

Completed SEAPs' sections of public buildings - Spain

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

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RE	Restricted to a group specified by the consortium (including the MA/JS Services)	
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Executive summary	
<p>The purpose of this deliverable is to test the applicability of the IMPULSE tools for the preparation of SECAP's sections of public buildings. In this framework, 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 was elaborated through the IMPULSE results. 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 the gradual renovation plan defined in the frame of D3.5.1 for Elche. D3.4.1 results we fed the Emission Inventories and the plan achieves a reduction of CO2 emissions by 1,085 tns/y, which is beyond Elche's 2030 goal (according to its SECAP) of 40%.</p>	
Keywords	Public buildings; Elche's SEAP; IMPULSE trial applications.

Contents

1. Introduction.....	4
2. SEAP trial applications' methodology and assumptions	4
3. SECAP set-up	5
4. SECAP results for Elche priority municipal buildings.....	8
5. Conclusion	10
Annex.....	10

1. Introduction

This report presents the procedure of adopting IMPULSE tools predictions, regarding the energy upgrading of the initial priority set of public buildings of Elche, for the completion of the so-called emission inventories of the Sustainable Energy Action Plan (SEAP) specifically for the selected municipal buildings. The approach is consisted of the following basic steps:

- Definition of the baseline year and energy conditions (Key Performance Indicators, KPIs) of the selected public buildings as produced by the energy analysis in the framework of the deliverable [D3.4.1](#).
- Decision of the target for emissions' avoidance by the 2030 milestone for energy transition, specifically for the selected public buildings.
- Conclusion of the required retrofits in order to achieve the aforementioned target.
- Utilize D3.4.1 KPIs for Elche as inputs to the SEAP emission inventory templates for the baseline year (2017) and for the 2030 scenario assuming the completion of the projects foreseen in the Gradual Renovation Plan obtained through IMPULSE plug-in, as it was defined in D3.5.1.

It was concluded that a 7% surface area retrofitted each year for the selected public buildings would lead to the completion of all foreseen renovation projects by the target year 2030, which implies the deep retrofit of all public buildings except those corresponding to the typologies PBT1 and PBT4, which would only reach Major and Minor retrofit levels respectively, according to the prioritization criteria defined in D3.4.1_KPIs. Ensuring an avoidance of ~48% CO2 emissions by 2030, which is beyond the target of the Municipality.

2. SEAP trial applications' methodology and assumptions

First of all it was decided to perform the trial applications using the most recent template for Sustainable Energy and Climate Action Plan ([SECAP template](#)) as found in the website of the Initiative of the Covenant of Mayors. The following assumptions are adopted:

- According to the (under finalization) SECAP of Elche, the target CO2 emission reduction by 2030 of Heraklion is 40%.
- For the purposes of the current application, the 40% is set equally to all municipality end-uses, i.e. emission reduction target 40% is also assumed for the initial sample of public buildings selected in the framework of the IMPULSE project (the initial sample of buildings may be found in deliverable [D3.3.1](#) for Elche).
- The absolute value for CO2 emission option is adopted.
- SECAP Baseline: Year 2017 with KPIs obtained by dynamic energy simulations in the existing case.
- SECAP Business As Usual (BAU): Year 2030 with KPIs obtained by the dynamic energy simulations for the gradual renovation plan set in D3.5.1, which implies the deep retrofit of all building included in the initial set of public buildings except of those belonging to PBT1 and PBT4, which



would have only reached Major and Minor Retrofit levels respectively by 2030, according to the prioritization criteria set in D3.4.1.

- The current demonstration focuses only on mitigation actions, i.e. the SECAP adaptation assessment is considered out of the scope of the activity. Impacts of extreme climate events on the selected public buildings is also excluded from the activity.

