Adoption of Energy-Mix Efficiency Plans for Public Institutions: Assessment and Recommendations

Med SE(A)CAP integration through uniform adapted assessment and financing methods, mainly targeting buildings in education and health sectors, for sustainable development goals in a smart society

SEACAP 4 SDG (C_B.4.3_0058)

Financed in the framework of the ENI CBC Mediterranean Sea Basin Programme 2014-2020

The objective of this booklet is to present a summary regarding partners' activities while tackling:

- **Output 6.1: Adoption of 9 Energy-mix efficiency plans for public institutions**

  Activity 6.1.1: Evaluation of demonstrator results to develop energy-mix efficiency plans at local/ regional levels

The Lebanese Center for Energy Conservation (LCEC) has developed this booklet based on inputs from project partners.

Executive Summary

SEACAP 4 SDG considers the Sustainable Energy Access and Climate Action Plans (SE(A)CAP) background, under a common vision, strategy and evaluation tool, to achieve Med SE(A)CAP integration through uniform adapted assessment and financing methods, for sustainable development goals in a smart society. SEACAP 4 SDG capitalizes on the outputs and outcomes of 10 projects, identifying characteristics to be generalized, and by adapting gained knowledge to maximize efficiency and effectiveness of energy refurbishment strategies adapted to local Mediterranean specificities, notably energy poverty. These outputs and outcomes will be implemented in nine cities around the Mediterranean, selected using an approach developed under the European City Facility initiative. Considering the Covid-19 pandemic and the global economic downturn, the project focuses primarily on education and health buildings.

This booklet summarizes activities performed by project partners including L1 Demonstrators (SEACAP updates) on municipality levels and L2 Demonstrators (Energy Efficiency Action Plans) on building levels. The Annex Section includes detailed numbers of both levels as shared by project partners.

The Booklet relies on the methodology adopted in the SEACAP 4 SDG project starting by the selection of municipalities and external energy entities, passing by the Living Labs then tools developed in previous projects (Selected Reference Projects) to train Local LL members and propose adapted SE(A)CAPs and Energy Action Plans.

Contents

List of Figures:

List of Tables:

1. Introduction

1.1 What is the SEACAP4SDG Project?

Territories surrounding the Mediterranean Sea face similar specific issues with the adaptation to mitigation of climate change, specifically regarding energy efficiency and renewable energy measures in public buildings. It is thus proposed that they work together on a strategy to capitalize on reference projects' results. To do so, SEACAP 4 SDG will consider the Sustainable Energy Access and Climate Action Plans (SE(A)CAP) background, under a common vision, strategy and evaluation tool, to achieve Med SE(A)CAP integration through uniform adapted assessment and financing methods, for sustainable development goals in a smart society. SEACAP 4 SDG capitalizes on the outputs and outcomes of 10 projects, identifying characteristics to be generalized, and by adapting gained knowledge to maximize efficiency and effectiveness of energy refurbishment strategies adapted to local Mediterranean specificities, notably energy poverty. These outputs and outcomes will be implemented in 9 cities around the Mediterranean, selected using an approach developed under the European City Facility initiative. Considering the Covid-19 pandemic and the global economic downturn, the project will focus primarily on education and health buildings.

1.2 Partner Countries and Associates

Table 1 - List of project partners

		Project Partner	*Associated Partner*
LB	ECN/NCA	Nice Côte d'Azur Metropolis represented by Euromed Cities Network	
PP1	AASTMT	Arab Academy for Science, Technology and Maritime Transport	
PP2	UPatras	University of Patras	
PP3	ANEA	Agenzia Napoletana per l'Energia e l'Ambiente	Interdepartmental Research Centre Laboratory of Urban and Regional Planning Raffaele d'Ambrosio (LUPT)
PP4	NERC	National Energy Research Centre - Royal Scientific Society	Jordan University of Science and Technology (JUST)
PP5	LCEC	Lebanese Centre for Energy Conservation	Ministry of Energy and Water (MEW)
PP6	IREC	Institut en Recerca de Energia de Catalunya	Catalan Institute for Energy (ICAEN) Metropolitan Area of Barcelona (AMB)
PP7	IVE	Institut Valenciano de la Edificacion	Generalitat Valenciana (GVA)

			Valencian Federation of Municipalities and Provinces (FVMP)
PP8	MEDREC	Mediterranean Centre for Renewable Energy	

2. Selection of Municipality and External Expert

2.1 The Selected Municipality

Following the call for municipalities to apply for the SEACAP 4 SDG project, all countries have launched an Expression of Interest for accepting applications. Based on scoring criteria in all the project partner countries, the selected municipalities are:

- The Municipality of Naples – Italy
- The Municipality of Aigialeia - Greece
- The Municipality of Lloret de Mar – Catalunya, Spain
- The Municipality of Sax – Valencia, Spain
- The Municipality of Jdeideh El Chouf – Lebanon
- The Municipality of Bizerte – Tunisia
- The Aqaba Special Economic Zone Authority "ASEZA" – Jordan
- Alexandria Water Company, Governorate of Alexandria – Egypt

2.2 Selection of the External Entity

After selecting the municipalities in project partner countries, and to proceed with SEACAP activities, an external entity needed to be assigned to assist each of the project partners and municipalities. Another round of calls was released for interested external entities to apply. After receiving applications, a scoring process was applied. The selected entities are:

- MES Energy "MESOGEOS group" - Greece
- The Interdepartmental Research Centre Laboratory of Urban and Regional Planning (LUPT) – Italy
- Estudi Ramon Folch i Associats – ERF Energia & Sostenibillitat SLU – Catalunya, Spain
- AZIGRENE CONSULTORES S.L. – Valnecia, Spain
- Energy Efficiency Group (EEG) – Lebanon
- The Agency Atmospheres ADD – Tunisia

- ECOSOL – Jordan
- Egyptian for Engineering & Commerce "EGEC" – Egypt

2.3 Goals to Be Achieved Within the Project in the Municipality

The signatories of the covenant of mayors have a target to achieve within a selected timeframe. This target may vary from one country to another. However, in the SEACAP 4SDG project different targets are set within each municipality based on their baseline and the target year selected.

The external entity in **Egypt** is required to assist the municipality to use the Toolkit in their day-to-day work to a specific purpose: Improve their SEACAP or energy-mix efficiency. It also must demonstrate at Level 2 Demonstrator to achieve a minimum energy saving of 5% over the total energy consumption of the city in alignment with the project objectives.

The Municipality of Aigialeia - **Greece** aimed to cut CO_2 emissions by 20% by 2020 compared to 2010 levels.

In reference to the year 2005, the **Italian** Municipality of Naples is expecting to reach a minimum reduction of 25% CO_2 emissions.

In ASEZA - **Jordan**, within the implementation of the Energy – Mix Efficiency Plan, it is expected to achieve 162,891 MWh saving in energy consumption, and 131,720 tons reductions in CO_2 emissions by the year 2030.

Moreover, the Municipality of Jdeideh El Chouf - **Lebanon** has a target to reach 40% of CO_2 emission reduction by the year 2030 set by proposing several mitigation actions.

In **Spain**, the SEACAP of Lloret de Mar – **Catalunya** indicates that in year 2030, a 56.1% reduction of CO_2 emissions reference to the year 2005 is to be achieved, in addition to having a saving of 356.129 MWh per year and a production of 12.114 MWh of renewable energy. On the other hand, the Town Council of Sax - **Valencia** has set the goal to increase energy efficiency in the city by 32.5% in 2030, compared to energy consumption in 2007.

Moreover, the **Tunisian** Municipality of Bizerte and based on the proposed climate action plan, the total emissions to be avoided from the proposed measures are 15.742,08 $kgCO_{2\text{-}eq}$ per year.

3. Stakeholders

The stakeholders that would have an impact on the project and the implementation of its recommendations are listed below in all country partners. More information related to this impact is detailed for each project partner in the annex in Table 5 , Table 6, Table 13, Table 29, Table 38, Table 40, and Table 49.

Stakeholder	Impact
Egypt-MED QUAD ENI CBC MED project	Harmonization of efforts between stakeholders and optimization of solutions.
Egypt-Alexandria Drinking Water Company	Support in public awareness, capacity building, and reaching the target audience.
Egypt-New and Renewable Energy Authority	Providing energy data needed in analysis.
Egypt-RCREEE, Regional Center for Renewable Energy and Energy Efficiency	Providing energy data needed in analysis.
Greece-University of Patras (UPatras)	Continued expertise contribution, collaboration in future projects.
Greece-Municipality of Aigialeia	Sustain adopted practices, model for others, local development.
Greece-MES Energy S.A.	Offering consultancy, expand energy practices.
Greece-Regional Administrations (Regions)	Collaboration for regional development, energy efficiency.
Greece-Other Municipalities in Greece	Incorporation of lessons, enhancement of energy management.
Greece-Residents and Local Communities	Continued energy-efficient behaviors, conservation.
Greece-Local Businesses and Organizations	Integration of energy-efficient practices, benefit economically.
Greece-Government Authorities and Regulatory Bodies	Continued policy support, advance energy initiatives.
Greece-Educational Institutions	Integration of energy concepts, research, education.
Greece-NGOs and Community Groups	Sustain community engagement, promotion of responsibility.
Italy RENAEL Network	Introduction of energy efficiency measures to clients.
Italy-EnergyMed 2023 Conference	Spreading awareness about the danger of the continuation of releasing CO_2 at the current rate, conducting seminars to mitigate these issues.
Italy-LUPT Centre	Technical skills and trainings, helping in local trainings and testing.

