Seatoria. Major PRIT: Standa Seatoria. Seatoria. Primorda Seatoria. Major PRIT: Standa Seatoria. Seatoria. Major Seatoria. Major PRIT: Standa Seatoria. Seatoria. Seatoria. Major PRIT: Standa Seatoria. Major Seatoria. Major Seatoria. Major PRIT: Standa Seatoria. Major Seator	3318,8922 5319,300 10.611 47 196.306 WF Thirty State International prints goal Dat 5. Wages: United States International Print Pr	\$589,068 281.148 8.840 33 154.699 175.4	3185,996 185.951 4.886 25 25 124.234 1972: South Berlinnin Chief Peter Peter Assign Peter	3246,798 454.034 454.034 18.733 62 62 281.279 972. Sauta Francia. Cui- High Head of	221 6206	2284,103 669,036 727,377 64 146,000 14	3299,6297 3.191.083 66.699 776 778 778 778 778 778 778 778 778 777 778		
3487,4654 354.823 28.139 76 355.4651 76 355.4651 PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. PRIT: Standa	3318,8922 5319,300 10.611 47 196.306 WF Thirty State International prints goal Dat 5. Wages: United States International Print Pr	\$589,068 281.148 8.840 33 154.699 9701. There's board before desired things benefit (1971) 19701. There's board before desired things benefit (1971). There's board before desired there's board before the part families (1971). There's board before desired there's board begin benefit (1971). The board before desired there's board begin families. 1972. Seals definitional benefit (1972). The board before desired there's board benefit (1972).	3185,996 185.951 4.886 25 25 124.234 1972: South Berlinnin Chief Peter Peter Assign Peter	3246,798 455.034 18.733 62 281.179 1972 - South Foresten S. Carlotte Stage Sta	121 1 6206	2284,100 609,005 72,137 609 1000 1000 1000 1000 1000 1000 1000	329,629 . 3.191.083 66.699 176 7786.718 with 9071 South Primaria Security Sugar Security 1071 South Primaria Security Security Sugar Security 1071 South Primaria Security Security Sugar Security 1071 South Security Security Security Security Security 1071 South Security Secur		
3487,4654 354.823 28.139 76 355.4651 76 355.4651 PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. PRIT: Standa	3318,8922 5319,300 10.611 47 196.306 WF Thirty State International prints goal Dat 5. Wages: United States International Print Pr	\$589,068 281.148 8.840 33 154.699 9701. There's board before desired things benefit (1971) 19701. There's board before desired things benefit (1971). There's board before desired there's board before the part families (1971). There's board before desired there's board begin benefit (1971). The board before desired there's board begin families. 1972. Seals definitional benefit (1972). The board before desired there's board benefit (1972).	3185,996 185.951 4.886 25 25 124.234 1972: South Berlinnin Chief Peter Peter Assign Peter	3246,798 455,034 18,733 62 281,179 1972 Sasiah Promota A, Galvinett Migar Breed, Sandar San	331 A GORD	2284,100 609,005 72,137 609 1000 1000 1000 1000 1000 1000 1000	329,629 . 3.191.083 66.699 176 7786.718 with 9071 South Primaria Security Sugar Security 1071 South Primaria Security Security Sugar Security 1071 South Primaria Security Security Sugar Security 1071 South Security Security Security Security Security 1071 South Security Secur		
3487,4654 354.823 28.139 76 355.4651 76 355.4651 PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. PRIT: Standa	3318,8922 5319,300 10.611 47 196.306 WF Thirty State International prints goal Dat 5. Wages: United States International Print Pr	\$589,068 281.148 8.840 33 154.699 9701. There's board before desired things benefit (1971) 19701. There's board before desired things benefit (1971). There's board before desired there's board before the part families (1971). There's board before desired there's board begin benefit (1971). The board before desired there's board begin families. 1972. Seals definitional benefit (1972). The board before desired there's board benefit (1972).	3185,996 185.951 4.886 25 25 124.234 1972: South Berlinnin Chief Peter Peter Antique Peter	3246,798 455.034 18.733 62 281.179 1972 - South Foresten S. Carlotte Stage Sta	### 111,000 ### 1,000 ###	2284,100 609,005 72,137 609 1000 1000 1000 1000 1000 1000 1000	329,629 . 3.191.083 66.699 176 7786.718 with 9071 South Primaria Security Sugar Security 1071 South Primaria Security Security Sugar Security 1071 South Primaria Security Security Sugar Security 1071 South Security Security Security Security Security 1071 South Security Secur		
3487,4654 354.823 28.139 76 355.4651 76 355.4651 PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. PRIT: Standa	3318,8922 5319,300 10.611 47 196.306 WF Thirty State International prints goal Dat 5 Mayor - 1 196.306 WF Thirty State Therman Term Major Benefit WF Thirty State Thirty State Could State of the State State Office of the State St	\$589,068 281.148 8.840 33 154.699 9701. There's board before desired things benefit (1971) 19701. There's board before desired things benefit (1971). There's board before desired there's board before the part families (1971). There's board before desired there's board begin benefit (1971). The board before desired there's board begin families. 1972. Seals definitional benefit (1972). The board before desired there's board benefit (1972).	3185,996 185.951 4.886 25 25 124.234 1972: South Berlinnin Chief Peter Peter Antique Peter	3246,798 455,034 18,733 62 281,179 1972 Sasiah Promota A, Galvinett Migar Breed, Sandar San	### 1311,050% 1.500,000 1.500,0	2284,100 609,205 72,337 146,600 146,60	329,629 . 3.191.083 66.699 176 7786.718 with 9071 South Primaria Security Sugar Security 1071 South Primaria Security Security Sugar Security 1071 South Primaria Security Security Sugar Security 1071 South Security Security Security Security Security 1071 South Security Secur		