As already defined in the Gradual Renovation Plan described in D.3.5.1, the surface area to be renovated each year will be 7% in order to reach at least the 40% reduction of CO₂ emissions by 2030. The plan described in D3.5.1 will reach the Deep retrofit for all the set of public buildings in 14 years. The implementation of the projects will start in 2020 and will finish in 2033. The Gradual Renovation Plan thus defined will allow us to achieve the objectives established for 2030, when only buildings belonging to PBT1 and PBT4 typologies would have not yet reached Deep Retrofit levels, they would only have reached Major and Minor Retrofit levels respectively in that year (2030). And the buildings belonging to the rest of typologies would have already reached Deep Retrofit levels.

Retrofit level		AGGREGATED INDICATORS FOR ALL BUILDINGS OF EACH TYPOLOGY			
		Annual electricity consumption	Annual consumption of fossil fuel	Annual CO ₂ emissions from electricity consumption	Annual CO ₂ emissions from fossil fuels consumption
		kWh/yr	kWh/yr	kg/yr	kg/yr
Major	PBT1	412.740,88	704.087,38	135.510,00	218.509,88
Deep	PBT2	0,00	255.824,40	0,00	75.006,91
Deep	PBT3	101.892,88	409.634,15	34.651,83	127.056,71
Minor	PBT4	222.736,89	437.274,88	72.970,25	136.101,81
Deep	PBT5	237.212,56	0,00	53.634,33	0,00
Deep	PBT6	10.559,79	0,00	3.489,00	0,00
Deep	PBT7	71.459,15	85.649,62	23.718,36	26.556,45
Deep	PBT8	0,00	298.856,63	0,00	79.590,15
Deep	PBT9	12.108,41	44.859,99	3.952,05	13.916,27
Deep	PBT10	13.461,01	0,00	4.360,33	0,00
Deep	PBT11	0,00	33.943,76	0,00	10.647,58
Deep	PBT12	0,00	64.269,00	0,00	16.127,30
TOTAL		1.082.171,57	2.334.399,79	332.286,14	703.513,05

3. SECAP set-up

Initially, the Strategy should be thoroughly described in the SECAP template. This means to provide information about the vision of the Municipality, the Commitment (regarding emissions' reduction), the organisational structure of the SECAP, involvement of stakeholders and citizens, budget of the plan and financial resources, monitoring approach, etc. For the purpose of the current trial application and considering the assumptions of the methodology above, the following Strategy is formulated:

Strategy

1) Vision

The current strategy stands for the trial application of the IMPULSE project tools to demonstrate their applicability in conducting/updating the SEAPs of local authorities. In this case, the present platform is created only for the municipal buildings tested for the City of Elche in the framework of the IMPULSE project, particularly through the elaboration of KPIs and plans concluded in deliverables D3.4.1 and D3.5.1 completed for Elche, Alicante, Spain. In this exercise, the renovation scenarios are considered only as mitigation actions; adaptation is considered out of the scope of this activity.

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2) Commitments

Mitigation					
CO ₂ Target	Unit	Target Year	Base Year	Reduction Type	Population estimates in target year
	%	2020	2017	absolute	195731
40%	%	2030	2017	absolute	195731
	%			absolute	

6) Overall budget for implementation and financing sources

Source	Budget foreseen for plan implementation (t)					
		Mitigation		[Select x]	Adaptation	
		Investment (t)	Non-investment (t)		Investment (t)	Non-investment (t)
Local Authority's own resources	N	8207066		[Select x]		
Other actors:	N			[Select x]		
- National Funds & Programmes	N	643750	0	[Select x]	0	0
- EU Funds & Programmes	N	643750		[Select x]		
- Private	N	0		[Select x]		
Total		8850816	0		0	0

Select x for the ones that are applicable.

Time period: 2017 2030 14 years

Budget resources data were taken from the IMPULSE deliverable D3.5.1, i.e. the action plan for gradual energy upgrade of Elche's selected priority buildings. According to the plan, the foreseen projects initially selected buildings are expected to last for 14 years, achieving a total reduction of primary energy consumption by 6.35 GWh, corresponding to 50% reduction of primary energy consumption for these buildings. The renovation measures adopted for each priority public-building typology are detailed in both the deliverables D3.4.1 and D3.5.1 of the IMPULSE project.