Italy-Municipality of Naples	Addressing several issues related to CO2 emissions and energy consumption in the local context, law enforcement, and policy-making.
Jordan-ASEZA	Institutional decision makers. Is the selected municipality to implement SECAP project activities.
Jordan-ECOSOL	External Entity, Eco Engineering and Energy Solutions (EcoSol) is a leading energy, water and sustainability consulting headquartered in Amman- Jordan. EcoSol has been involved in developing sustainable solutions in Jordan and the Middle East to help clients in meeting sustainability aspects in a techno-economical and cost-effective way.
Jordan-Ministry of Education	Socio-economic operators, schools are the targeted end users to implement the SEACAP project as the Ministry of Education governs them.
Jordan-Ministry of Education	Institutional decision makers. Is the selected municipality to implement SECAP project activities.
Jordan-NEPCO	National and Regional Energy Management Authority (NEPCO) is responsible for managing and operating the electrical system, transmission of electric power, and bulk supply.
Lebanon- Industrial Research Institute (IRI)	Technical skills and trainings. Training and testing.
Lebanon-Building owners	Facilitating working on buildings. Students and patients will benefit from the applied measures.
Lebanon-ESCOs	Abiding with laws and regulations. Introduction of energy efficiency measures to clients.
Lebanon-Ministry of Education and Higher Education (MeHe)	Facilitating working with schools and technical academies. Ensuring access to affordable, reliable and sustainable energy (given electricity shortage in Lebanon + price increase)
Lebanon-Ministry of Energy and Water (MEW)	Addressing several issues related to CO2 emissions and energy consumption. Law enforcement and policy-making.
Lebanon-Ministry of Health (MoH)	Providing healthcare centers or hospitals to apply EE and EC measures.
Lebanon-Municipalities	Spreading awareness about the danger of continuing to release CO2 at the current rate. Helping in local trainings, conducting seminars to mitigate these issues.
Spain-Consultancy entities and support companies	Technical skills and trainings. Training and testing.

Spain-Regional government and supra-municipality public entities	Addressing several issues related to CO2 emissions and energy consumption. Law enforcement, policy-making and support to local authorities and key stakeholders.
Tunisia-Building energy managers and users	Co-creation of the renovation process.
Tunisia-Green Building Council (TGBC)	Feedback on measures/process proposed for the pilot building selected.
Tunisia-National Heritage Institute (INP)	Safeguarding, protection, restoration and exhibition of documents of the pilot building in Bizerte.
Tunisia-Société de Gestion de Technopole de Bordj Cedria	Feedback on measures/process proposed for the pilot building selected.
Tunisia-Startup dB.Sense	Proposing new approaches to promote sustainable behaviors of building users.
Tunisia-Students/professors and researchers	Definition and evaluation of innovative renovation measures based on the latest technological developments and while using advanced software.
Tunisia-The National Agency for Energy Management (ANME)	Feedback on measures/process proposed for the pilot building selected.
Tunisia-The National Federation of Municipalities (FNCT)	Feedback on measures/process proposed for the pilot building selected.

4. Project Actions

4.1 Living Lab /Toolkit

Following the Cross Border Living Lab (CBLL) training, each project partner was asked to create local living Lab to train their relevant stakeholders on the materials given during the CBLL.

In **Egypt**, physical training on the implementation of Edufootprint and Impulse toolkits was carried out on site on 1/5/2023 in the pilot building location to address the current situation of energy consumption and the environmental impact of some initiatives. EGEC and Alexandria Water Company and its associated school representative have discussed the most suitable toolkit for the selected case study. The most appropriate toolkit is Impulse Preparatory setup and Edufootprint in particular

In **Greece**, the University of Patras (UPatras) led WP4, focusing on Living Lab activities, gathering valuable insights through direct stakeholder engagement in Aigialeia Municipality. The Living Lab emphasized energy efficiency in public buildings, particularly schools, vital for achieving SEACAP emission reduction targets. The Living Lab also highlighted the need for a green procurement manual. The training program involved three levels: Training on Selected Reference

Projects (SRPs), training of SEACAP Local Implementation Teams (SLIT), and stakeholder training through Local Living Labs. The overarching objective was to bridge awareness and action gaps regarding climate change. Activities included tailored trainings, continuous engagement, and collaboration between UPatras, MES Energy, and Aigialeia Municipality. These efforts significantly influenced stakeholder commitment to energy efficiency, affecting SEACAP 4 SDG project objectives positively. In addition, the University of Patras (UPatras) conducted a series of trainings as part of the Living Lab activities within the SEACAP 4 SDG project, Local Living Lab Training in Aigialeia Municipality, and Living Lab Training in Smart Communities as part of the Green Building Open Event.
The tool selected is the Impulse tool.
In **Italy**, the goal of the SEACAP 4 SDG training for the City of Napoli is to integrate relevant tools proposed by the project within the methodological workflow already defined by the Technical Department "Environmental monitoring and SEAP implementation" for the upgrade of the current Napoli – Italy SEAP into SECAP.
The Local Living Lab training was carried out between February and April 2023, by implementing three workshops focused on the following methodological steps/tools:

- 27 February 2023 - Integrating SECAP Napoli - Italy legacy tools with SEACAP 4 SDG tools (tools interface parameters and process workflow from preliminary assessment to planning, design, and implementation);
- 31 March 2023 - Assessment tools: Public Building Energy Renovation - KPIs-processor's GIS plug-in and financial scheme evaluation tool (Impulse), and School LCA Calculator (Edufootprint) within the exhibition on circular economy and energy transition EnergyMed 2023;
- 26 April 2023 - Co-design tools: MCBLL - Mediterranean Cross-Border Living Lab (MED-ECOSURE), and SBT-Sustainable Building Tool and SNT-Sustainable Neighbourhood Tool (CESBA MED S).

In **Jordan**, the Living Lab's primary objective is to bridge the gap between the community and its inability to address climate change. Although this goal may seem broad, in simpler terms, it aims to raise awareness among people about their unwitting activities that contribute to the release of more CO_2 into the atmosphere. The living lab also strives to make energy efficiency measures more accessible to citizens, helping to alleviate the environmental challenges discussed in the training. The activities for the Living Lab include:

- Conducting trainings
- Site visit during the Implementation Phase
- Maintaining relations with Living Lab members

EcoSol, the local expert, and NERC, the project coordinator, conducted online meetings with Aqaba Special Economic Zone Authority (ASEZA) - Jordan to evaluate the tools used for SEACAP projects (PriorityEE). Additionally, training courses were organized with ASEZA - Jordan and Living Lab members to provide methodology and training on the selected project tools.
ASEZA - Jordan identified educational buildings as a priority and consequently selected the PriorityEE outcomes to streamline the prioritization process for energy efficiency measures in public educational buildings.

The Local Living Lab training was conducted online in **Lebanon** in February, where the Living Lab engages various stakeholders such as public building owners and managers, decision and policy makers, research and educational centers, universities, business support organizations, technical chambers, innovative companies, SMEs, energy agencies, school owners, and engineering students. Below is the list of sessions conducted during the training:

- SEACAP 4 SDG Support Mechanism
- Introduction to SEACAPs
- SEACAP Living Lab
- Involvement and engagement of stakeholders and citizens through LL
- Tool Selection and Implementation
- Financing Options

The toolkits chosen in this project were the Impulse and Edufootprint tools. Although Edufootprint was planned to be used in the school audit, the tool was built to match the needs and requirements of preselected countries. The LCEC team contacted the tool developers asking for modifications or having access to an open-source toolkit, but these options were not possible due to some restrictions.

In **Spain**, the SEACAP Living Labs consisted of two sessions to share among the different involved key stakeholders of the implemented support mechanism of the SEACAP 4 SDG project. See Figure 7, Figure 8, and Figure 9.

Therefore, the two selected municipalities, Sax - Valencia in the region of Valencia and Lloret de Mar in Catalonia, it was proposed that their representative technicians, the selected external entities that offer their support for the definition of the new SEACAPs, and other key stakeholders (as supralocal entities), could join a set of sessions, in which to focus on several topics of their related processes. Specifically, the sessions aimed to share scenarios descriptions, key stakeholder definitions, main SRP outcomes used during new plan developments, or the resulting actions. However, the implementation will be combined with the use of Impulse Plus and Edufootprint.

In **Tunisia**, the local Living Lab "Eco-City TUN" (Innovative eco-sustainable process for Sustainable Tunisian cities) was established with the aim of improving the technical capacities of the public building managers of the Municipality of Bizerte – Tunisia, by developing and enhancing energy efficiency actions through tools identified within the SEACAP 4 SDG project. The first day of the local training addressed the use and exploitation of the selected tools (PrioritEE, Impulse and Med-EcoSuRe). While the second was dedicated to a detailed step by step training focusing on the use of the "decision aid tool for optimal renovation measures" of Med-EcoSuRe project. The second day of the training included:

- Meetings and training courses
- Challenges to proposing innovative and cost-effective renovation solutions
- Co-creation workshop: Building energy renovation measures implementation based on a Living Lab approach
- Green Nudges challenge

The tool selected were the Impulse Plus tool and the Med-EcoSuRe tool. More details are available in the Annex.

4.2 Assessment of Updated SEACAPs- Level 1 Demonstrator

As per the objectives of the project to modify/update the existing SEACAPs of the selected municipalities. Based on the provided data this section will address the updated SEACAPs in the partner countries.

In **Italy**, the SEAP dates back to 2017, as CO_2 emission reduction have reached 354,091.2 tCO_2-eq in 2014, or 12.15% relative the baseline year 2005. In 2020, the estimated emission reduction is

752,694.99 tCO_2-eq, which is two times higher than in 2014 and 25.84% relative to the baseline year, which is above the targets of the Municipality of Napoli - Italy.
This estimated reduction mainly comes from residential buildings and public transport sectors representing 12% of the total estimated emission reduction.

In **Greece**, the Municipality of Aigialeia is a signatory of the Covenant of Mayors (CoM) since February 2015 and has a Sustainable Energy Action Plan (SEAP) targeting a 20% CO_2 emission reduction by 2020. SEAP focuses on energy-efficient upgrades of municipal buildings, street lighting, renewable energy sources (RES), and more. However, the Greek Climate Law and Directive 2018/2002/EU demand updating the SEAP to a Sustainable Energy and Climate Action Plan (SECAP), addressing a 30% emission reduction by 2030 and climatic vulnerabilities. Aigialeia's challenges include updating the SEAP and building stock energy plan to comply with these laws. The external entity utilized the SEACAP 4 SDG toolkit to assist the municipality in updating its plans, prioritizing actions, and conducting technical studies for future project implementation.

In the **Spanish** case of Lloret de Mar – **Catalunya**, 2019 is the year of SEACAP. It is noticeable that between 2005 and 2019, energy consumption in Lloret de Mar – Catalunya has increased by 3.9%. Consumption decreased from 2008 to 2014 because of an economic crisis, but it recovered thereafter. It grew from a total consumption of 670,601 MWh in 2005 to 696,205 MWh in 2019.

