Completed SEAPs' sections of public buildings - Greece

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

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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)	
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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 Greek partner proceeded to the elaboration of the IMPULSE results produced for the initially selected priority set of the 76 buildings 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 Heraklion as foreseen in the deliverable D3.4.1 for Heraklion. The D3.4.1 results were fed to the Emission Inventories and the plan achieves a reduction of CO2 emissions by 1,690 tns/y, which is far beyond the Heraklion's 2030 goal (according to its SEAP) of 40%.	
Keywords	Public buildings; Heraklion SEAP; IMPULSE trial applications.

Contents

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 Heraklion, 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 Heraklion 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 framework of IMPULSE.

It was concluded that a 6% 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, ensuring an avoidance of ~83% CO2 emissions, which is well 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) SEAP of Heraklion, 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 Heraklion).
- 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 deep retrofit case of the selected municipal buildings.
- 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.

By reviewing the renovation projects of the selected buildings, the completion of major retrofits (refer to sheet “Projection_Major retrofit” in the excel annex of D3.4.1) leads to a reduction of total annual CO2 emissions by ~48%, while the completion of deep retrofits (refer to the sheet “Projection_Deep retrofit” of the excel annex of D3.4.1) achieves a 83% reduction of CO2 emissions which is well beyond the 2030 target set by the Municipality. Considering that, it was decided to assume the completion of all deep retrofits by the 2030 in order to ensure the achievement of Municipality’s target. Using the IMPULSE excel-based planning tool for gradual renovation for Heraklion, this means that 6% surface area of the public buildings should be renovated each year leading to the 14 year plan; which is considered feasible by the Municipality. Hence, the current SECAP test considers the completion of all deep retrofits in a timeline by 2030 and that these projects are the BAU Scenario up to 2030.

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 Municipality of Heraklion 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 Heraklion, Crete. In this exercise, the renovation scenarios are considered only as mitigation actions; adaptation is considered out of the scope of this activity.

2) Commitments

Mitigation					
CO_2 Target	Unit	Target Year	Base Year	Reduction Type	Population estimates in target year
	%	2020	2017	absolute	173993
40%	%	2030	2017	absolute	173993
	%			absolute	

6) Overall budget for implementation and financing sources

Source		Budget foreseen for plan implementation (€)				
		Mitigation			Adaptation	
		Investment (€)	Non-investment (€)		Investment (€)	Non-investment (€)
Local Authority's own resources	x	1485985		[Select x]		
Other actors:	x	16934522	0	[Select x]	0	0
- National Funds & Programmes	x	7900000		[Select x]		
- EU Funds & Programmes	x	850000		[Select x]		
- Private	x	8184522		[Select x]		
Total		18420507	0		0	0

ⓘ Select x for the ones that are applicable.

Time period: 2017 – 2030 (14 years)

Source
Local Authority's own resources
Other actors:
- National Funds & Programmes
- EU Funds & Programmes
- Private
Total

Time period

Budget resources data were taken from the IMPULSE deliverable D3.5.1, i.e. the action plan for gradual energy upgrade of Heraklion's selected priority buildings. According to the plan, the foreseen projects until the deep renovation of all initially selected buildings are expected to last for 14 years, achieving a total reduction of primary energy consumption by 4.8 GWh, corresponding to 84% 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.

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

Baseline Emission Inventory

1)	Inventory year	2017
2)	Number of inhabitants in the inventory year	173993
3)	Emission factors.	☑ IPCC ☐ LCA (Life Cycle Assessment)
4)	Emission reporting unit	☑ tonnes CO_2 ☐ tonnes CO_2 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 maybe found in the deliverables D3.3.1 and D3.4.1 of the IMPULSE project for the Municipality of Heraklion.

A. Final energy consumption

ⓘ Please note that for separating decimals dot [.] is used. No thousand separators are allowed.

Sector		FINAL ENERGY CONSUMPTION [MWh]															
				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 AND INDUSTRIES																	
Municipal buildings, equipment/facilities		1686.66				766.62											2453.28
Tertiary (non municipal) buildings, equipment/facilities																	0
Residential buildings																	0
Public lighting																	0
Industry	Non-ETS																0
	ETS (not recommended)																0
Subtotal		1686.66	0	0	0	766.62	0	0	0	0	0	0	0	0	0	0	2453.28
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
OTHER																	
Agriculture, Forestry, Fisheries																	0
TOTAL		1686.66	0	0	0	766.62	0	0	0	0	0	0	0	0	0	0	2453.28

Emission Inventory

Sector		CO_2 emissions [t] / CO_2 eq. emissions [t]															
				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 AND INDUSTI																	
Municipal buildings, equipment/facilities		1791	0	0	0	205	0	0	0	0	0	0	0	0	0	0	1996
Tertiary (non 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	0
	ETS (not recommended)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal		1791	0	0	0	205	0	0	0	0	0	0	0	0	0	0	1996
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		1791	0	0	0	205	0	0	0	0	0	0	0	0	0	0	1996

The above sheet present 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 deep renovation case. The following set-up is emerged:

Monitoring Emission Inventory

Copy as many "MEI" tabs for Monitoring Emission Inventories as necessary.