3487,4654 354.823 28.139 76 355.4651 76 355.4651 PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. PRIT: Standa	3318,8922 5319,300 10.611 47 196.306 WF Thirty State International prints goal Dat 5 Mayor - 1 196.306 WF Thirty State Therman Term Major Benefit WF Thirty State Thirty State Could State of the State State Office of the State St	\$589,068 281.148 8.840 33 154.699 9701. There's board before desired things benefit (1971) 19701. There's board before desired things benefit (1971). There's board before desired there's board before the part families (1971). There's board before desired there's board begin benefit (1971). The board before desired there's board begin families. 1972. Seals definitional benefit (1972). The board before desired there's board benefit (1972).	3185,996 185.951 4.886 25 25 124.234 1972: South Berlinnin Chief Peter Peter Antique Peter	3246,798 455,034 18,733 62 281,179 1972 Sasiah Promota A, Galvinett Migar Breed, Sandar San	MILLSON 1840001 1840001 1840001 1840001 1840001 1850010 1850010 18500100 1850010000000000	2284,100 609.035 22.137 23.137 24.137	329,629 . 3.191.083 66.699 176 7786.718 with 9071 South Primaria Security Sugar Security 1071 South Primaria Security Security Sugar Security 1071 South Primaria Security Security Sugar Security 1071 South Security Security Security Security Security 1071 South Security Secur		
3487,4654 354.823 28.139 76 355.4651 76 355.4651 PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. PRIT: Standa	3318,8922 5319,300 10.611 47 196.306 WF Thirty State International prints goal Dat 5 Mayor - 1 196.306 WF Thirty State Therman Term Major Benefit WF Thirty State Thirty State Could State of the State State Office of the State St	\$589,068 281.148 8.840 33 154.699 9701. There's board before desired things benefit (1971) 19701. There's board before desired things benefit (1971). There's board before desired there's board before the part families (1971). There's board before desired there's board begin benefit (1971). The board before desired there's board begin families. 1972. Seals definitional benefit (1972). The board before desired there's board benefit (1972).	3185,996 185.951 4.886 25 25 124.234 1972: South Berlinnin Chief Peter Peter Antique Peter	3246,798 455,034 18,733 62 281,179 1972 Sasiah Promota A, Galvinett Migar Breed, Sandar San	### 1,500 Mills	2284,100 609,205 72,139 100 100 100 100 100 100 100 100 100 10	329,629 . 3.191.083 66.699 176 7786.718 with 9071 South Primor Management of the Man		
3487,4654 354.823 28.139 76 355.4651 76 355.4651 PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. PRIT: Standa	3318,8922 5319,300 10.611 47 196.306 WF Thirty State International prints goal Dat 5 Mayor - 1 196.306 WF Thirty State Therman Term Major Benefit WF Thirty State Thirty State Could State of the State State Office of the State St	\$589,068 281.148 8.840 33 154.699 9781. There's book of bifferina derivated Wage Secret. 9781. Secret. Secret. Secret. Secret. 9781. Secret. Secret. Secret. Secret. Secret. 9781. Secret. Secret. Secret. Secret.	3185,996 185.951 4.886 25 25 124.234 1972: South Berlinnin Chief Peter Peter Antique Peter	3246,798 455,034 18,733 62 281,179 1972 Sasiah Promota A, Galvinett Migar Breed, Sandar San	311,000 Million State Committee Comm	2284,100 609,205 609,205 72,237 146,500 146,50	329,629 . 3.191.083 66.699 176 7786.718 with 9071 South Primor Management of the Man		
3487,4654 354.823 28.139 76 355.4651 76 355.4651 PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. PRIT: Standa	3318,8922 5319,300 10.611 47 196.306 WF Thirty State International prints goal Dat 5 Mayor - 1 196.306 WF Thirty State Therman Term Major Benefit WF Thirty State Thirty State Could State of the State State Office of the State St	\$589,068 281.148 8.840 33 154.699 9781. There's book of bifferina derivated Wage Secret. 9781. Secret. Secret. Secret. Secret. 9781. Secret. Secret. Secret. Secret. Secret. 9781. Secret. Secret. Secret. Secret.	3185,996 185.951 4.886 25 25 124.234 1972: South Berlinnin Chief Peter Peter Antique Peter	3246,798 455,034 18,733 62 281,179 1972 Sasiah Promota A, Galvinett Migar Breed, Sandar San	M311,000 1 1640 609 1	2284,100 GH 2015 GH 20	329,629 . 3.191.083 66.699 176 7786.718 with 9071 South Primor Management of the Man		