Most of the energy consumption in 2019 was corresponds to transport and mobility (56%), while the tertiary sector is responsible for 28 percent. The residential sector represents the remaining 16% of total energy consumption.
Fossil fuels such as diesel and gasoline form 55% of energy sources, also related to mobility. The use of electricity is 27% of overall consumption, followed by natural gas.

In **Valencia**, the updated SEACAP is for the year 2021 with 2007 as a reference year. The annual energy consumption in 2021 has increased by approximately 2.5% compared to 2007.
Hence, the target for 2030 has now to reach 34.21% of consumption in 2021, resulting in an energy savings target equal to 16,823.96 MWh. A new target has been set to areas that directly depend on the Town Council of Sax – Valencia, which is to reach a 40.67% in savings. However, energy savings in areas that are not directly dependent on the Town Council have to reach 35.82% in

savings. It is necessary to also highlight that, between 2007 and 2021, CO_2 emissions decreased by around 20%. This indicates that according to the updated SEACAP of Sax – Valencia, target emission in 2030 has to be 7,984.03 tCO_2, 55% lower than its 2007 emissions.

The SEACAP was updated in **Lebanon** to the year 2023 with a new baseline year of 2022. This update has resulted in 13% increase in the total energy consumed from 120.171 GWh to 138.5 GWh. This is due to the increase in the total area of households by 10%, accompanied by people seeking refuge in their village at the time the economic crisis and the pandemic hit.

In addition, emissions in 2022 increased by 18% from 47,113 to 55,372.86 $tCO_{2\text{-eq}}$. Therefore, the forecasted emission for 2030 is 73,092.17 $tCO_{2\text{-eq}}$. Therefore, the emission reduction target by 2030 for Jdeideh El Chouf Municipality - Lebanon according to the Covenant of Mayors should be at least 40% against the calculated 2030 emissions, or 29,236.87 tCO_2 eq, whereas the mitigation actions estimate emission reduction at 42,464.22 tCO_2 eq.
The actions implemented in the municipality have achieved 908.8 $tCO_{2\,eq}$ out of the 29,001.45 tCO_{2eq} set in 2016.
According to the BEI, the sectors contributing the most to the carbon footprint are the residential (56.2%), followed by the tertiary Sector (37.92 %).
Due to the economic crisis that was followed with an electric shortage crisis, a large number of the Lebanese citizens whether in the residential or commercial sector have shifted towards renewable energy solutions such as photovoltaic systems with and/or without storage capacity. Therefore, Jdeideh El Chouf - Lebanon has witnessed an increase in PV installations by around 21% in households making the total share of PV in the energy mix 7%. Moreover, since Jdeideh El Chouf - Lebanon is in a cold region relative to the Lebanese weather, Jdeideh – Lebanon citizens use heating oil for heating in the winter. This has decreased by a margin of 30% with a 30% increase in firewood usage.

In **Tunisia**, there is no development of SEACAPs. There are equivalent plans, called Climate Action Plans.

In **Jordan**, no update has been done on the SECAP baseline. Yet the mitigation and adaptation measures were reviewed to investigate the impact level on both GHG emission and energy consumption.

The table below summarizes energy consumption as per the updated SEACAPs (based on the data provided) within the municipalities in project partner countries.

Table 2 - Energy consumption per municipality and energy source

Municipality - Source (MWh)	*Jdeideh – Lebanon*	*ASEZA – Jordan*	*Lloret de Mar – Catalunya*	*Sax - Valencia*	*Aigialeia - Greece*	***Total***
Electricity	44,031.03	386,623	184,075.68	33,643.40	109,189.78	**702,373.11**
LPG	22,518.10	36,352.00	4,696.88	7,365.83		**70,932.81**
Diesel	438.31	153,595.00	350,193.97	4,802.80		**509,030.08**
Gasoline	7,330.68	130,679.00	43,406.87	2,171.34		**183,587.89**
Electric/PV	5,644.87	-	457	-		**6,101.87**
Thermal	218	22,481.00	570	-		**23,269.00**
Heating oil	53,556.71	9,759.00	-	-	134,026.62	**63,015.71**
Kerosene	-	803	-	-		**803**
Natural gas	-	-	113,802.54	-		**113,802.54**
Biomass	-	-		241.1	38,644.76	**241.1**

4.3 Energy Mix Efficiency Plan- Municipality Level

This section showcases a brief assessment of the mitigation actions provided by project partners for their case studies. More details are available in the Annex.

4.3.1 ASEZA- Jordan

ASEZA - Jordan has created comprehensive mitigation actions, putting in place a strategy to address different aspects of sustainability and enhance energy efficiency in their region:

- **Long-Term Impact:** The initiatives, such as energy manager appointment, green building codes, and solar energy integration, indicate a commitment to long-term energy efficiency and sustainability.
- **Collaboration and Stakeholder Engagement:** The involvement of selected professional groups, eco-driving seminars, and promotion of car sharing showcase efforts to engage stakeholders and foster collaboration.
- **Alignment with SEACAP 4 SDG Objectives:** The actions closely align with SEACAP 4 SDG objectives, particularly in sustainable energy access, climate action, and sustainable cities and communities.
- **Waste Management:** The promotion of recycling, reduction of organic waste content, and awareness campaigns exhibit consideration for responsible waste management.
- **Local Economic Development:** The deployment of solar power plants and efficient vehicles contribute to local economic growth through job creation and reduced energy costs.
- **Transportation Initiatives:** Plans for efficient vehicles, eco-driving, car sharing, and solar systems on buses highlight efforts to achieve sustainable transportation.
- **Awareness and Education:** The range of awareness activities, training, and information events indicate a commitment to educational and behavioral change.
- **Renewable Energy Integration:** The integration of solar collectors, PV installations, and solar power plants demonstrates a clear focus on renewable energy integration.
- **Energy Efficiency:** The actions encompass efficient equipment, automation, and green building principles, underscoring a commitment to improving energy efficiency.
- **Comprehensive Approach:** The actions span various sectors, including municipal, residential, tertiary, transportation, and local electricity production, indicating a comprehensive strategy.

The mitigation actions of ASEZA - Jordan reflect a comprehensive and integrated approach to energy efficiency and sustainability. They are aligned with SEACAP 4 SDG objectives, emphasize collaboration and stakeholder engagement, and highlight a commitment to long-term impact. The incorporation of renewable energy, energy-efficient technologies, and education demonstrates ASEZA's - Jordan dedication to achieving sustainable energy goals across different sectors.

4.3.2 Jdeideh El Chouf - Lebanon

The proposed mitigation actions for the SEACAP at Jdeideh El Chouf - Lebanon demonstrate a well-rounded and proactive strategy to address energy efficiency and sustainable practices across various sectors. The assessment of these actions are summarized below:

- **Comprehensive Approach:** The mitigation actions span a wide range of sectors, including municipal buildings, street lighting, residential and tertiary buildings, transportation, local renewable energy production, waste management, and agriculture. This approach ensures thorough coverage of key areas contributing to energy consumption and emissions.
- **Energy Efficiency:** The incorporation of energy-efficient technologies, such as LED lamps, motion sensors, efficient air conditioners, street lighting, in municipal buildings, residential and tertiary sectors, showcases a commitment to reducing energy consumption and energy costs.
- **Renewable Energy Integration:** The inclusion of photovoltaic systems in municipal buildings, rooftops, and even the establishment of a PV farm highlight the emphasis on renewable energy adoption. This action not only reduces dependence on fossil fuels but also contributes to the local generation of clean energy, and reducing CO_2 emissions.
- **Awareness and Education:** The planned awareness campaigns for municipal employees, communities, residents' associations, and the public reflect a proactive effort to promote energy-saving behaviors, create a culture of sustainability, and encourage citizen engagement.
- **Transportation Initiatives:** The transport sector actions, including promoting eco-driving, car sharing, and cycling, demonstrate a recognition of the transportation sector's significant energy consumption. These initiatives aim to reduce emissions while encouraging sustainable and efficient travel choices.
- **Local Economic Development:** Implementing initiatives like the PV farm and energy-efficient upgrades can potentially contribute to local economic growth through job creation, technological advancement, and reduced energy expenses.
- **Waste Management and Agriculture:** Addressing food waste through awareness campaigns and promoting reforestation indicate consideration of environmental sustainability beyond energy efficiency.
- **Alignment with SEACAP 4 SDG Objectives:** The mitigation actions closely align with the project's objectives. The actions not only contribute to emission reduction but also promote climate resilience and environmental protection.
- **Collaboration and Stakeholder Engagement:** The actions involving awareness campaigns, education, and collaboration with residents' associations and NGOs signify a recognition of the importance of community involvement in achieving sustainable energy goals.

- **Long-Term Impact:** The combination of short-term actions, such as LED lamp replacement, and long-term projects like the PV farm showcases a balanced approach that can yield immediate energy savings while setting the foundation for sustainable practices in the future.

In summary, the proposed mitigation actions for Jdeideh El Chouf – Lebanon display a comprehensive and forward-looking strategy that can contribute significantly to energy efficiency, renewable energy adoption, emission reduction, and overall sustainable development in the municipality.

4.3.3 Lloret de Mar – Catalunya

The mitigation actions for the Municipality of Lloret de Mar – Catalunya align well with the specified criteria:

- **Long-Term Impact:** The actions demonstrate a focus on sustainable development, incorporating measures across sectors like energy, transportation, waste, and water management, aimed at creating enduring positive effects.
- **Collaboration and Stakeholder Engagement:** Initiatives such as the municipal energy manager, mobility manager, and citizen involvement strategy showcase collaboration with stakeholders for effective implementation and engagement.
- **Alignment with SEACAP 4 SDG Objectives**: The actions resonate with SEACAP's goals, addressing energy transition, waste reduction, sustainable mobility, and environmental protection, contributing to the sustainable development goals.
- **Waste Management and Agriculture:** The proposed selective collection enhancement, reduction of single-use products, a new wastewater and sewerage masterplan, and increase of surface and quality of green spaces align with waste management and sustainable agricultural practices.
- **Local Economic Development:** Measures like energy-efficient plans, eco-friendly transportation systems, and green urban planning can stimulate local economic growth through energy savings and eco-tourism.
- **Transportation Initiatives:** Strategies for mobility management, electrification, car-sharing, and cycling indicate a commitment to reducing emissions and enhancing sustainable transportation.

