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

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Dissemination level		
Target group	City of Cannes	
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**
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Executive summary	
The purpose of this deliverable is to further test the applicability of the IMPULSE tools for the preparation of SEAP's sections of public buildings. In this framework, the French partner proceeded to the elaboration of the IMPULSE results produced for the initially selected priority set of the total building stock towards the completion of the relevant Emission Inventories' sections of the Sustainable Energy Action Plan (SEAP) sections in the framework of the Covenant of Mayors Initiative. The trial application procedure was focused mainly on completing the Emission Inventories for the Base-case scenario assumed at the year 2017, and for the Energy-upgrading Scenario ahead to 2030 regarding the implementation of gradual renovation interventions until the deep retrofit of all the priority sample of municipal buildings of Cannes as foreseen in the deliverable D3.4.1 for France. The D3.4.1 results were fed to the Emission Inventories and the plan achieves a reduction of CO2 emissions by 84,9 tns/y, which is far beyond the Cannes' 2030 goal (according to its SEAP) of 40%, because in 2030 it will be a total of 1018 tns of CO2 saving, 88% less emissions.	
Keywords	Public buildings; Cannes SEAP; France ; IMPULSE trial applications.

Table des matières

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 Cannes realised by AREA Région SUD.

1. 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 Cannes, 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 Cannes:

	Weight factor	Measures
23. Total annual primary energy savings - KWh/m²/yr	30	KWh/m2/yr
35. Total annual avoided CO2 emissions - kg/m²/yr	10	kg/m2/yr
53. Simple Payback period - yr	35	yr
21. Estimated Investment cost - National Currency/m²	25	National Currency/m2
53. Simple Payback period - yr	0	yr

Figure 1: Reminde of the seclected KPIs and weight factor for BASE CASE city of Cannes

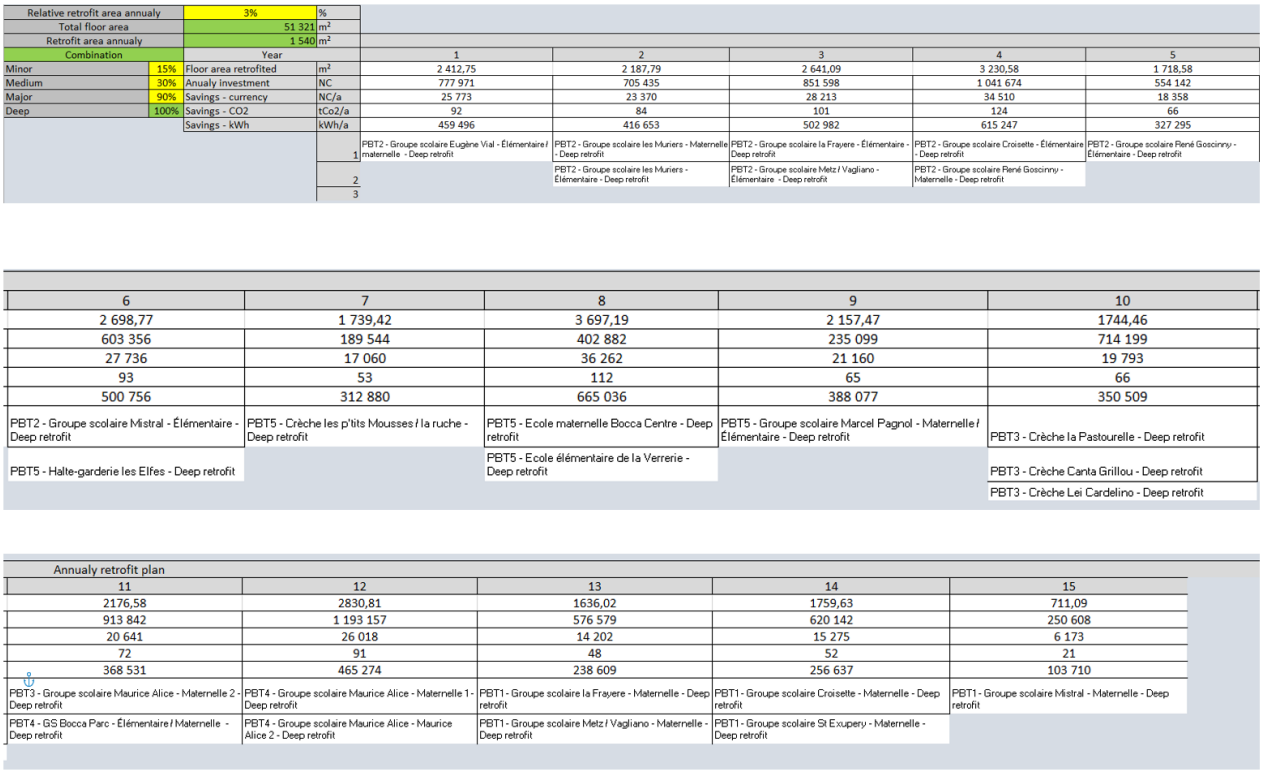
2. Results of the base case simulation with performance indicators for the pilot city of Cannes