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In a second step the Baseline Emission Inventory (BEI) is set using the emissions coming from the KPIs' database D3.4.1 for Elche. The following information is provided in the SECAP relevant template/sheet:

Emission Inventory

HOME

Baseline Emission Inventory

1) Inventory year: 2017

2) Number of inhabitants in the inventory year: 173933

3) Emission factors: ☒ IPCC ☐ LCA (Life Cycle Assessment)

4) Emission reporting unit: ☒ tonnes CO₂ ☐ tonnes CO₂ equivalent

5) Methodological notes: The data presented in the tables below stand for the energy performance of the priority set of buildings selected in the IMPULSE project. Essentially, these data are the results obtained by the projection of KPIs obtained through the dynamic energy simulations for each public-building typology (as defined in the deliverable D3.3.1-Library of priority municipal buildings), specifically the simulation of the Ambassador building of each Typology, from the Ambassador building to all buildings of each typology. Further details may be found in the deliverables D3.3.1 and D3.4.1 of the IMPULSE project for the City of Elche.

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A. Final energy consumption

Ⓔ Please note that for separating decimals dot (.) is used. No thousand separators are allowed.

Sector	Electricity	Heat/cold	FINAL ENERGY CONSUMPTION (MWh)													Total	
			Fossil fuels							Renewable energies							
			Natural gas	Liquid gas	Heating oil	Diesel	Gasoline	Lignite	Coal	Other fossil fuels	Plant oil	Biofuel	Other biomass	Solar thermal	Geothermal		
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRY																	
Municipal buildings, equipment/facilities	3753					3274											7033
Tertiary (non-municipal) buildings, equipment/facilities																	0
Residential buildings																	0
Public lighting																	0
Industry	Non-ETS																0
	ETS (not reconvertible)																0
Subtotal	3753	0	0	0	0	3274	0	0	0	0	0	0	0	0	0	0	7033
TRANSPORT																	
Municipal fleet																	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	0
OTHER																	
Agriculture, Forestry, Fisheries																	0
TOTAL	3753	0	0	0	0	3274	0	0	0	0	0	0	0	0	0	0	7033

Consistent Key Symbols

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 I	
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRY																
Municipal buildings, equipment/facilities	1244	0	0	0	0	1018	0	0	0	0	0	0	0	0	0	2262
Tenanted/municipal buildings, equipment/facilities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential buildings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public lighting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry	Non-ETS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	ETS (not recommended)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	1244	0	0	0	0	1018	0	0	0	0	0	0	0	0	0	2262
TRANSPORT																
Municipal fleet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Private and commercial transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER																
Agriculture, Forestry, Fisheries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER NON-ENERGY RELATED																
Waste management																0
Waste water management																0
Other non-energy related																0
TOTAL	1244	0	0	0	0	1018	0	0	0	0	0	0	0	0	0	2262
Covered by the Sector																

The above sheet presents the emission inventory only for the priority set of public buildings selected in the framework of the IMPULSE project. The result produced is based on the projections of energy consumption obtained through the relative KPIs of all buildings of the initial priority set as produced by the projection and dynamic energy simulations conducted in the framework of the activity A3.4 of the IMPULSE project.

Finally, the “Monitoring” emission inventory is completed by inserting the BAU energy consumption indicators for the target year 2030. The latter are coming from the D3.4.1 database for the Gradual Renovation Plan defined in D3.5.1. The following set-up is emerged:

Monitoring Emission Inventory

① Copy as many “MEI” tabs for Monitoring Emission Inventories as necessary.