- **Awareness and Education:** Incorporation of the "EUROMAX 100/100" philosophy and awareness campaigns enhance education on sustainable practices among schools and the public.
- **Energy Efficiency:** Energy efficiency plans, retrofits, and monitoring highlight a commitment to reducing energy consumption and costs.
- **Comprehensive Approach:** The strategy covers various sectors including energy, transportation, waste, water, nature, and citizen engagement, indicating a well-rounded and integrated approach.

Incorporating these indicators into the assessment, the mitigation actions for the Municipality of Lloret de Mar – Catalunya are seen to be well rounded, encompassing various dimensions of sustainability. These actions reflect a multifaceted approach that considers not only environmental aspects but also societal, economic, and technological factors to promote a more sustainable future.

4.3.4 Sax - Valencia

The Municipality of Sax - Valencia has formulated an extensive set of mitigation measures, reflecting a comprehensive approach to addressing various aspects of sustainability and energy efficiency:

- **Long-Term Impact:** The array of measures, such as energy audits, equipment optimization, and renewable energy installations, indicate a commitment to sustained energy efficiency and long-term impact.
- **Collaboration and Stakeholder Engagement**: The establishment of committees, energy managers, and community awareness programs showcase a dedication to involving stakeholders and fostering collaboration.
- **Alignment with SEACAP 4 SDG Objectives:** The actions align well with SEACAP 4 SDG objectives, particularly in energy access, climate action, and sustainable cities and communities.
- **Waste Management and Agriculture**: Initiatives to sensitize employees, promote energy-efficient practices, water recycling and plans against forest fires demonstrate consideration for responsible waste practices.
- **Local Economic Development:** Implementing activities like efficient purchasing, green energy procurement, and energy-efficient building permits contribute to local economic growth through job creation and reduced energy costs.

- **Transportation Initiatives:** Plans for efficient transportation, vehicle fleet upgrade, and cycling promotion, align with sustainable mobility goals.
- **Awareness and Education:** A comprehensive set of awareness programs, training, and sensitization efforts for both employees and residents emphasize commitment to education and behavior change.
- **Renewable Energy Integration:** The inclusion of solar and wind energy, along with energy efficiency, showcase a comprehensive approach to renewable energy integration.
- **Energy Efficiency**: The actions encompass energy-efficient equipment, lighting, building upgrades, and insulation, indicating clear dedication to improving energy efficiency.
- **Comprehensive Approach:** The mitigation actions of Sax - Valencia illustrate a comprehensive approach to energy efficiency and sustainability.

These actions align well with SEACAP 4 SDG objectives, prioritize collaboration and stakeholder engagement, and highlight long-term impact. The integration of renewable energy, efficient technologies, and education underscores Sax's commitment to achieving sustainable energy goals across various sectors.

4.4 Selecting a Pilot Building/s- Level 2 Demonstrator

This section is exclusive to the Level 2 Demonstrators developed in South Med countries.

4.4.1 Egypt Case Studies – Alexandria Water Company

The Alexandria Water Company manages various public buildings across Alexandria, Behera, and part of Matrough Governorates. The Technical Secondary School in the Amria district of Alexandria was chosen as a pilot building for the region's schools. The school has 132 students and spans four floors, covering approximately 4,300 m². It includes facilities like a water analysis lab, workshops, library, and computer labs. The school plans to retrofit its infrastructure, and the project's outcomes will address these retrofitting efforts.

4.4.2 Jordan Case Studies – Educational Sector

After consulting with the municipality team, it was concluded that schools are the ideal choice to proceed with. This decision was reached during a meeting with Living Lab members, taking into account both the social and environmental impacts on the local community. Following this agreement, ASEZA - Jordan recommended three specific schools for an energy audit, the Jordan Boys' High School, the Jordan Girls' High School and Jordan Mixed Elementary School. These schools were selected because they are considered representative samples of most educational facilities in the region, allowing us to conduct a comprehensive and relevant analysis.
In selecting these school buildings, we prioritized the following key aspects:

- School Size: To encompass a broad community.
- Gender Inclusivity: Selections included boys-only, girls-only, and mixed-gender schools.
- Development Prospects: Schools where administration demonstrated openness and enthusiasm for future facility enhancements.
- Energy Profile: A consideration of diverse facilities and installed appliances, including space heating and cooling, to represent various energy uses.
- Potential for Retrofitting: An evaluation of the adaptability and opportunity for energy-efficient improvements.

4.4.3 Lebanon Case Studies – Education Sector

After the first site visit, the LCEC team has selected two buildings to continue with the Level 2 Demonstrator. The first was the Moukhtara High School" and the second was the Development Services Center in Al Moukhtara. This selection was based on the needs of the municipality. In

addition, the municipal building is not often used, therefore, it would not be a great fit to conduct a study on this building.

However, it is important to note that the school holds significant importance within the context of this selection process. Being a public high school, it serves as a vital institution for families with low income. As such, it plays a crucial role in the social aspect of the project, as it provides educational opportunities for students who may not have access to other resources. The inclusion of this school in the project aims to address the specific needs and challenges faced by these students and their families.

Similarly, the development service center also holds a prominent position in the selection. As a governmental center, it houses a healthcare facility that serves the local community. The center plays a critical role in providing essential healthcare services to residents, particularly those who may not have access to private healthcare options. By including this center in the project, the aim is to address the specific energy needs of the healthcare facility and contribute to its sustainability. This, in turn, ensures that the center can continue to provide vital healthcare services to the community in a reliable and efficient manner.

Both school and development service center were chosen not only for their energy consumption characteristics but also for their broader social significance within the project's scope. The inclusion of these institutions demonstrates a commitment to addressing the needs of vulnerable communities and supporting their social wellbeing through sustainable energy solutions.

4.4.4 Tunisian Case Study – City Hall

Similarly, in Tunisia, the City Hall of Bizerte was selected to be the pilot building for the present project.

This choice was made using an agile - and therefore iterative – approach. Preliminary discussions within the team of experts, in preparation for the meeting with the Municipality and MEDREC teams, set the criteria and constraints for the choices to be made. The reflections were completed and adjusted during a meeting held at the premises of the Municipality of Bizerte – Tunisia, and second, following the training on SRP outcomes.

Among the buildings belonging (managed) to the municipality, the City Hall represents a significant heritage, memorial and affective value for the inhabitants of Bizerte – Tunisia. Its renovation would have a major social impact. Its strategic position as a landmark in the city would also make it easier to disseminate and replicate initiatives.

The building typifies the colonial architecture present in the city centre of Bizerte – Tunisia, but also in most of the city centres of Tunisian coastal cities. It underwent an in-depth energy audit in

2019, which therefore allowed having data on which the analyses were based. This makes it easier to replicate the actions proposed.

5. Building Energy Efficiency Action Plans

5.1 Case Studies-Proposed Measures

After selecting the buildings, project partners and selected external entities conducted site assessments to gather data required for the energy audits.

5.1.1 Egypt

To implement the Energy Mix Efficiency Plan, the following steps were undertaken:

- Collecting school's connected load and time schedule.
- Reviewing energy consumption records from the energy meter for the past year.
- Evaluating the effectiveness of implemented energy-efficient actions and the current situation.
- Installing an online monitoring system to track daily consumption.
- Calculating the school's carbon footprint in its current state.
- Determining average consumption.

Based on the analysis and proposed action plan, the following measures can be implemented:

- Behavior-Based Measures:
  - Creating an energy management team.
  - Implementing initiatives and assessing their impact.
  - Updating the maintenance schedule.
  - Applying the Edufootprint toolkit to address impact.
- Technology-Based Measures:
  - Installing roof-mounted solar panels (PV).
  - Implementing smart metering and automatic lighting.

5.1.2 Jordan

In Jordan, the loads were categorized as: Lighting, split unit fans, AC exterior units, PCs, Pumps, and other loads, in the three schools accordingly. As a result, it was found that the AC exterior units have the highest percentage of electrical consumption among the three schools, 67%, 65%

and 72% in Jordan Boys' High School, Jordan Girls' High School and Jordan Mixed Elementary School respectively.

As for the proposed measures, it is recommended for the three schools to:

- Replace the existing conventional lighting by a higher efficiency LED Tube Lighting
- Apply automatic control of lighting and AC system using occupancy sensors
- Install a Wi-Fi smart switch to automatically deactivate power supply upon the conclusion of the school day

Meanwhile in the Jordan Boys' High School, it is recommended to modify lighting control circuits to allow partial lighting at the classrooms.

5.1.3 Lebanon

In Lebanon, two energy audits were performed on the school and the development service center. The energy analysis in the school categorized the loads as: Lighting, motors/pumps, heating, cooling, and office equipment. However, according to the electrical energy balance, the electric load was the major consumer of electricity in the building making up to 72% of the total electrical consumption.

On the other hand, in the development service center, the loads were categorized as: Lighting, medical equipment, HVAC, IT and other loads (fridges and electric heaters…). The electrical energy balance resulted in a breakdown of the electrical consumption in the center, where medical equipment had the largest share of the consumption of 40%, followed by other loads with 31%.

The proposed measures for both the school and the center are:

- Motion detector in individual offices – for both school and the center
- Lighting retrofit – for both school and the center
- Improve building insulation – for the center
- Solar PV installation – for both school and the center
- Use of wood pellets instead of diesel in heaters – for the center
- Waste heat recovery from generator - for the school

5.1.4 Tunisia

Based on the energy audit performed for the City Hall of Bizerte – Tunisia, the establishment's electricity consumption is mainly divided into four sectors:

- Air conditioning, with 65% of electricity consumption, is the most significant use with enormous energy saving potential.
- Office automation and equipment: Representing 20% of electricity consumption and allowing the operation of the various IT installations.
- Lighting: Representing 12% of electricity consumption, consisting of lighting at the premises of the establishment, including outdoor lighting.
- Miscellaneous items represent approximately 3% of total electricity consumption.

To identify retrofit solutions, the abacus developed by the project Med-EcoSuRe and the repository of good practices and the briefs of the PrioritEE toolbox were very useful. Moreover, the analytical database of the PrioritEE toolbox offers a large panel of products used in the Mediterranean region. The considered measures for an eco-rehabilitation of the building aim to improve its energy performance and that of its use by offering possibilities of appropriation by the citizen. It also aims to strengthen the relationship with the public space. In addition to the strict energy aspect, the approach aims to take into account the heritage and memorial dimension and emphasize the social and solidarity economy dimension.