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 Cannes, is mainly focus on their educational buildings in priority for their renovation projects. So, for this scenario of renovation plan for the city of Cannes, only the PBTs 1, 2, 3, 4, 5 are considered, being all educational typologies.

Also, all types of retrofit are considered, from Minor to Deep retrofit scenario.



Relative retrofit area annualy		3%	%						
Total floor area		51 321	m²						
Retrofit area annualy		1 540	m²						
Combination		Year		1	2	3	4	5	
Minor	15%	Floor area retrofited	m²	2 412,75	2 187,79	2 641,09	3 230,58	1 718,58	
Medium	30%	Anualy investment	NC	777 971	705 435	851 598	1 041 674	554 142	
Major	90%	Savings - currency	NC/a	25 773	23 370	28 213	34 510	18 358	
Deep	100%	Savings - CO2	tCo2/a	92	84	101	124	66	
		Savings - kWh	kWh/a	459 496	416 653	502 982	615 247	327 295	
			1	PBT2 - Groupe scolaire Eugène Vial - Élémentaire / maternelle - Deep retrofit	PBT2 - Groupe scolaire les Muriers - Maternelle - Deep retrofit	PBT2 - Groupe scolaire la Frayere - Élémentaire - Deep retrofit	PBT2 - Groupe scolaire Croisette - Élémentaire - Deep retrofit	PBT2 - Groupe scolaire René Goscinny - Élémentaire - Deep retrofit	
			2		PBT2 - Groupe scolaire les Muriers - Élémentaire - Deep retrofit	PBT2 - Groupe scolaire Metz / Vagliano - Élémentaire - Deep retrofit	PBT2 - Groupe scolaire René Goscinny - Maternelle - Deep retrofit		
			3						

6	7	8	9	10
2 698,77	1 739,42	3 697,19	2 157,47	1744,46
603 356	189 544	402 882	235 099	714 199
27 736	17 060	36 262	21 160	19 793
93	53	112	65	66
500 756	312 880	665 036	388 077	350 509
PBT2 - Groupe scolaire Mistral - Élémentaire - Deep retrofit	PBT5 - Crèche les p'tits Mousses / la ruche - Deep retrofit	PBT5 - Ecole maternelle Bocca Centre - Deep retrofit	PBT5 - Groupe scolaire Marcel Pagnol - Maternelle / Élémentaire - Deep retrofit	PBT3 - Crèche la Pastourelle - Deep retrofit
PBT5 - Halte-garderie les Elfes - Deep retrofit		PBT5 - Ecole élémentaire de la Verrerie - Deep retrofit		PBT3 - Crèche Canta Grillou - Deep retrofit
				PBT3 - Crèche Lei Cardelino - Deep retrofit