1) Inventory year	2030	
2) Number of inhabitants in the inventory year	173993	
3) Emission factors	☑	IPCC
	☐	LCA (Life Cycle Assessment)
4) Emission reporting unit	☑	tonnes CO_2
	☐	tonnes CO_2 equivalent

Key Actions	Area of intervention	Policy instrument	Origin of the action	Responsible body	Implementation timeframe	
					Start	End
MUNICIPAL BUILDINGS, EQUIPMENT/FACILITIES						
Envelope insulation (walls, windows, roofs)	Building envelope	Building standards	Local authority	Municipality of Heraklion	2017	2030
Replacement of heating system, Compensation of heating system, Thermostatic valves at terminal units	Energy efficiency in space heating and hot water	Building standards	Local authority	Municipality of Heraklion	2017	2030
Replacement of lighting system with presence and natural light controls	Energy efficient lighting systems	Building standards	Local authority	Municipality of Heraklion	2017	2030
Replacement of cooling system	Energy efficient electrical appliances	Building standards	Local authority	Municipality of Heraklion	2017	2030
Installation of roof PVs	Renewable energy for space heating and hot water	Building standards	Local authority	Municipality of Heraklion	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]															
			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 AND INDUSTRIES																
Municipal buildings, equipment/facilities	226.8				234.8											461.6
Tertiary (non municipal) buildings, equipment/facilities																0
Residential buildings																0
Public lighting																0
Industry – Non-ETS																0
Industry – ETS (not recommended)																0
Subtotal	226.8	0	0	0	234.8	0	0	0	0	0	0	0	0	0	0	461.6
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
OTHER																
Agriculture, Forestry, Fisheries																0
TOTAL	226.8	0	0	0	234.8	0	0	0	0	0	0	0	0	0	0	461.6

Emission Inventory

Sector		CO_2 emissions [t] / CO_2 eq. emissions [t]															
				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	Geotherma l	Total
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTI																	
Municipal buildings, equipment/facilities		241	0	0	0	63	0	0	0	0	0	0	0	0	0	0	304
Tertiary (non 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	0
	ETS (not recommended)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal		241	0	0	0	63	0	0	0	0	0	0	0	0	0	0	304
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		241	0	0	0	63	0	0	0	0	0	0	0	0	0	0	304

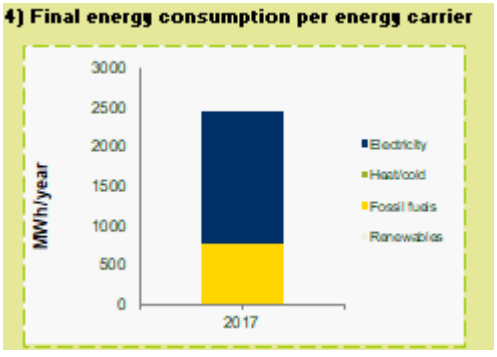
It should be mentioned that in the aforementioned matrices the compensation of the energy consumption by renewable energy is already incorporated in the KPIs received by the D3.4.1 database. For that reason, the respective RES matrices are not directly complete in the SECAP template. Hence, in the deep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