Given the context of the Municipality of Bizerte – Tunisia, the use of passive measures was favored with the occasional use of more active measures.

The measures were identified in collaboration with the Living Lab members and based on the results of a challenge that was organized for architecture students.

These measures include:

- Upgrade the Opaque envelope
- Upgrade the windows (air infiltration and glazing)
- Manage and optimize inner spaces
- Integrate Shading Devices
- Valorize Daylight
- Allow Natural ventilation
- Insert green elements
- Integrate renewable energy
- Consider efficient plant systems

- Digitalize management
- Regulate Outdoor microclimate
- Increase the integration of renewable energy resources
- Allow greater appropriation of public space and improve its quality
- Promote sustainable behaviors: Green Nudges

5.2 Criteria of Prioritization

Following the delivery of training sessions on the Selected Reference Projects, each partner has selected a tool/s to proceed with both Levels 1 and 2 Demonstrators.

In **Jordan**, NERC identified the measures for the three schools, and calculated the total savings for the all the measures in each school.
Starting from Jordan Boys' High School, the proposed measures were estimated to reduce 4,500 $kgCO_{2\text{-}eq}$, where the cost of savings would reach €3,450.
In a similar scenario in both the Jordan Girls' High School and Jordan Mixed Elementary School, emission reduction was estimated to reach 3,815 $kgCO_{2\text{-}eq}$ in the girls' school with €2,925 in savings. On the other hand, 10,904 $kgCO_{2\text{-}eq}$ of emissions shall be reduced with savings reaching €8,360 in the mixed school.

In **Lebanon**, using the Impulse tool and the results from the energy audit, the proposed measures were prioritized as follows:

- For the Mokhtara High School:
    1. Lighting control
    2. Heat recovery from generator
    3. Installation of PV
    4. Lighting retrofit
- For the Moukhtara Development Service Center:
    1. Use of pellets instead of diesel in heater
    2. Installation of PV
    3. Lighting retrofit
    4. Lighting control
    5. Building Envelope Retrofit

The energy audit has shown a significant decrease in CO_2 from the proposed measures, reaching 10,697 $kgCO_{2\text{-eq}}$ in the school and 3,810 $kgCO_{2\text{-eq}}$ in the center, with an estimate cost savings of around €4,227 at the school and €1,305 at the center annually.

In **Tunisia**, a comparison of the profitability of the different retrofits was performed by comparing their respective simple payback periods. Replacing neon lighting by LED lights is the most profitable with a simple payback period of 0.1 year. Then comes the replacement of electrical heating by gas heating with a payback period of 2.65 years. The installation of a PV system yields the usual 7.23 years of payback period. On the other hand, the envelope insulation and window double-glazing is not profitable. It has a payback period of 44.64 years. This is offset in the deep retrofit with the much shorter payback periods of all the other retrofits, resulting in a simple payback period of 10.85 years for the deep retrofit.
Based on the above discussion, the following retrofits are deemed profitable and are therefore recommended in this order of priority:

1. Replacement of all neon lighting by LED lights.
2. Changing the improvised electrical heating by gas heating.
3. Installing 25 kWp of PV electrical generation.

In **Egypt**, based on feasibility analysis, financial scheme, system efficiency, and implementation limitations, the applicable measures are as follows:

- All behavior-based measures have been implemented.
- Technology-based measures based on priorities:
    - Priority 1: Implementing smart meters for energy monitoring and supporting behavior-based measures, with a payback of less than one year, targeting over 10% energy reduction.
    - Priority 2: Installing a 20kW or larger roof-mounted PV system. Financing options include a national bank loan or an Independent Power Producer (IPP). Payback is approximately 8 years. IPP implementation is recommended. This PV system could reduce consumption by over 50% and cut carbon footprint by 1,8352 kg CO2eq/year (Edufootprint analysis in Figures 17 and 18).

- Smart lighting implementation is less efficient due to:
    - High implementation cost.
    - Effectiveness of behavior-based measures and energy management campaigns.
    - Economical when done alongside overall building retrofitting.
    - Feasibility of using IR cameras to control lighting based on class schedules and energy team input.

6. Assessment of the Project's Impact

The SEACAP 4 SDG project in Greece, led by the University of Patras, focused on enhancing sustainable energy practices and efficiency. It involved renovating public buildings in Aigialeia Municipality through energy audits, action plans, and renewable energy installations like solar panels. In Italy, the City of Napoli's SEACAP methodology has evolved through projects like CLARITY and KNOWING, enhancing climate resilience and adaptation. In Catalunya, Lloret de Mar's SEACAP initiative began with a municipality and external support selection, followed by Living Labs training and tool utilization. Valencia's Sax Municipality also partnered with an external expert, AZIGRENE, for SEACAP development. In Lebanon, implemented actions include lighting retrofit and solar installations between 2016 and 2022. A partnership was also established between the municipality and an external expert to provide support in updating the SEACAP. Consequently, in Jordan, SEACAP implementation was limited due to project scope, focusing on roadmap validation and impact assessment using the PRIORITEE tool. Moreover, behavior-based measures were successfully implemented and assessed in Egypt. These measures encompassed enhancing staff skills, forming an energy management team, observing staff initiatives, deploying chosen toolkits, and monitoring energy usage. The effects of each measure were detailed and analyzed in subsequent sections.

Furthermore, in Lebanon, the proposed measures resulting from the energy audit that takes into consideration the needs of the Moukhtara High School and the important role of the school in the region, a 20kWp solar PV system with 30kWh storage will be installed.

6.1 Meeting SEACAP4SDG project goals

In **Jordan**, although physical implementation did not occur during the project, the projected roadmap will lead to substantial energy consumption savings of 41,915 kWh and a CO_2 emission reduction of 19,218 kg/year, surpassing the initial target of 10,000 kWh reduction.

Tunisia's approach involved assessing and evaluating proposed measures to determine the best strategies for its socio-climatic region, emphasizing cost-effective retrofit scenarios and sustainable material choices.

IVE effectively achieved its project objectives by practically analyzing the toolkit resources. Expert external evaluators like AZIGRENE and the Municipality of Sax - **Valencia** ensured the identification of feasible measures for adoption.

IREC achieved most of the SEACAP 4 SDG goals by involving multiple authorities and stakeholders. Lloret de Mar – **Catalunya** now possesses a well-defined, collaboratively developed SEACAP with clear 2030 objectives, setting the stage for successful implementation.

The University of Patras indicates that the implemented measures aligned perfectly with the SEACAP 4 SDG project goals. The project aimed to enhance energy efficiency in public buildings, reduce carbon emissions, and promote the use of renewable energy sources. The renovation and energy upgrade efforts successfully contributed to achieving these goals by significantly improving the energy performance of the buildings and reducing their environmental impact. Moreover, the project's emphasis on community engagement and knowledge dissemination ensured the wider adoption of sustainable practices.

Italy's Naples integrated SEACAP 4 SDG tools into their inventory, enhancing their capacity to fight climate change through energy efficiency improvements in public buildings. Key tools, such as GIS-integrated KPI processors and sustainable building assessment tools, were successfully integrated.

Lebanon's energy analysis of both Level 1 and 2 Demonstrators underscored the effectiveness of proposed measures. The roadmap for the school and center showed the potential to save over 17,000 kWh and reduce 14,500 $kgCO_{2\text{-}eq}$ in emissions.

In **Egypt**, the measures achieved over 10% energy reduction for beneficiaries and planned actions are projected to raise it to over 60%. Extrapolating pilot indicators to all municipal and similar school buildings (about 30% of total consumption) reveals that the expected citywide reduction ranges from 3% (conservative scenario) to 18%. Hence, the project aims to surpass its goal by achieving over 5% in energy consumption reduction.

6.2 Barriers and Constraints

For **IREC**, the main challenge was the limited time available for implementing the SEACAP mechanism, compounded by the need for consensus among diverse stakeholders. Additionally, local elections led to a change in administration in Lloret de Mar – Catalunya, affecting the process. Solutions involved extending the timeline and providing support to experts. Public participation sessions were postponed due to the elections. Plans to hold public presentations are scheduled for Autumn 2023.

According to **IVE**, no major barriers were encountered, probably because the small size of the municipality together with the high interest of its politicians has facilitated the process. Moreover, although there have been municipal elections, the same team has remained in office, so our interlocutors have always been the same.

Throughout the project, **NERC** encountered challenges that required problem solving and collaboration. These obstacles and solutions can offer insights for future endeavors:

- Tool implementation issues: bugs and data calculation problems with the Toolkit. Communication with the developer helped resolve them. Future projects should pre-test tools and maintain regular contact with developers to prevent similar issues.
- Data collection challenges: Limited data availability for SECAP review caused setbacks. To overcome this, the use of alternative sources and the engagement of local authorities was necessary. Future projects should prioritize robust data collection plans and backup strategies.
- Project timeframe limitations: The project's timeline did not account for interdependent WP outputs and other unforeseen issues, leading to delays in delivering outcomes within the allocated timeframe.

The challenge in Lebanon as per the **LCEC** relates to the data collection as it took time to be ready. For example, not all the data in the school was recorded and so it was imposed to work with data from 2017. In addition, Edufootprint was disregarded when working with Level 2 Demonstrator. It was not applicable for Lebanon as there were several fixed parameters that cannot be modified.

For **MEDREC**, during the establishment of the LLL, challenges emerged including difficulties in stakeholder identification and involvement, leading to altered communication methods. Limited responsiveness of actors and changes in municipal contact persons added to management and

scheduling complications. Academic calendar constraints and frequent personnel changes posed further hurdles. Solutions included regular meetings, workshops, and clearly defined stakeholder roles based on project phases. For instance, students participated in framing knowledge and co-creating renovation scenarios for the chosen pilot building.

During project implementation, challenges faced by **UPatras** included managing technical complexities within budget constraints, selecting the municipality, navigating regulations, and ensuring long-term maintenance. Solutions involved careful planning, collaboration with local authorities, capacity-building, training, and maintenance protocols. Sharing these experiences can offer guidance on strategic planning, stakeholder engagement, and addressing technical/administrative challenges for successful outcomes.

The only issue that **AASTMT** has faced was the approval of financing schemes to implement the technology-based measures.