Annualy retrofit plan				
11	12	13	14	15
2176,58	2830,81	1636,02	1759,63	711,09
913 842	1 193 157	576 579	620 142	250 608
20 641	26 018	14 202	15 275	6 173
72	91	48	52	21
368 531	465 274	238 609	256 637	103 710
PBT3 - Groupe scolaire Maurice Alice - Maternelle 2 - Deep retrofit	PBT4 - Groupe scolaire Maurice Alice - Maternelle 1 - Deep retrofit	PBT1 - Groupe scolaire la Frayere - Maternelle - Deep retrofit	PBT1 - Groupe scolaire Croisette - Maternelle - Deep retrofit	PBT1 - Groupe scolaire Mistral - Maternelle - Deep retrofit
PBT4 - GS Bocca Parc - Élémentaire / Maternelle - Deep retrofit	PBT4 - Groupe scolaire Maurice Alice - Maurice Alice 2 - Deep retrofit	PBT1 - Groupe scolaire Metz / Vagliano - Maternelle - Deep retrofit	PBT1 - Groupe scolaire St Exupery - Maternelle - Deep retrofit	

Figure 2 Results Base Case of D3.5 simulation for city of Cannes

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

Table 1 Results of the base case for SEAP integration, BASE CASE, Cannes

Indicator	unity	Data in 2018	Expected results 2020	Expected resutls 2030	Expected results at the end of the planification (Cannes - 2033)
Retrofited area	m2	0	4 600,54	29 235,49	33 342,23
Saving currency	€	0	49 144	298 894	334 544
CO2 Saving	tCO2	1161,3	176	1 018	1 139
CO2 Saving	%		15%	88%	98%
Energy Saving	MWh	5971,693	876,149	5 372, 736	5 971, 693
Energy saving	%		15%	90%	100%

As we can see on the table 1 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 90% 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.

To make this table 1, APPs use the D3.4.1_KPI file and agragade the data from the retrofit plan define in the D3.5.1.

3. Results of renovation plan with a define priority

This part of the report is done to allows 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).

3.1. 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 finale performance regarding the goal mentioned bellow of 20% energy saving by 2020.

Year		1	2	3	4
Floor area retrofited	m²	1 688,52	1 684,02	1 539,86	88,93
Anualy investment	NC	168 716	191 699	119 617	8 448
Savings - currency	NC/a	30 111	22 471	18 377	750
Savings - CO2	tCo2/a	91	69	29	3
Savings - kWh	kWh/a	548 738	394 444	302 608	13 247
	1	PBT5 - Halte-garderie les Elfes - Minor Retrofit	PBT2 - Groupe scolaire les Muriers - Maternelle - Minor Retrofit	PBT4 - GS Bocca Parc - Élémentaire / Maternelle - Minor Retrofit	PBT3 - Crèche Lei Cardelino - Minor Retrofit
	2	PBT5 - Crèche les p'tits Mousses / la ruche - Minor Retrofit	PBT2 - Groupe scolaire les Muriers - Élémentaire - Minor Retrofit	PBT4 - Groupe scolaire Maurice Alice - Maternelle 1 - Minor Retrofit	PBT3 - Groupe scolaire Maurice Alice - Maternelle 2 - Minor Retrofit
	3	PBT5 - Ecole maternelle Bocca Centre - Minor Retrofit	PBT2 - Groupe scolaire la Frayere - Élémentaire - Minor Retrofit	PBT4 - Groupe scolaire Maurice Alice - Maurice Alice 2 - Minor Retrofit	
	4	PBT5 - Ecole élémentaire de la Verrerie - Minor Retrofit	PBT2 - Groupe scolaire Metz / Vagliano - Élémentaire - Minor Retrofit	PBT1 - Groupe scolaire la Frayere - Maternelle - Minor Retrofit	
	5	PBT5 - Groupe scolaire Marcel Pagnol - Maternelle / Élémentaire - Minor Retrofit	PBT2 - Groupe scolaire Croisette - Élémentaire - Minor Retrofit	PBT1 - Groupe scolaire Metz / Vagliano - Maternelle - Minor Retrofit	