1) Inventory year: 2030

2) Number of inhabitants in the inventory year: 195791

3) Emission factors: ☒ IPCC ☐ LCA (Life Cycle Assessment)

4) Emission reporting unit: ☒ tonnes CO₂ ☐ tonnes CO₂ equivalent

<u>Key Actions</u>	<u>Area of intervention</u>	<u>Policy instrument</u>	<u>Origin of the action</u>	<u>Responsible body</u>	<u>Implementation timeframe</u>	
					<u>Start</u>	<u>End</u>
MUNICIPAL BUILDINGS, EQUIPMENT/FACILITIES						
<i>Envelope insulation (walls, windows, roofs)</i>	Building envelope	Building standards	Local authority	City of Elche	2017	2030
<i>Replacement of heating system, Compensation of heating system, Thermostatic valves at terminal units</i>	Energy efficiency in space heating and hot water	Building standards	Local authority	City of Elche	2017	2030
<i>Replacement of lighting system with presence and natural light controls</i>	Energy efficient lighting systems	Building standards	Local authority	City of Elche	2017	2030
<i>Installation of heat recovery ventilation systems</i>	Energy efficiency in space heating and hot water	Building standards	Local authority	City of Elche	2017	2030
<i>Installation of roof PVs</i>	Renewable energy for space heating and hot water	Building standards	Local authority	City of Elche	2017	2030

A. Final energy consumption

Ⓢ Please note that for separating decimals dot (.) is used. No thousand separators are allowed.

Sector	FINAL ENERGY CONSUMPTION (MWh)																Total
	Electricity	Heat/cold	Fossil fuels								Renewable energies						
			Natural gas	Liquid gas	Heating oil	Diesel	Gasoline	Lignite	Coal	Other fossil fuels	Plant oil	Biofuel	Other biomass	Solar thermal	Geothermal		
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRY																	
Municipal buildings, equipment/facilities	1082					2334											3416
Tertiary (non-municipal) buildings, equipment/facilities																	0
Residential buildings																	0
Public lighting																	0
Industry	Non-ETS																0
	ETS (not recommended)																0
Subtotal	1082	0	0	0	0	2334	0	0	0	0	0	0	0	0	0	0	3416
TRANSPORT																	
Municipal fleet																	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	0
OTHER																	
Agriculture, Forestry, Fisheries																	0
TOTAL	1082	0	0	0	0	2334	0	0	0	0	0	0	0	0	0	0	3416

Emission Inventory

Sector	CO ₂ emissions (t) / CO ₂ eq. emissions (t)																Total
	Electricity	Heat/cold	Fossil fuels								Renewable energies						
			Natural gas	Liquid gas	Heating Oil	Diesel	Gasoline	Lignite	Coal	Other fossil fuels	Plant oil	Biofuel	Other biomass	Solar thermal	Geothermal		
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRY																	
Municipal buildings, equipment/facilities	358	0	0	0	0	726	0	0	0	0	0	0	0	0	0	0	1084
Tertiary (non-municipal) buildings, equipment/facilities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential buildings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public lighting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry	Non-ETS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	ETS (not recommended)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	358	0	0	0	0	726	0	0	0	0	0	0	0	0	0	0	1084
TRANSPORT																	
Municipal fleet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Private and commercial transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER																	
Agriculture, Forestry, Fisheries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER NON-ENERGY RELATED																	
Waste management																	0
Waste water management																	0
Other non-energy related																	0
TOTAL	358	0	0	0	0	726	0	0	0	0	0	0	0	0	0	0	1084

It should be mentioned that in the aforementioned matrices the compensation of the energy consumption by renewable energy is already incorporated in the KPIs received by the D3.4.1 database. For that reason, the respective RES matrices are not directly complete in the SECAP template. Hence, in the deep retrofit for which most buildings have PV panels the consumption coming from RES is already subtracted by the energy consumption indicator.