In summary, the obstacles faced were substantial but not insurmountable. By adopting proactive communication, data collection planning, and flexible timelines, we were able to navigate through these challenges. These lessons learned could be used as unified solutions or warnings for future projects, helping them to be more aware and prepared.

7. Future plans and recommendations

7.1 Future plans for the SEACAP 4 SDG project

In planning for future involvement in SEACAP 4 SDG projects or similar initiatives or identifying aspects from this project that might be altered, our focus would center on strengthening outcomes and encouraging more municipalities to develop SECAPs or SEACAPs. To achieve this, we would concentrate on the following strategies:

- Conducting awareness campaigns: Creating and launching public awareness campaigns would increase understanding and acceptance of the project's goals and methods. By educating the community about the importance of Renewable Energy (RE) and Energy Efficiency (EE), we could foster more comprehensive support.
- Implementing impactful RE or EE measures: Future projects should focus on implementing the most effective and influential RE or EE measures. This would include not just planning but

actual execution, translating ideas into concrete actions that lead to tangible energy savings and sustainability benefits.

- Addressing data challenges: Our experience has shown the critical importance of data availability, collection, and management. Future initiatives must emphasize a systematic approach to data handling, ensuring accurate and timely information to guide decision-making.
- Enhancing collaboration: Building stronger relationships with municipalities, local authorities, and other stakeholders can create a more unified approach. This partnership ensures that the project aligns with local needs and leverages local expertise.
- Monitoring and continuous improvement: Implementing regular monitoring and evaluation mechanisms would enable real-time adjustments and continuous improvement, ensuring that the project stays on track and learns from any challenges encountered.
- Flexibility in implementation: Allowing room for adaptations and alterations based on ongoing feedback and emerging trends ensures that the project remains relevant and effective.
- Time constraints: The duration of the SEACAP 4 SDG project has been the main handicap faced. Based on everything developed, the process would now be easily replicable, and it could be interesting to carry it out in other municipalities in the same regions, to end up creating a community that could act as a task force on the problems of how to mitigate and adapt to climate change, which ultimately requires collaboration between municipalities.

By integrating these aspects, the aim would be to create a more resilient, impactful, and forward-thinking approach in future projects. This vision represents a synthesis of our learnings from the current project and a commitment to continuous improvement and innovation.

7.2 Recommendations for scaling up the project in other regions

- Encouraging new municipalities to develop a Sustainable Energy and Climate Action Plan (SEACAP) requires a comprehensive approach that combines information dissemination, relationship-building, and practical support. Here's how this could be achieved:
- Educational outreach: Start with an awareness campaign that educates municipalities about the benefits of SEACAPs. This might include workshops, webinars, informational brochures, and case studies showcasing the success of existing SEACAPs.

- Share success stories: Elaborate examples of municipalities that have successfully implemented SEACAPs. Real-world success stories can be powerful motivators, illustrating the practical benefits and positive impacts.
- Provide technical assistance: Many municipalities may be interested but unsure where to start. Offering technical support, guidance, and toolkits can help them take the first steps. This might include assistance with data collection, identification of appropriate RE and EE measures, and support in planning and implementation.
- Facilitate peer networking: Encourage interactions between municipalities that have successfully developed SEACAPs and those considering them. Peer-to-peer learning can provide unique insights and foster a sense of community and shared purpose.
- Incentivize participation: If possible, identify and promote incentives that might encourage municipalities to develop SEACAPs. This could include grants, technical resources, public recognition, or other forms of support.
- Promote transparency and collaboration: Encourage municipalities to include various stakeholders in the development of SEACAPs, such as local businesses, NGOs, and community members. This inclusive approach can build broader support and enhance the plan's effectiveness.
- Utilize media and social platforms: Engage with local media and utilize social media platforms to reach a wider audience, sharing success stories, upcoming events, and key messages about the importance of SEACAPs.

Furthermore, LCEC is collaborating with four municipalities as part of the Green City project. The Energy Action Plan devised for the Moukhtara High School in the SEACAP 4 SDG project will be replicated and implemented across all four municipalities. Similarly, for MEDREC, the Energy Efficiency Action Plan and roadmap created for the Municipality of Bizerte – Tunisia can be shared with other municipalities in Tunisia to adopt and/or adapt some of the measures proposed.
However, in the Valencian region, it is possible to encounter new municipalities through the Valencian Federation of Municipalities and Provinces (FVMP), Energy Agency of Alicante and through the contacts list in IVE's database.

7.3 Opportunities for Partnerships

Following the SEACAP 4 SDG project, all the partners are in favor of collaborating on other projects are initiatives targeting energy efficiency, sustainable energy and fighting climate change. External partnership can be established in collaborating with NGOs, Energy Agencies, Ministries and any initiative with goals that align with the SDGs.

8. Summary

The SEACAP 4 SDG project has accomplished substantial achievements, leaving a notable impact on both society and environment. Through a series of well-designed actions and activities, the project has created a positive transformation in the area of sustainability and climate resilience.
The project's scope contains several initiatives that collectively contributed to its success. Notable actions included the development and implementation of a comprehensive toolkit, providing municipalities with practical solutions for crafting and executing their Sustainable Energy and Climate Action Plans (SEACAPs). This approach streamlined planning processes, ensuring that municipalities were equipped with effective tools to drive sustainable change.
Collaboration was a target of the project, with engagement extending to key stakeholders such as municipalities, external experts, and local communities. The project's emphasis on data collection and analysis served as a foundation for informed decision-making. By gathering comprehensive information on energy consumption patterns and CO_2 emissions, the project paved the way for targeted interventions that maximized impact.
Several sectors were targeted for energy efficiency interventions, leading to the proposal of different measures. This translated into a substantial energy savings target and reduced carbon emissions, making significant strides in climate change mitigation.
Moreover, the project extended its impact through awareness campaigns and training initiatives. The education of municipal employees and the wider community about sustainable energy practices and climate change effects fostered a culture of environmental responsibility and understanding.

The SEACAP 4 SDG project stands as a testament to the power of collaborative efforts, data-driven strategies, and comprehensive planning. The targets of planning in energy efficiency, emission reduction, public awareness, and policy alignment underscore the project's lasting impact on society and environment.

9. Annexes – Detailed Results Per Partner

This annex section details the L1 and L2 Demonstrator results per partner.

9.1 AASTMT – Egypt

Figure 1 - Area covered by the municipality

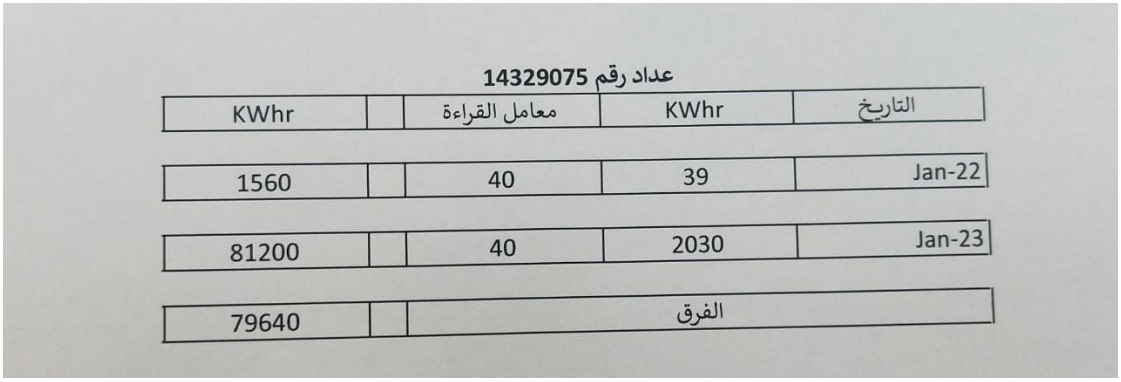
Figure 2 - The secondary technical school of water company as a beneficiary

Figure 3 - The local Living lab training – Egypt

Figure 4 – Site visits - Egypt

عداد رقم 14329075

معامل القراءة	KVhr		KWhr		معامل القراءة	KWhr	التاريخ
40	26		80200		40	2005	26/12/2022



عداد رقم 14329075

KWhr		معامل القراءة	KWhr	التاريخ
1560		40	39	Jan-22
81200		40	2030	Jan-23
79640		الفرق		

Figure 5 - Energy Meter Reading within 2022 and 2023 and during the site visit – Egypt

حصر الإنارة الداخلية والخارجية للمدرسة الفنية الثانوية لمياه الشرب والصرف الصحي

م	نوع اللمبة	القدرة (وات)	العدد		الاجمالي (وات)
			كشاف	لمبة	
1	ليد كروية	11	-	49	539
2	ليد كروية	9	-	39	351
3	كشاف (1 لمبة)	18	1	1	18
4	كشاف (2 لمبة)	18	19	2	684
5	كشاف (3 لمبة)	18	24	3	1296
6	كشاف (4 لمبة)	18	131	4	9432
7	كشاف شوارع	150	14		2100
8	كشاف واجهات	250	7		1750
	الإجمالي				**16170**