	6	PBT2 - Groupe scolaire Eugène Vial - Élémentaire / maternelle - Minor Retrofit	PBT2 - Groupe scolaire René Goscinny - Maternelle - Minor Retrofit	PBT1 - Groupe scolaire Croisette - Maternelle - Minor Retrofit
	7		PBT2 - Groupe scolaire René Goscinny - Élémentaire - Minor Retrofit	PBT1 - Groupe scolaire St Exupery - Maternelle - Minor Retrofit
	8		PBT2 - Groupe scolaire Mistral - Élémentaire - Minor Retrofit	PBT1 - Groupe scolaire Mistral - Maternelle - Minor Retrofit
	9			PBT3 - Crèche la Pastourelle - Minor Retrofit
	10			PBT3 - Crèche Canta Grillou - Minor Retrofit

Figure 3 Results Minor retrofit of D3.5 simulation for city of Cannes

Table 2 Results of the minor retrofit for SEAP integration, BASE CASE, Cannes

Indicator	unity	Data in 2018	Expected results 2020	Expected resutls 2022
Retrofited area	m2	0	3 372,55	5 001,33
Saving currency	€	0	52 583	71 710
CO2 Saving	tCO2	1161,3	161	192
CO2 Saving	%		14%	17%
Energy Saving	MWh	5 971,693	943,182	1 259,037
Energy Saving	%		16%	21%

As we can see on the table 2 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 2022 with 21% of energy saving, but regarding the CO2 emission, it's not enough regarding the global Europeans objectives.

3.2. 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		1	2	3	4	5	6
Floor area retrofited	m²	2 690,48	3 327,47	1 941,72	2 171,48	1 969,01	2 376,98
Anualy investment	NC	178 197	220 386	128 605	622 960	564 876	681 916
Savings - currency	NC/a	20 001	24 737	14 435	18 963	17 195	20 758

Savings - CO2	tCo2/a	54	67	39	70	63	76
Savings - kWh	kWh/a	367 865	454 960	265 489	339 003	307 395	371 086
	1	PBT5 - Halte-garderie les Elfes - Major Retrofit	PBT5 - Ecole maternelle Bocca Centre - Major Retrofit	PBT5 - Groupe scolaire Marcel Pagnol - Maternelle / Élémentaire - Major Retrofit	PBT2 - Groupe scolaire Eugène Vial - Élémentaire / maternelle - Major Retrofit	PBT2 - Groupe scolaire les Muriers - Maternelle - Major Retrofit	PBT2 - Groupe scolaire la Frayere - Élémentaire - Major Retrofit
	2	PBT5 - Crèche les p'tits Mousses / la ruche - Major Retrofit	PBT5 - Ecole élémentaire de la Verrerie - Major Retrofit			PBT2 - Groupe scolaire les Muriers - Élémentaire - Major Retrofit	PBT2 - Groupe scolaire Metz / Vagliano - Élémentaire - Major Retrofit

Year	7	8	9	10	11	12	13
m²	2 907,52	1 546,72	1 902,93	2929,896	2547,729	2162,718	1533,348
NC	834 120	443 729	557 229	888 270	767 593	682 445	483 848
NC/a	25 391	13 507	17 005	23 217	17 482	13 411	9 508
tCo2/a	94	50	60	73	55	49	35
kWh/a	453 912	241 469	302 548	413 040	314 012	227 744	161 468
1	PBT2 - Groupe scolaire Croisette - Élémentaire - Major Retrofit	PBT2 - Groupe scolaire René Goscinny - Élémentaire - Major Retrofit	PBT2 - Groupe scolaire Mistral - Élémentaire - Major Retrofit	PBT3 - Crèche Canta Grillou - Major Retrofit	PBT4 - Groupe scolaire Maurice Alice - Maternelle 1 - Major Retrofit	PBT1 - Groupe scolaire la Frayere - Maternelle - Major Retrofit	PBT1 - Groupe scolaire St Exupery - Maternelle - Major Retrofit
2	PBT2 - Groupe scolaire René Goscinny - Maternelle - Major Retrofit		PBT3 - Crèche la Pastourelle - Major Retrofit	PBT3 - Crèche Lei Cardelino - Major Retrofit	PBT4 - Groupe scolaire Maurice Alice - Maurice Alice 2 - Major Retrofit	PBT1 - Groupe scolaire Metz / Vagliano - Maternelle - Major Retrofit	PBT1 - Groupe scolaire Mistral - Maternelle - Major Retrofit
3				PBT3 - Groupe scolaire Maurice Alice - Maternelle 2 - Major Retrofit		PBT1 - Groupe scolaire Croisette - Maternelle - Major Retrofit	
4				PBT4 - GS Bocca Parc - Élémentaire / Maternelle - Major Retrofit			