3487,4654 354.823 28.139 76 355.4651 76 355.4651 PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. PRIT: Standa	3318,8922 5319,300 10.611 47 196.306 WF Thirty State International prints goal Dat 5 Mayor - 1 196.306 WF Thirty State Therman Term Major Benefit WF Thirty State Thirty State Could State of the State State Office of the State St	\$589,068 281.148 8.840 33 154.699 9781. There's book of bifferina derivated Wage Secret. 9781. Secret. Secret. Secret. Secret. 9781. Secret. Secret. Secret. Secret. Secret. 9781. Secret. Secret. Secret. Secret.	3185,996 185.951 4.886 25 25 124.234 1972: South Berlinnin Chief Peter Peter Antique Peter	3246,798 455,034 18,733 62 281,179 1972 Sasiah Promota A, Galvinett Migar Breed, Sandar San	311,000 M 1,000 M 1,00	2284,100 609,205 609,205 72,137 146,600 147,146,600 14	329,629 . 3.191.083 66.699 176 7786.718 with 9071 South Primor Management of the Man		
3487,4654 354.823 28.139 76 355.4651 76 355.4651 PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. PRIT: Standa	3318,8922 5319,300 10.611 47 196.306 WF Thirty State International prints goal Dat 5 Mayor - 1 196.306 WF Thirty State Therman Term Major Benefit WF Thirty State Thirty State Could State of the State State Office of the State St	\$589,068 281.148 8.840 33 154.699 9781. There's book of bifferina derivated Wage Secret. 9781. Secret. Secret. Secret. Secret. 9781. Secret. Secret. Secret. Secret. Secret. 9781. Secret. Secret. Secret. Secret.	3185,996 185.951 4.886 25 25 124.234 1972: South Berlinnin Chief Peter Peter Antique Peter	3246,798 455,034 18,733 62 281,179 1972 Sasiah Promota A, Galvinett Migar Breed, Sandar San	311,000 M 140 M 14	2284,100 609,005 609,005 72,107 72,107 74,10	329,629 . 3.191.083 66.699 176 7786.718 with 9071 South Primor Management of the Man		
3487,4654 354.823 28.139 76 355.4651 76 355.4651 PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. PRIT: Standa	3318,8922 5319,300 10.611 47 196.306 WF Thirty State International prints goal Dat 5 Mayor - 1 196.306 WF Thirty State Therman Term Major Benefit WF Thirty State Thirty State Could State of the State State Office of the State St	\$589,068 281.148 8.840 33 154.699 9781. There's book of bifferina derivated Wage Secret. 9781. Secret. Secret. Secret. Secret. 9781. Secret. Secret. Secret. Secret. Secret. 9781. Secret. Secret. Secret. Secret.	3185,996 185.951 4.886 25 25 124.234 1972: South Berlinnin Chief Peter Peter Antique Peter	3246,798 455,034 18,733 62 281,179 1972 Sasiah Promota A, Galvinett Might Performance of the Control of th	STELLOWS 1 1600 007 1 1600 007 1 1600 1	2284,103 609,395 12,126 13,126 144,500 144,500 144,500 144,500 144,500 145,500 146,	329,629 . 3.191.083 66.699 176 7786.718 with 9071 South Primor Management of the Man		
3487,4654 354.823 28.139 76 355.4651 76 355.4651 PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. PRIT: Standa	3318,8922 5319,300 10.611 47 196.306 WF Thirty State International prints goal Dat 5 Mayor - 1 196.306 WF Thirty State Therman Term Major Benefit WF Thirty State Thirty State Could State of the State State Office of the State St	\$589,068 281.148 8.840 33 154.699 9781. There's book of bifferina derivated Wage Secret. 9781. Secret. Secret. Secret. Secret. 9781. Secret. Secret. Secret. Secret. Secret. 9781. Secret. Secret. Secret. Secret.	3185,996 185.951 4.886 25 25 124.234 1972: South Berlinnin Chief Peter Peter Antique Peter	3246,798 455,034 18,733 62 281,179 1972 Sasiah Promota A, Galvinett Might Performance of the Control of th	311,000 M 140 M 14	2284,100 609,205 609,205 12,137 146,500 146,50	329,629 . 3.191.083 66.699 176 7786.718 with 9071 South Primor Management of the Man		
3487,4654 354.823 28.139 76 355.4651 76 355.4651 PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. PRIT: Standa	3318,8922 5319,300 10.611 47 196.306 WF Thirty State International prints goal Dat 5 Mayor - 1 196.306 WF Thirty State Therman Term Major Benefit WF Thirty State Thirty State Could State of the State State Office of the State St	\$589,068 281.148 8.840 33 154.699 9781. There's book of bifferina derivated Wage Secret. 9781. Secret. Secret. Secret. Secret. 9781. Secret. Secret. Secret. Secret. Secret. 9781. Secret. Secret. Secret. Secret.	3185,996 185.951 4.886 25 25 124.234 1972: South Berlinnin Chief Peter Peter Assign Peter	3246,798 455,034 18,733 62 281,179 1972 Sasiah Promota A, Galvinett Might Performance of the Control of th	MILLSON 1.862.003 1.	2284,100 609.035 609.035 22.137 144.650 145.650 146.65	329,629 . 3.191.083 66.699 176 7786.718 with 9071 South Primor Management of the Man		
3487,4654 354.823 28.139 76 355.4651 76 355.4651 PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. Calabases in Major Revision PRIT: Standa Primeria. PRIT: Standa	3318,8922 5319,300 10.611 47 196.306 WF Thirty State International prints goal Dat 5 Mayor - 1 196.306 WF Thirty State Therman Term Major Benefit WF Thirty State Thirty State Could State of the State State Office of the State St	\$589,068 281.148 8.840 33 154.699 9781. There's book of bifferina derivated Wage Secret. 9781. Secret. Secret. Secret. Secret. 9781. Secret. Secret. Secret. Secret. Secret. 9781. Secret. Secret. Secret. Secret.	3185,996 185.951 4.886 25 25 124.234 1972: South Berlinnin Chief Peter Peter Assign Peter	3246,798 455,034 18,733 62 281,179 1972 Sasiah Promota A, Galvinett Might Performance of the Control of th	STILLOWS 1 Med 2007 1 Med 20	2284,100 609.035 609.035 22.137 144.650 145.650 146.65	329,629 . 3.191.083 66.699 176 7786.718 with 9071 South Primor Management of the Man		