Figure 6 - Summary of lighting laminar in the school – Egypt

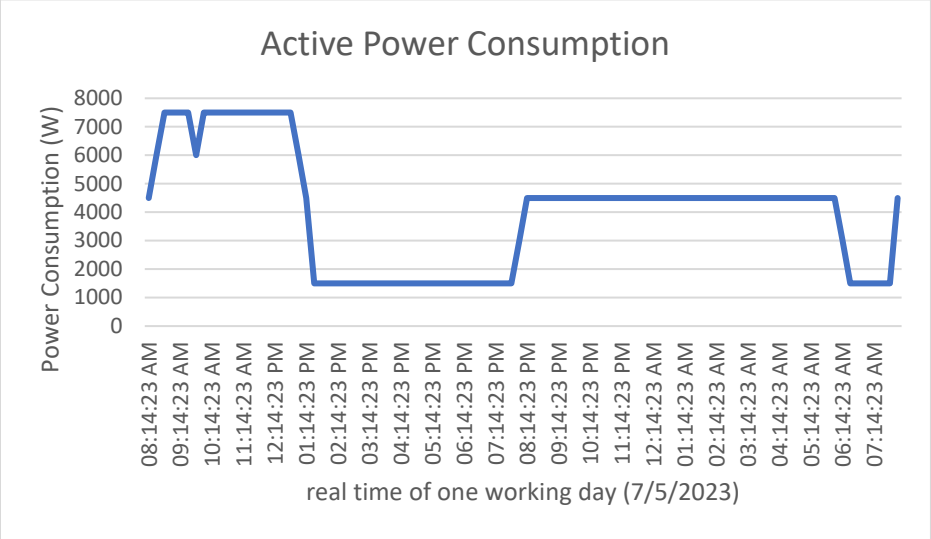


Figure 7 - Real time power consumption of the school for 24 hour working day

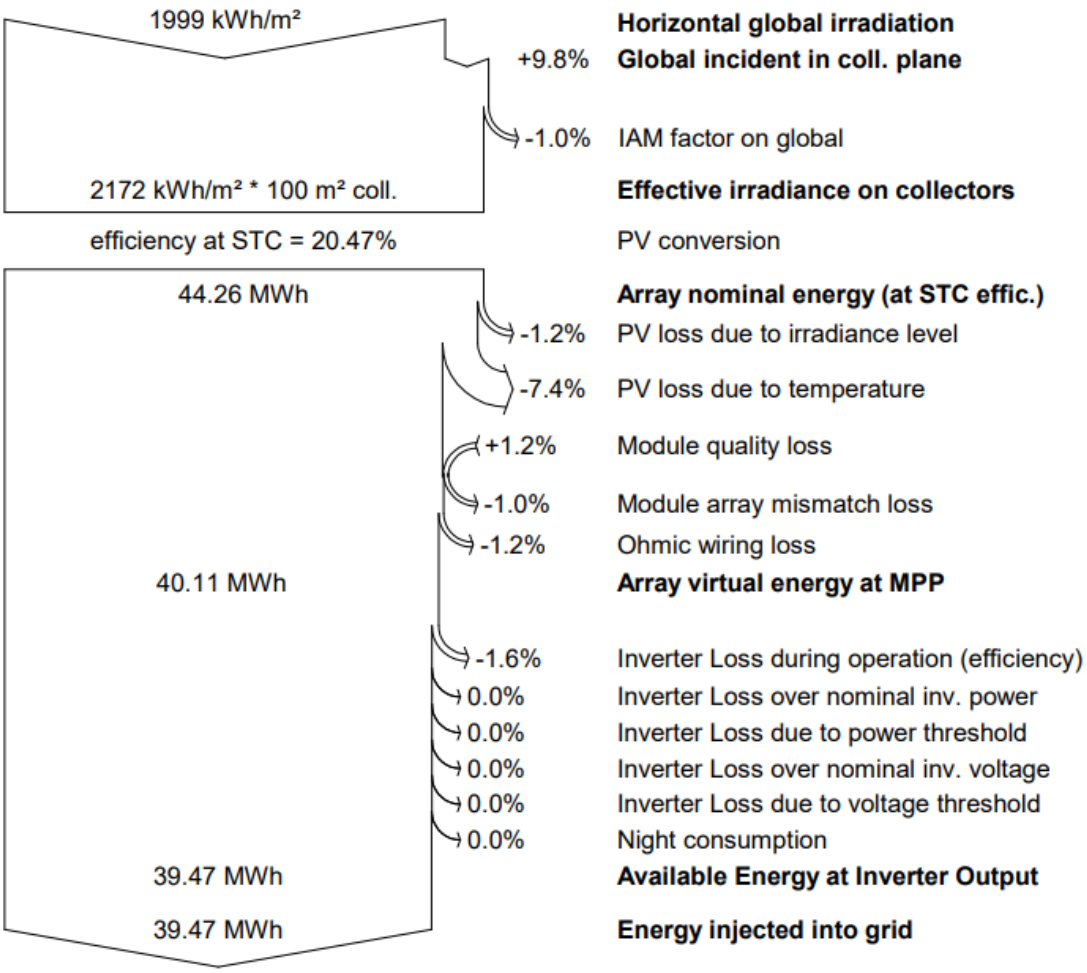


Figure 8 - The expected PV power generation /year - Egypt

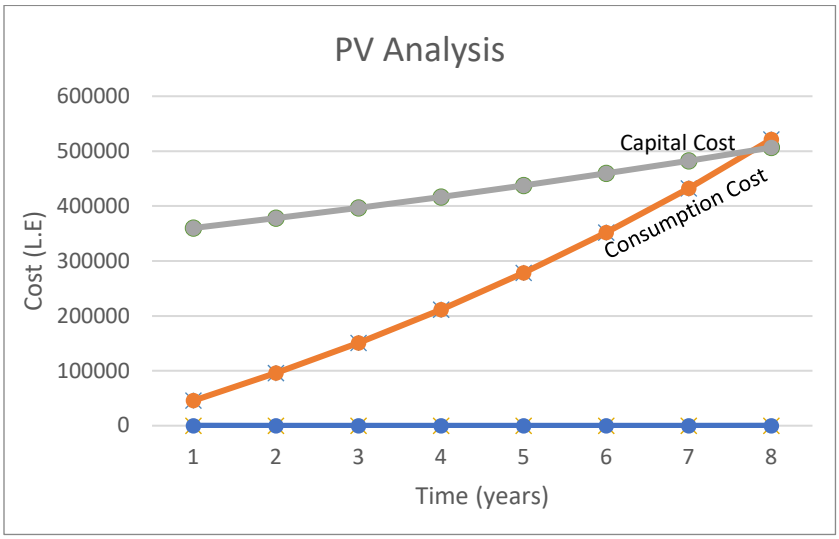


Figure 9 - Cost analysis of 20kW roof mounted PV self-funding - Egypt

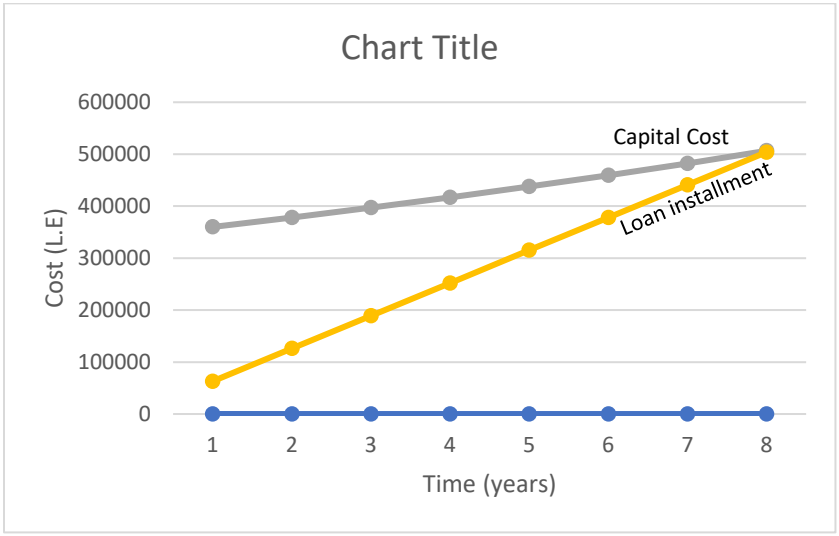
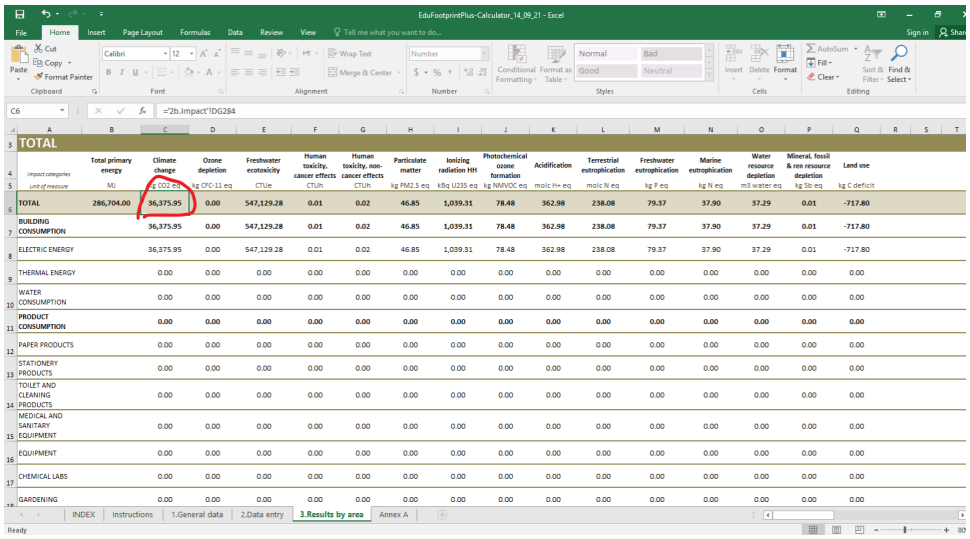


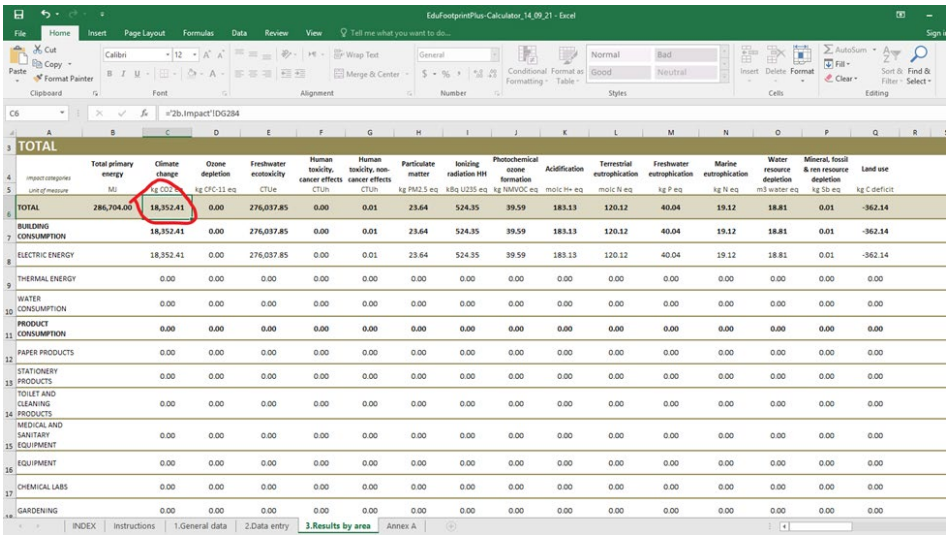
Figure 10 - Cost analysis of roof mounted PV using loan - Egypt