Figure 4 Results major retrofit of D3.5 simulation for city of Cannes

Table 3 Results major retrofit of D3.5 simulation for city of Cannes

Indicator	unity	Data in 2018	Expected results 2020	Expected resutls 2030	Expected results at the end of the planification (Cannes - 2031)
Retrofited area	m2	0	6 017,95	28 474,66	30 008,01
Saving currency	€	0	44 738	226 103	235 611
CO2 Saving	tCO2	1161,3	121	749	784
CO2 Saving	%		10%	64%	67%
Energy Saving	MWh	5 971,693	822,825	4 058,523	4 219,992
Energy Saving	%		14%	68%	71%

As we can see on the table 3 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 an 2030 with 68% 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.

3.3. 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.

Year		1	2	3	4	5	6	7
Floor area retrofited	m²	2 989,42	3 697,19	2 157,47	2 412,75	2 187,79	2 641,09	3 230,58
Anualy investment	NC	325 757	402 882	235 099	777 971	705 435	851 598	1 041 674
Savings - currency	NC/a	29 320	36 262	21 160	25 773	23 370	28 213	34 510
Savings - CO2	tCo2/a	90	112	65	92	84	101	124
Savings - kWh	kWh/a	537 725	665 036	388 077	459 496	416 653	502 982	615 247
	1	PBT5 - Halte-garderie les Elfes - Deep retrofit	PBT5 - Ecole maternelle Bocca Centre - Deep retrofit	PBT5 - Groupe scolaire Marcel Pagnol - Maternelle / Élémentaire - Deep retrofit	PBT2 - Groupe scolaire Eugène Vial - Élémentaire / maternelle - Deep retrofit	PBT2 - Groupe scolaire les Muriers - Maternelle - Deep retrofit	PBT2 - Groupe scolaire la Frayere - Élémentaire - Deep retrofit	PBT2 - Groupe scolaire Croisette - Élémentaire - Deep retrofit

	2	PBT5 - Crèche les p'tits Mousses / la ruche - Deep retrofit	PBT5 - Ecole élémentaire de la Verrerie - Deep retrofit		PBT2 - Groupe scolaire les Muriers - Élémentaire - Deep retrofit	PBT2 - Groupe scolaire Metz / Vagliano - Élémentaire - Deep retrofit	PBT2 - Groupe scolaire René Goscinny - Maternelle - Deep retrofit

Year	8	9	10	11	12	13	14
m²	1 718,58	2 114,37	3255,44	2830,81	1636,02	1759,63	711,09
NC	554 142	739 647	1 355 538	1 193 157	576 579	620 142	250 608
NC/a	18 358	23 028	32 882	26 018	14 202	15 275	6 173
tCo2/a	66	81	112	91	48	52	21
kWh/a	327 295	409 648	585 303	465 274	238 609	256 637	103 710
1	PBT2 - Groupe scolaire René Goscinny - Élémentaire - Deep retrofit	PBT2 - Groupe scolaire Mistral - Élémentaire - Deep retrofit	PBT3 - Crèche Canta Grillou - Deep retrofit	PBT4 - Groupe scolaire Maurice Alice - Maternelle 1 - Deep retrofit	PBT1 - Groupe scolaire la Frayere - Maternelle - Deep retrofit	PBT1 - Groupe scolaire Croisette - Maternelle - Deep retrofit	PBT1 - Groupe scolaire Mistral - Maternelle - Deep retrofit
2		PBT3 - Crèche la Pastourelle - Deep retrofit	PBT3 - Crèche Lei Cardelino - Deep retrofit	PBT4 - Groupe scolaire Maurice Alice - Maurice Alice 2 - Deep retrofit	PBT1 - Groupe scolaire Metz / Vagliano - Maternelle - Deep retrofit	PBT1 - Groupe scolaire St Exupery - Maternelle - Deep retrofit	
3			PBT3 - Groupe scolaire Maurice Alice - Maternelle 2 - Deep retrofit				
4			PBT4 - GS Bocca Parc - Élémentaire / Maternelle - Deep retrofit				