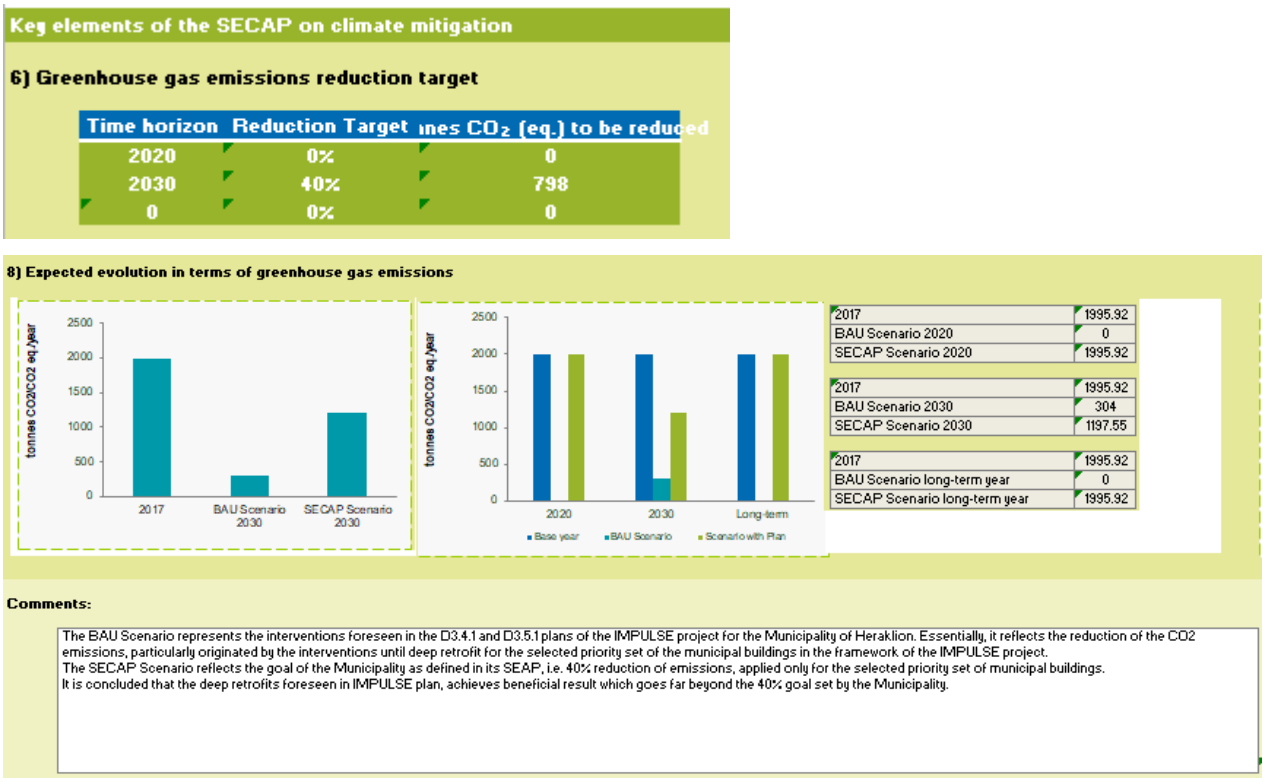
4. SECAP results for Heraklion priority municipal buildings

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

		Municipal
Business-as-Usual projections by 2030 (if applicable)	CO_2 emissions (t CO2 (eq.)/a)	304
	Final energy consumption (MWh/a)	461.6

The Mitigation actions refers to the ones foreseen in the Deliverable D3.4.1 for the priority set of Municipal Buildings for Heraklion. The estimated emission reductions are envisaged to a time Horizon until 2030, which corresponds to a 6% surface area renovation rate of the IMPULSE priority set of buildings, by applying the retrofitting projects defined in the framework of IMPULSE project.





Key elements of the SECAP on climate mitigation

6) Greenhouse gas emissions reduction target

Time horizon	Reduction Target	tnes CO_2 (eq.) to be reduced
2020	0%	0
2030	40%	798
0	0%	0

8) Expected evolution in terms of greenhouse gas emissions

2017	1995.92
BAU Scenario 2020	0
SECAP Scenario 2020	1995.92
2017	1995.92
BAU Scenario 2030	304
SECAP Scenario 2030	1197.55
2017	1995.92
BAU Scenario long-term year	0
SECAP Scenario long-term year	1995.92

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 Heraklion. Essentially, it reflects the reduction of the CO2 emissions, particularly originated by the interventions until deep retrofit for the selected priority set of the municipal buildings in the framework of the IMPULSE project.
The SECAP Scenario reflects the goal of the Municipality as defined in its SEAP, i.e. 40% reduction of emissions, applied only for the selected priority set of municipal buildings.
It is concluded that the deep retrofits foreseen in IMPULSE plan, achieves beneficial result which goes far beyond the 40% goal set by the Municipality.

According to the SECAP processes using the IMPULSE deep retrofit scenarios, the following major outcomes are drawn:

- The CO2 emissions are reduced from 1995.92 tns in the baseline (2017) to 304 tns (2030), meaning an 84% reduction which is far beyond the Municipalty's target of 40% i.e. 1197.5 tns CO2.
- To achieve the aforementioned ambitious goal, the priority buildings should be renovated by 6% building surface area each year.
- A 14-year time duration of renovation projects is estimated until the deep renovation of all priority buildings.

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 Heraklion 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.

Annex

Excel file “SECAP_IMPULSEtrialapp_Heraklion” completed SECAP template with IMPULSE KPIs for the priority municipal buildings for Heraklion.