The final results of the base case have to be presented by following the shape of the CoM CO2 matrice:

Indicator	unity	Data in 2014	Expected results 2020	Expected resutls 2030	Expected results at the end of the planification (Ravenna - 2038)
Retrofited area	m2	0	7.475,96	50.608,37	73.745,97
Saving currency	€	0	59.127	271.089	584.887,56
CO2 Saving	tCO2	3.535,25	183	660	1.555,98
CO2 Saving	%		5%	18,66%	44%
Energy Saving	MWh	3.785,97*	685,296	2752,60	6.654,20
Energy saving	%		18,10%	72,70%	>100%

^{*} RES Included

As we can see on the above this prioritization does not allow to the city to attempt the results of 20% of energy saving in 2020. This renovation programme let the city attempt the objective between 2020 and 2030 with 72,70% of energy saving in 2030, and regarding the CO2 emission, it's not enough regarding the global Europeans objectives in 2020 but as the objective of energy saving, this program reach the objectives in 2030.

4. Results of renovation plan with a define priority

This part of the report is done to allow for the pilot city the difference of cost and number of years to reach the ultimate goal of at least 20% energy savings of their public-building stock by 2020 (see CoM objectives).

4.1. Renovation plan with minor retrofit priority

APPs will use the D3.5. PlugIn Tool to edit a plan with the minor retrofit priority, in order to see the final performance regarding the goal mentioned below of 20% energy saving by 2020.

In this case Ravenna Municipality take into account the whole stock public building and not only the educational one.







Year		1	2	3	4	5
Floor area retrofited	m²	3.543,49	3.342,19	3.547,63	3.230,31	2.201,59
Anualy investment	NC	140.425	110.184	287.792	357.277	375.179
Savings - currency	NC/a	29.628	18.939	50.122	42.841	24.836
Savings - CO2	tCo2/a	82	53	124	121	66
Savings - kWh	kWh/a	279.519	153.741	531.281	521.321	295.135
		PBT6 - Bacino Canottaggio Standiana - Minor	PRT4 - Scuola Secondaria di primo grado 5	PRT4 - Scuola Primaria V. Randi - Minor	PRT9 - Uffici Circoscrizione Prima - Minor	PRT2 - Scupia dell'infanzia i Delfini - Minor
	1	Retrofit	Metro in Vincoli B. Gessi - Minor Retrofit	Retrofit	Retrefit	Retrofit
	_		PBT4 - Scuola Secondaria di primo grado	PST4 - Scuola Secondaria di primo grado		PST2 - Scuola dell'Infanzie Osteria Peter Pen
	2		Guido Novello - Minor Retrofit	Ricci-Muratori - Minor Retrofit	PRTIG - Museo Dicattico - Minor Retrofit	- Minor Betrofit
	2	PRT6 - Palestra Souria Secondaria S. Pietro in Vincoli R.Gessi - Minor Retrofit	PBT4 - Scuola Primaria A. Torre - Minor Retrofit	PST8 - Circosorizione di Mezzano - Minor Retrofi	PRT10 - Casa Vignuzzi - Minor Retrofit	PBT2 - Scuola Dell'infanzia Lametta - Minor Retrofit
		PBT6 - Palestra Sounia Secondaria di primo	PRT4 - Scuola Primaria Goffredo Marneli -	PBT8 - Azienca Ausl S. Pietro in Vincoli -	Printer-Case agreement which resident	PBT2 - Scuola Dell'infanzia Garibaldi e Nido
	4	grado Suido Novelo - Minor Retrofit	Minor Retrofit	Minor Retrofit	PRTIO - Riblioteca Guerrini - Minor Betrofit	dell'Infanzia Garibaldi - Minor Retrofit
		PBT5 - Palestra Sounia Secondaria di primo	PRT4 - Scuola Primaria Iobal Mas h - Minor	PRT8 - Ullici Grosscrizione Piangipane -		PBT2 - Scuola Dell'intanzia Freccia Azzurra -
	5	grado M. Mortanari - Minor Betrofit	Retrofit	Minor Betrofit	PRTIO - Biblioteca Oriani - Minor Retrofit	Minor Betrofit
				PRT9 - Palazzo Rasponi "Del Cavaliere"		PBT2 - Scuola Dell'infanzia Peter Pan -
		PBTS - Pales da Soucia Secondaria di primo grado Don S. Minorni - Minor Betrofit	PRT4 - Scuola Secondaria di primo grado 5. P. Campiano V. da Feltre - Minor Retrofit	(Palazzo Basponi 2, Ex Tribunale) - Minor Retrofit	PRT IO - Centro Lettura Albero dei Bimbi (Er Lucertola) - Minor Betrofit	Minor Retrofit
		PRT5 - Palestra Squoia Primeria A. Torre -	PST4 - Scuala Secondaria di primo grado C.	13011 0111	PSTIO - Palazzone Museo Nature - Minor	PRT2 - Scuola Primaria A. Ceci - Minor
	7	Miner Retrofit	Viali - Minor Retrofit	PBT9 - Uffici VV UU - Minor Betrofit	Retrofit	Retrofit
				PBT9 - Residenza Municipale - Minor	PBT10 - Biblioteca S. Stefano - Minor	PBT2 - Scuola Primaria A. Gulmineli - Minor
	8	PRT5 - Palestra Plangipane - Minor Retrolit		Retrolit	Retrotit	Retrolit
	_	PRT5 - Palestra Sounia Media Statale C. Viali - Minor Retrofit			PRTTT - Residenza ACFR n. 15 - Minor Retrofit	PBT I - Scuola Primaria Burioli - Minor Retrofit
	9	PBT5 - Palestra Souola Elementare Riccardo			PST11 - Residenze ACER n.11 - Minor	PST1 - Squale dell'Infanzie Impero Giocendo
	10	Ricci - Minor Retrofit			Retrofit	- Minor Betrofit
		PRTS - Palestra Sounta Primaria V. Randi -				PST1 - Scuola dell'Infanzia I Airone - Mirror
	11	Minor Retrofit			PRTTT - Residenza ACFR n.9 - Minor Retrofit	Retrofit
		PBT5 - Palestra Scunia Secondaria di primo				PBT1 - Scuola Primaria Roncelceci Martiri
	12	grado Bicci-Muratori - Minor Betrofit			PBT11 - Residenza ACFR n.5 - Minor Retrofit	del Montone - Minor Retrofit
	13	PRT5 - Palestra Sounia Dell'Infanzia Garibaidi - Minor Betrofit			PBT11 - Residenza ACFR n. I - Mirror Retrolit	PRT1 - Nido Dell'Infanzia Le Margherite - Minor Retrofit
	- 13	PRT5 - Palestra Scuola Scuola Primaria G.			THE RESIDENCE OF THE PROPERTY OF	PRT1 - Scuola Dell'infanzia D. Missiroli -
	14				PBT7 - Cimosorizione Terza - Minor Betrofit	Minor Retrofit
		PRT4 - Scuola Secondaria di primo grado M.	•			PRTT - Nido Dell'Infanzia Lovatelli - Minor
	15	Monteneri - Minor Retrofit			PRT7 - Uffici Patrimonio - Minor Retrofit	Retrofit
	16	PRT4 - Scuola Secondaria di primo grado Don G. Minzori - Minor Retrofit			PRT7 - Uffici Grouscrizione Roncalceci -	PRT1 - Scuola Rell'infanzia II Gabbiano -
	10	PRT4 - Accademia Di Belle Arti - Minor			Minor Retrofit PRT7 - Uffici Granscrizione S. Alberta -	Minor Retrofit PRT1 - Nido Dell'Infanzia Ponte Nuovo -
	17	Remofit			Minor Retrofft	Minor Recrofit
					PRT3 - Scuola Dell'infanzia M. G. Zaccagnini -	
	18				Minor Retrofit	
	40				PRT3 - Scuola Primaria San Zaocada - Minor	
	19				Retrofit PST3 - Scuols Secondaria di primo grado Γ	
	20				Casacio - Minor Retrofit	
						•
					PRTS - Scuola Dell'infanzia S. Antonio e Nido	
	21				Dell'infanzia S. Antonio - Minor Retrofit	
	22				PRT3 - Scuola Primeria Marie Bertolotti - Minor Betrofit	
	- 22				PRT3 - Istituto Superiore Musicale Vend -	
	23				Minor Retrofit	
					PRT3 - Scuola Primaria Grande Albero -	
	24				Minor Retrofit	
	25				PRT2 - Scuola Dell'infanzia Mani Fiorite - Minor Retrofit	
	25				PRT2 - Scuola Dell' ofanzia Sergio Fusconi -	
	26				Minor Retrofit	
					PBT2 - Scuola Dell'infanzia Felici Insieme -	
	27				Minor Betrofit	
					PRT2 - Scuola Dell'infanzia Mario Pasi -	
	28				Minor Retrofit	
	29				PBT2 - Nido Dell'Infanzia Pavirani - Minor Retrolit	
	23					