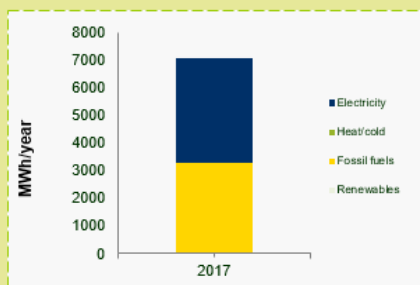
4. SECAP results for Elche priority municipal buildings

The results obtained by the previously described set-up are presented in the figures below (Sheet "Mitigation report" of the SECAP template):

<u>Business-as-Usual projections by 2030</u> (if applicable)		CO ₂ emissions (t CO ₂ (eq.)/a)		Municipal	
			1084		1084
		Final energy consumption (MWh/a)	3416		3416

The Mitigation actions refers to the ones foreseen in the Deliverable D3.4.1 for the priority set of Municipal Buildings for Elche. The estimated emission reductions are envisaged to a time horizon until 2030, which corresponds to a 7% surface area renovation rate of the IMPULSE priority set of buildings, by applying the retrofitting projects defined in the Gradual Renovation Plan obtained through IMPULSE plug-in, as it was defined in D3.5.1.

4) Final energy consumption per energy carrier

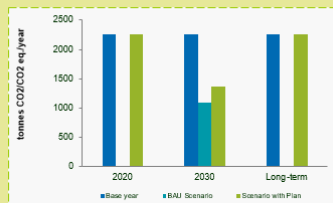
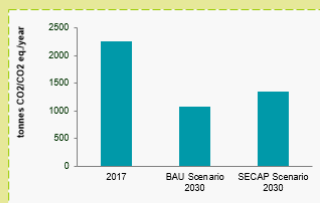


Key elements of the SECAP on climate mitigation

6) Greenhouse gas emissions reduction target

Time horizon	Reduction Target	tonnes CO ₂ (eq.) to be reduced
2020	0%	0
2030	40%	905
0	0%	0

8) Expected evolution in terms of greenhouse gas emissions



2017	2262.44
BAU Scenario 2020	0
SECAP Scenario 2020	2262.44
2017	2262.44
BAU Scenario 2030	1084
SECAP Scenario 2030	1357.47
2017	2262.44
BAU Scenario long-term year	0
SECAP Scenario long-term year	2262.44

Comments:

The BAU Scenario represents the interventions foreseen in the D3.4.1 and D3.5.1 plans of the IMPULSE project for the Municipality of Elche. Essentially, it reflects the reduction of the CO₂ emissions, particularly originated by the gradual renovation plan set in D3.5.1, which implies the deep retrofit of all building included in the initial set of public buildings except of those belonging to PBT1 and PBT4, which would have only reached Major and Minor Retrofit levels respectively by 2030. The SECAP Scenario reflects the goal of the Municipality as defined in its SECAP, i.e. 40% reduction of emissions, applied only for the selected priority set of municipal buildings. It is concluded that the Gradual Renovation Plan designed in the framework of IMPULSE project, achieves beneficial result which goes far beyond the 40% goal set by the Municipality.

According to the SECAP processes using the IMPULSE results, the following major outcomes are drawn:

- The CO₂ emissions are reduced from 2262.44 tns in the baseline (2017) to 1084 tns (2030), meaning an 52% reduction which is beyond the Municipality's target of 40% i.e. 905 tns CO₂.
- To achieve the aforementioned ambitious goal, the priority buildings should be renovated by 7% building surface area each year.
- According to the Gradual Renovation Plan defined in the frame of A3.5 activity, Elche Municipality will far reach their goal of 40% reduction of CO₂ emissions by 2030, implementing the deep retrofit projects for all building included in the initial set of public buildings except of those belonging to PBT1 and PBT4, which would have only reached Major and Minor Retrofit levels respectively by 2030, according to the prioritization criteria set in D3.4.1.

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'.
- The IMPULSE protocols and platforms allows mature SECAPs with realistic and tailored actions to reduce CO2 emissions for any local authority.
- As future steps for improvements the following may be proposed:
 - Adaptation of IMPULSE platform for the automatic fill-in of the SECAP matrices with the KPIs calculated based on the Mitigation Actions to be implemented instead of the retrofitting levels to be achieved.
 - 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.

Annex

Excel file "SECAP_IMPULSEtrialapp_Elche" completed SECAP template with IMPULSE KPIs for the priority municipal buildings for Elche.