Figure 5 Results deep retrofit of D3.5 simulation for city of Cannes

Table 4 Results major retrofit of D3.5 simulation for city of Cannes

Indicator	unity	Data in 2018	Expected results 2020	Expected resutls 2030	Expected results at the end of the planification (Cannes - 2033)
Retrofited area	m2	0	6 686,61	30 871,51	33 342,23
Saving currency	€	0	65 581	313 096	334 544
CO2 Saving	tCO2	1161,3	202	1 066	1 139
CO2 Saving	%		17%	92%	98%
Energy Saving	MWh	5971, 693	1 202,762	5 611,345	5 971,693
Energy Saving	%		20%	94%	100%

As we can see on the table 4 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, it's plenty enough regarding the

global Europeans objectives in 2020. The main difference between the other programming is the financial cost.

4. 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, pertners chosen to use a simplified table as presented – table 5.

Table 5 extract from the SECAP template with integrated results of city of Cannes

Actual Performance (2018)

Sector	FINAL ENERGY CONSUMPTION [MWh]															
	Electricity	Heat/cold	Fossil fuels								Renewable energies					Total
			Natural gas	Liquid gas	Heating oil	Diesel	Gasoline	Lignite	Coal	Other fossil fuels	Plant oil	Biofuel	Other biomass	Solar thermal	Geothermal	
BUILDINGS, EQUIPMENT/F																
Municipal buildings, equipment/facilities	478,23									4737,86						5216

Sector	CO_2 emissions [t] / CO_2 eq. emissions [t]															
	Electricity	Heat/cold	Fossil fuels								Renewable energies					Total
			Natural gas	Liquid gas	Heating Oil	Diesel	Gasoline	Lignite	Coal	Other fossil fuels	Plant oil	Biofuel	Other biomass	Solar thermal	Geothermal	
BUILDINGS, EQUIPMENT/F																
Municipal buildings, equipment/facilities	30									1109						1139

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

Table 6 minutes of the global results of the city of Cannes

Indicator	Unit	Data in 2018	Expected results 2020	Expected results 2030	Expected results at the end of the planification (Cannes - 2033)
Retrofited area	m2	0	4 600,54	29 235,49	33 342,23
Saving currency	€	0	49 144	298 894	334 544
CO2 Saving	tCO2	1161,3	176	1 018	1 139
CO2 Saving	%		15%	88%	98%
Energy Saving	MWh	5971,693	876,149	5 372, 736	5 971, 693
Energy Saving	%		15%	90%	100%

As we can see on the table 6 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 90% 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.

5. Conclusion

The trial applications conducted in this activity demonstrated that:

- The IMPULSE platforms facilitate significantly the completion of the public-buildings' section of the SECAP due to the immediate availability of KPIs' databases compatible with required inputs in the SECAP templates.
- Adopting the foreseen IMPULSE renovations (D3.4.1) as BAU for the municipality draws an affordable path to the achievement of the energy transition goals for the Municipality of Cannes in compliance with the SECAP.
- The IMPULSE protocols and platforms ensures mature SECAPs with realistic actions to reduce CO2 emissions for any local authority.
- As future steps for improvements the following may be proposed:
    - An automatic fill-in of the SECAP matrices with KPIs coming from IMPULSE platform would be a good IT utility to accelerate even more the development of the SECAP.
    - Adaptation actions and impacts of extreme climate events should be included in the enhancement of IMPULSE platforms in order to be included in the SECAP.
    - Similar planning protocols can be adopted for the other municipal end-use sectors (e.g. public lighting, transport, etc.) to ensure a good quality SECAP.