			Expected results	Expected resutls
Indicator	unit	Data in 2014	2020	2023
Retrofited area	m2	0	250.608	1.270.856
Saving currency	€	0	48.567	166.367
CO2 Saving	tCO2	3.535,25	135	445
CO2 Saving	%		3,81%	12,58%
Energy Saving	MWh	3.785,97*	433,26	1781
Energy Saving	%		11,44%	47,04%

^{*} RES Included







As we can see on the table this prioritization does not allow to the city to attempt the results of 20% of energy saving in 2020. This renovation programme let the city attempt the objective by 2023 with 47% of energy saving, but regarding the CO2 emission, it's not enough regarding the global Europeans objectives.

4.2. Renovation plan with major retrofit priority

APPs will use the D3.5. PlugIn Tool to edit a plan with the major retrofit priority, in order to see the finale performance regarding the goal mentioned bellow of 20% energy saving by 2020.

Year		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Floor area retrofited	m²	4.417,65	3.676,05	5.740,63	5.610,90	4.381,68	3.686,22	7.468,17	5.263,97	3.356,07	6301,557	3680,919	3584,151
Anualy investment	NC	172.969	143.932	224.769	219.690	171.561	144.331	292.409	206.106	274.827	516.030	417.011	566.594
Savings - currency	NC/a	12.320	10.252	16.010	15.648	12.220	10.280	20.828	14.681	18.921	35.527	28.378	37.704
Savings - CO2	tCo2/a	39	32	50	49	38	32	65	46	58	109	89	121
Savings - kWh	kWh/a	153.145	127.436	199.009	194.511	151.898	127.789	258.897	182.484	223.738	420.104	369.379	519.556
	1	Montanari - Major	PRT4 - Scuola Secondaria di primo grado Dom G. Miozoni - Major Retrofit	PRT4 - Ao. ademia Di Belle Arti - Major Retrofit	PRT4 - Scuola Secondaria di primo grado Guido Vovello - Major Retrofit	PRT4 - Scuola Primaria Goffredo Mameli - Major Retrofit	PRT4 - Scuola Secondaria di primo grado S. P. Campiano V. da Feltre - Major Retrofit	PRT4 - Scuola Secondaria di primo grado C. Viali - Major Retrofit	PRT4 - Scuola Secondaria di primo grado Ricci- Muratori - Major Retrofit	PRT9 - Palazzo Rasponi 'Del Cavatiere' (Palazzo Rasponi 2, Ex Tribunale) - Major Retrofit	PRT9 - Uffici VV.UU Major Retrofit	PRTO - Uffici Oroserizione Prima - Major Retrofit	PRTS - Polisportiso Darsena - Major Retrofit
	2			Gessi - Major	PRT4 - Scuola Primaria A. Turre - Major Retrofit	PRT4 - Scuola Primaria Igbal Masih - Majur Retrofit		PRT4 - Scuola Primaria V. Randi - Major Retrofi;			Municipale -	PSTS - Bacino Canottaggio Standiana - Major Retrofit	PRT6 - Palestra Sounia Secondaria S. Pietro in Vincoli R.Gessi - Major Retrofii
	3											1	PBT6 - Palestra Sounia Secondaria el prime grado Guico Amello - Mejor Betrofit PST8 - Grosscrizione di Mezzano - Major
	5												PRTS - Azienca Ansl S. Pietro in Vinceli - Major Recrofit







2031	2032	2033	2034	2035	2036	2037	2038
3430,971	3290,5953	3977,631	4266,666	4161,546	3845,3688	3612,5505	3269,826
611.048	616.427	485.627	415.141	404.913	790.131	733.178	698.811
43.138	44.104	29.744	22.298	21.749	23.405	27.468	25.989
105	102	73	58	57	104	75	67
450.529	442.037	330.322	271.170	264.489	499.156	307.801	260.001
DOTO LIES		PBT5 - Palestra Souola	PBT2 - Nido				
PRT8 - Uffici Grasscrizione	PBT5 - Palestra	Dell'infanzia	Dell'infanzia	PRT2 - Scuola Dell Infanzia	PBT11 - Besidenza	PRT7 - Uffici Grasscrizione	PRT3 - Scuola Primeria Marie
Piangipane -	Piangipane -	Garibaldi - Major	Pavirani - Major	Freccia Azzucia -	ACEB n.15 - Major	Roncalceci - Major	Bartolotti - Major
		Retrofit	Retrofit		Retrofit	Retrofit	Retrofit
Major Retrofit	Major Retrofit	regione	roearanc	Major Retrofit	rveiron;	rveiron,	rveiron,
PBT5 - Palestra		PBT5 - Palestra					
Squala Secondaria	PBT5 - Palestra	Squola Squola	PBT2 - Scuola	PBT2 - Scuola		PBT7 - Uffici	PBT3 - Istituto
ci primo grado M.	Squola Media	Primeria G.	cell'Infanzia I	Dell Infanzia Peter	PBT11 - Besidenza	Grasscrizione S.	Superiore
Mortanari - Major	Statale C. Viali -	Garibaldi - Major	Dellini - Major	Pan - Major	ACEB n.11 - Major	Alberto - Major	Musicale Verdi -
Retrofit	Major Retrofit	Retrofit	Retrofit	Retrofit	Retrofit	Retrofit	Major Retrofit
PBT5 - Palestra							
Sounia Secondaria	PBT5 - Palestra	PBT2 - Scuola	PBT2 - Scuola			PBT3 - Scuola	PBT3 - Scuola
ci primo grado	Souola Flementare	Dell Infanzia Mani	cell'Infanzia	PBT2 - Scuola	PBT11 - Besidenza	Dell Infanzia M. G.	Primaria Grande
Den G. Minzeni -	Riccardo Bicci -	Fiorite - Major	Osteria Peter Pan -	Primaria A. Ceci -	ACEB n.9 - Major	Zaccagnini - Major	Albero - Major
Major Retrofit	Major Retrofit	Retrofit	Major Retrofit	Major Retrofit	Retrofit	Retrofit	Retrofit
PBT5 - Palestra	PBT5 - Palestra	PBT2 - Scuola	PBT2 - Scuola	PBT2 - Scuola		PRT3 - Scuola	
Souola Primaria A.	Scuola Primaria V.	DellInfanzia	DellInfanzia	Primeria A.	PBT11 - Besidenza	Primaria San	PBT1 - Scuola
Torre - Major	Randi - Major	Sergio Eusconi -	Lametta - Major	Gulminelli - Major	ACEB n.5 - Major	Zaccaria - Major	Primeria Burioli -
Retrofit	Retrofit	Major Retrofit	Retrofit	Retrofit	Retrofit	Retrofit	Major Retrofit
			PBT2 - Scuola				
	PBT5 - Palestra		DellInfanzia			PBT3 - Scuola	
	Scuola Secondaria	PBT2 - Scuola	Garibaldi e Nido			Secondaria di	PBT1 - Scuola
	ci primo gracko	Dell Infanzia Felici	dell'Infanzia		PRT11 - Residenza	primo grado F.	cell'Infanzia
	Ricci-Muratori -	Insieme - Major	Garibaldi - Major		ACER n.1 - Major	Casacio - Major	Imparo Giocando -
	Major Retrofit	Retrofit	Retrofit		Retrofit	Retrofit	Major Retrofit
						PRT3 - Scuola Dell Infanzia S.	
		PBT2 - Scuola			PRT7 -	Antonio e Nido	
		Dell Infanzia			Granscrizione	Dell'infanzia S.	
		Mario Pasi - Major			Terza - Major	Antonio - Major	
		Retrofit			Retrofit	Retrofit	
		17011 01 5			PBTZ - Uffici	1701011	
					Patrimonio -		
					Major Retrofit		
					and secon		







Indicator	unit	Data in 2014	Expected results 2020	Expected results 2030	Expected results at the end of the planification (2038)
Retrofited area	m2	0	8.093,70	57.167,97	87.023,12
Saving currency	€	0	22.572,42	232.769,51	470.664,47
CO2 Saving	tCO2	3.535,25	70,61	728,19	1.369,31
CO2 Saving	%		2%	20,60%	38,73%
Energy Saving	MWh	3.785,97*	280,58	2.927,94	5.753,45
Energy Saving	%		7,41%	77,33%	100%

^{*} RES Included

As we can see on the table above this prioritization allows to the city to attempt the results of 20% of energy saving in 2020. This renovation programme let the city attempt the objective between 2020 an 2030 with 77% of energy saving in 2030.

4.3. Renovation plan with deep retrofit priority (optional)

APPs will use the D3.5. PlugIn Tool to edit a plan with the deep retrofit priority, in order to see the finale performance regarding the goal mentioned bellow of 20% energy saving by 2020.

Ye	еаг	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Floor area ret	m²	3.625,29	3.899,29	4.169,35	6.142,81	7.001,73	3.648,75	3.273,79	6.474,52	4.084,50	6378,48	6234,33	3314,05
Anualy invest	NC	1.591.727	1.712.028	1.646.366	2.792.150	3.328.748	1.573.191	1.196.300	2.293.582	1.375.544	2.148.091	2.099.545	1.116.078
Savings - cum	NC/a	95.982	103.236	85.655	131.525	156.626	69.029	34.673	59.134	34.495	53.869	52.651	27.988
Savings - CO2	tCo2/a	222	239	234	367	420	199	119	172	100	156	152	81
Savings - kWh	kWh/a	991.879	1.066.845	950.900	1.500.944	1.648.907	801.947	526.601	729.775	416.619	650.605	635.902	338.033
	1				PRT5 - Priisportivo Darsena - Deep retrofit	PRT9 - Uffici VV.UU Deep retrofit	PRT9 - UMici Granscrizione Prima - Deep retrofit	PRT11 - Residenza ACFR n.9 - Deep retrofit	PRT7 - UMici Granscrizione Roncalceci - Deep retrofit	PRT4 - Scuola Secondaria di primo grado Don G. Minzoni - Deep retrofit	PST4 - Accademia Di Belle Arti - Deep retrofit	PRT4 - Scuola Secondaria di primo grado Guido Novello - Deep retrofit	PRT4 - Scuola Primeria Goffredo Mameli - Deep retrofit
	2	PRT5 - Palestra Sounia Secondaria ci primo grado Don G. Minzoni - Deep retrofit	PRT5 - Palestra Sozala Flementare Riocardo Ricci - Deep retrofit	PRT8 - Granscrizione di Mezzano - Deep retrofit	PRT6 - Palestra Sounia Secondaria S. Pietro in Vincoli R.Gessi - Deep retrofit	PRT9 - Residenza Municipale - Deep retrofit	PRTII - Residenza ACFR n.15 - Deep retrofit	PST11 - Residenza ACFR n.5 - Deep retrofit	PRT7 - Uffici Grasscrizione S. Alberto - Deep retrofit		PRT4 - Scuola Secondaria di primo grado S. Pietro in Vincoli B. Gessi - Deep retrofit	PRT4 - Scuola Primaris A. Turre - Deep retrofit	
	3	PRT5 - Palestra Sounia Primaria A. Torre - Deep retrofit	PRT5 - Palestra Sounda Primeria V. Randi - Deep retrofit	PRT8 - Avienca Ausl 5. Pietmin Vincoli - Deep retrofit	PRT6 - Palestra Sounia Secondaria di primo grado Guion Annello - Deep retrofit		PBT11 - Besidenza ACFB n.11 - Deep retrofit	PRTIII - Residenza ACFR n.1 - Deep retrofit	PRT4 - Scuola Secondaria di primo grado M Montanari - Deep retrofit				
	4	PRT5 - Palestra Plangipane - Deep retrofit	PRT5 - Palestra Sounia Secondaria di primo grado Ricci-Muratori - Deep retrofii	Graoscrizione	PBT9 - Palazzo Rasponi "Del Cavaiere" (Palazzo Rasponi 2, Ex Tribunalej - Deep retrofit			PRT7 - Granscrizione Terza - Deeg retrofit					
	5		PRT5 - Palestra Strank Dell' ofanzia Garibardi - Deep retrofit	PRT6 - Bacino Canoltaggio Standiana - Deep retrofit				PRT7 - UMici Patrimonio - Deep retrofit					







2031	2032	2033	2034	2035	2036	2037	2038
5650,28	3510	4787,97	5848,86	4097,932	3976,995	3974,66	3800,19
1.902.854	1.182.068	1.612.452	1.969.730	1.665.932	1.716.194	1.824.691	1.816.775
47.719	29.643	40.436	49.396	37.964	40.901	42.784	39.711
138	86	117	143	90	106	111	105
576.329	358.020	488.373	596.584	407.334	409.059	430.354	434.544
PRT4 - Sc.rola Primeria Igbal Masih - Deep	PRT4 - Scuola Secondaria di primo grado C. Viali - Deep	PRT4 - Scuola Primaria V. Randi -	PRT4 - Scuola Secondaria di primo grado Ricol- Muratori - Deep	PST10 - Museo Didatrico - Deep	PRTTO - Biblioteca 5. Stefano - Deep	PRT3 - Istituto Superiore Musicale Verdi -	PRT1 - Nido Dell'ofanzia le Margherite - Deep
retrofit PBT4 - Scuola	retrofit	Deep retrofit	retrofit	retrolit	retrofit	Deep retrofit	retrofit
Secondaria di primo grado S. P. Campiano V. da Feltre - Deep retrofit				PRT10 - Casa Vignuzzi - Deep retrofit	PRTS - Sc.iola Dell'Infanzia M. G. Zaccagnini - Deep retrofit	PRTS - Scuola Primaria Grande Albero - Deep retrofit	PRT1 - Scuola DellInfancia D Missinof - Deep retrofit
				PRTIO - Riblioteca Guerrini - Deep retrofit	PRTS - Scuola Primaris San Zaccaria - Deep retrofit	PRTI - Scuola Primaria Burioli - Deep retrofit	PRT I - Nido Dell' ofanzia Lovateli - Deep retrofit
				PRT10 - Biblioteca Oriani - Deep retrofit	PSTB - Scuola Secondaria di primo grado F. Casacio - Deep retrofit	PBT1 - Scuola cell'Infamia Imparo Giocando - Deep retrofit	PRT1 - Scuola Dell'Infanzia I Gabbiano - Deep retrofit
				PRT10 - Centro Lettura Albero dei Rimbi (Fx Lucertola) - Deep retrofit	PRTS - Scuola Dell'Infanzia S. Antonio e Nido Dell'Infanzia S. Antonio - Deep retrofit	PRT I - Scuola cell'Infamia f Ainme - Deep retrofit	PRT I - Nido Dell'infanzia Punte Nurwo - Deep retrofit
				PRT10 - Palazzone Museo Natura - Deep retrofii	PRT3 - Sc.rola Primaria Maria Bartolotti - Deep retrolit	PRT1 - Scuola Primaria Roncalceci Martiri del Montone - Deep retrofit	PRT2 - Scuola Dell'Infanzia Mani Fiorite - Deep retrofit







Indicator	unit	Data in 2014	Expected results 2020	Expected resutls 2030	Expected results at the end of the planification (2038)
Retrofited area	m2	0	7.524,58	58.246,89	93.893,77
Saving currency	€	0	199.217,63	904.863,46	1.233.417,51
CO2 Saving	tCO2	3.535,25	461,67	2.460,97	3.355,88
CO2 Saving	%		13%	70%	95%
Energy Saving	MWh	3.785,97*	2.058,72	10.258,96	13.959,55
Energy Saving	%		54,37%	100%	100%

^{*} RES Included

As we can see on the table this prioritization is the only one here who allow to the city to attempt the results of 20% of energy saving in 2020 and regarding the CO2 emission is possible to achieve the results in 2030.

5. Comparative results from the simulation and the reality case

[TPPs will integrate in this section a quick description of the comparative results from the simulation and the results of the real consumption after the renovation done on the chosen building according to the D3.6.]

Regarding the PBT_5 Gym of V. Rando Primary school the impact on energy performance monitored is worst than calculated one (36,82 kWh_{el}/ms/yr in the KPI's ex ante, 16,30 kWh_{el}/ms/yr in the KPI's ex post \rightarrow 44% compared to 35% monitored.

Regarding PBT_6 Gym of San pietro in Vincoli school the data are:

- 31,04 kWh_{el}/ms/yr in the KPI's ex ante
- 15,7 kWh_{el}/ms/yr in the KPI's ex post
- 50% calculated than 35% monitored.

The real consumption data monitored is correlated to the data obtained from the energy simulations, but the monitored results are not the same as the simulated one because in both buildings Ravenna Civil Infrastructure Service decided to change not only the type of bulbs (from halogen to led), but also decided to increase the lux in the gym, in order to increase the visual comfort and to comply with the compulsory technical standards for gym.







6. Integrated results to the "Covenant of Mayors" impacts matrices

Integrated results from the base case into the impacts matrices.

The Covenant of Mayors allows to the user the file of "Secap Template En" to feel the table presented under. According to the application form of the IMPULSE projects, partners chosen to use a simplified table as presented below.

		FINAL ENERGY CONSUMPTION (MWh)															
Sector				Fossil fuels						Renewable energies							
		Electricity	Heat/cold	Natural gas	Liquid gas	Heating oil	Diesel	Gasoline	Lignite	Coal	Other fossil fuels	Plant oil	Biofuel	Other biomass	Solar thermal	Geothermal	Total
BUILDINGS, EQUIPMENT/FACILITIES A	ND INDUSTRIES																
Municipal buildings, equipment/facilities		1591,8		7020,6													8612,4
Tertiary (non municipal) buildings, equipme	nt/facilities																0
Residential buildings																	0
Public lighting																	0
Industry.	Non-FTS																0
ministry.	FTS (not recommended)																0
Subtotal		1591,8	0	7020,6	0	0	0	0	0	0	0	0	0	0	0	0	8612,4
TRANSPORT																	
Municipal fieet																	0
Public transport																	0
Private and commercial transport																	0
Subtotal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER																	
Agriculture, Forestry, Fisheries																	0
TOTAL		1591,8	0	7020,6	0	0	0	0	0	0	0	0	0	0	0	0	8612,4

This table have to show, according to the objectives of the European commission and the Covenant of Mayors, the results to attempt till 2020 and 2030

Indicator	Unit	Data in 2014	Expected results 2020	Expected results 2030	Expected results at the end of the planification (Ravenna - 2038)
Retrofited area	m2	0	7.475,96	50.608,37	73.745,97
Saving currency	€	0	59.127	271.089	584.887,56
CO2 Saving	tCO2	3.535,25	183	660	1.555,98
CO2 Saving	%		5%	18,66%	44%
Energy Saving	MWh	3.785,97	685,296	2752,60	6.654,20
Energy Saving	%		18,10%	72,70%	>100%

As we can see this prioritization does not allow to the city to attempt the results of 20% of energy saving in 2020. This renovation programme let the city attempt the objective between 2020 and 2030 with 72,70% of energy saving in 2030, and regarding the CO2 emission, it's not enough regarding the global Europeans objectives in 2020 but as the objective of energy saving, this program reach the objectives and from far in 2030.

The only programming who attempts the objectives is the Deep Retrofit scenario. However we have to take into account that Ravenna Municipality prioritization program is regarded only the educational buildings.







7. Conclusion

The Ravenna SAEP has therefore drawn up a plan of actions that allow us to estimate a 23.3% reduction in carbon dioxide emissions in the municipal area by 2020 compared to 2007, the base year for local emissions.

Thanks to IMPULSE MED Ravenna would to exploit the possibility to concentrate on the educational building stock, combine both, seismic and energy analysis, so it could be possible to achieve more funds dedicated to.