TOTAL

impact categories / unit of measure	Total primary energy (MJ)	Climate change (kg CO2 eq)	Ozone depletion (kg CFC-11 eq)	Freshwater ecotoxicity (CTUe)	Human toxicity, cancer effects (CTUh)	Human toxicity, non-cancer effects (CTUh)	Particulate matter (kg PM2.5 eq)	Ionizing radiation HH (kBq U235 eq)	Photochemical ozone formation (kg NMVOC eq)	Acidification (molc H+ eq)	Terrestrial eutrophication (molc N eq)	Freshwater eutrophication (kg P eq)	Marine eutrophication (kg N eq)	Water resource depletion (m3 water eq)	Mineral, fossil & ren resource depletion (kg Sb eq)	Land use (kg C deficit)
TOTAL	**286,704.00**	**36,375.95**	**0.00**	**547,129.28**	**0.01**	**0.02**	**46.85**	**1,039.31**	**78.48**	**362.98**	**238.08**	**79.37**	**37.90**	**37.29**	**0.01**	**-717.80**
BUILDING CONSUMPTION		**36,375.95**	**0.00**	**547,129.28**	**0.01**	**0.02**	**46.85**	**1,039.31**	**78.48**	**362.98**	**238.08**	**79.37**	**37.90**	**37.29**	**0.01**	**-717.80**
ELECTRIC ENERGY		36,375.95	0.00	547,129.28	0.01	0.02	46.85	1,039.31	78.48	362.98	238.08	79.37	37.90	37.29	0.01	-717.80
THERMAL ENERGY		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WATER CONSUMPTION		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PRODUCT CONSUMPTION		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
PAPER PRODUCTS		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STATIONERY PRODUCTS		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOILET AND CLEANING PRODUCTS		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MEDICAL AND SANITARY EQUIPMENT		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EQUIPMENT		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHEMICAL LABS		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GARDENING		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 11 - Energy consumption and carbon footprint without PV - Egypt



TOTAL

impact categories / unit of measure	Total primary energy (MJ)	Climate change (kg CO2 eq)	Ozone depletion (kg CFC-11 eq)	Freshwater ecotoxicity (CTUe)	Human toxicity, cancer effects (CTUh)	Human toxicity, non-cancer effects (CTUh)	Particulate matter (kg PM2.5 eq)	Ionizing radiation HH (kBq U235 eq)	Photochemical ozone formation (kg NMVOC eq)	Acidification (molc H+ eq)	Terrestrial eutrophication (molc N eq)	Freshwater eutrophication (kg P eq)	Marine eutrophication (kg N eq)	Water resource depletion (m3 water eq)	Mineral, fossil & ren resource depletion (kg Sb eq)	Land use (kg C deficit)
TOTAL	**286,704.00**	**18,352.41**	**0.00**	**276,037.85**	**0.00**	**0.01**	**23.64**	**524.35**	**39.59**	**183.13**	**120.12**	**40.04**	**19.12**	**18.81**	**0.01**	**-362.14**
BUILDING CONSUMPTION		**18,352.41**	**0.00**	**276,037.85**	**0.00**	**0.01**	**23.64**	**524.35**	**39.59**	**183.13**	**120.12**	**40.04**	**19.12**	**18.81**	**0.01**	**-362.14**
ELECTRIC ENERGY		18,352.41	0.00	276,037.85	0.00	0.01	23.64	524.35	39.59	183.13	120.12	40.04	19.12	18.81	0.01	-362.14
THERMAL ENERGY		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WATER CONSUMPTION		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PRODUCT CONSUMPTION		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
PAPER PRODUCTS		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STATIONERY PRODUCTS		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOILET AND CLEANING PRODUCTS		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MEDICAL AND SANITARY EQUIPMENT		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EQUIPMENT		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHEMICAL LABS		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GARDENING		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 12 - Energy analysis and carbon Footprint after using 20 kW PV - Egypt

Table 3 - Daily consumption of the school - Egypt

Date	*Consumption (kWh)*
7/4/2023	96.375
8/5/2023	88.5
9/5/2023	86.625

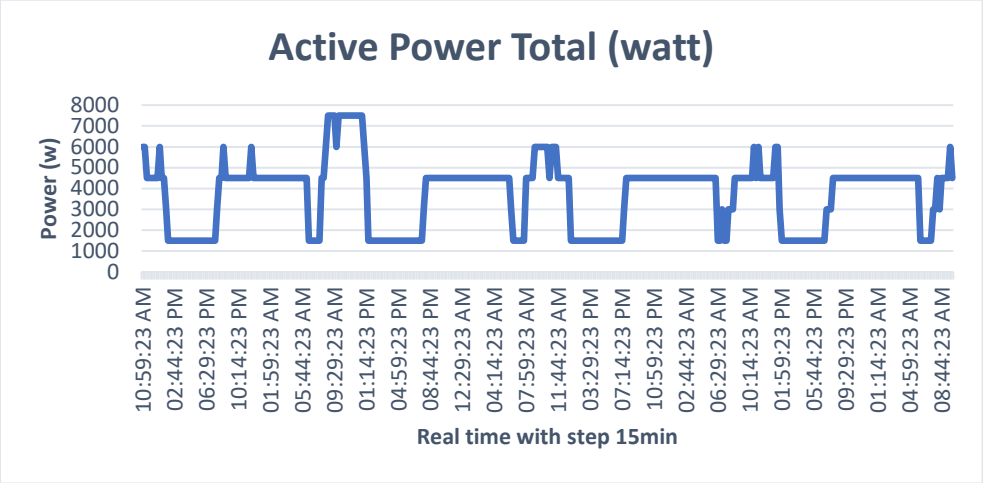


Figure 13 - Online monitoring of power consumption for 4 days (6,7,8,9 May 2023) - Egypt

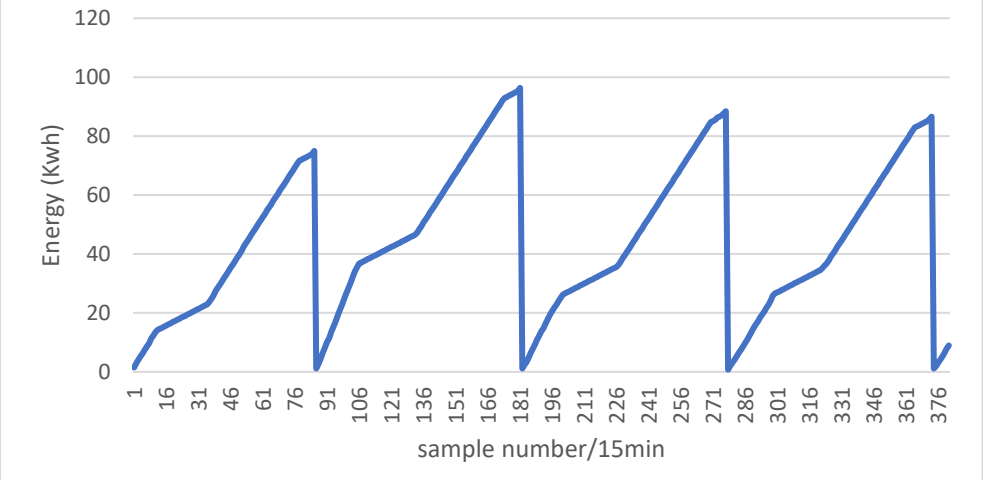


Figure 14 - Energy consumption for 4 days before and during initiative implementation - Egypt

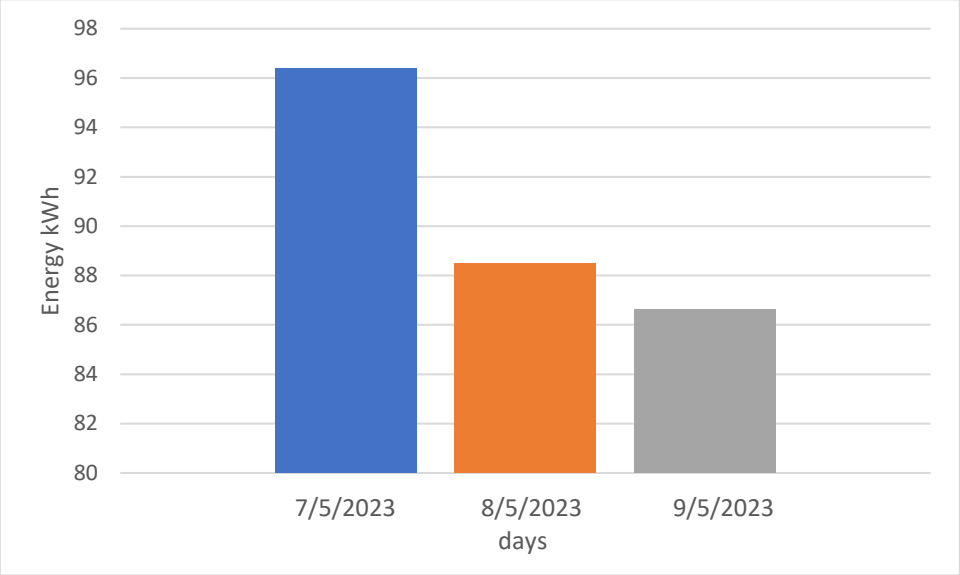


Figure 15 - Total Energy/day before and during the implementation of initiatives - Egypt

Table 4 - Summary of KPI measure - Egypt

KPI	*% Reduction of Energy*	*% Reduction in CO_2*	*Cost*
SEAP Implementation	6	25.8	0
SEAP implemented +Proposed	60%	>60%	39000 LE

RESULTS BY AREA: School's Environmental Footprint

TOTAL

Impact categories / Unit of measure	Total primary energy MJ	Climate change kg CO2 eq	Ozone depletion kg CFC-11 eq	Freshwater ecotoxicity CTUe	Human toxicity, cancer effects CTUh	Human toxicity, non-cancer effects CTUh	Particulate matter kg PM2.5 eq	Ionizing radiation HH kBq U235 eq	Photochemical ozone formation kg NMVOC eq	Acidification molc H+ eq	Terrestrial eutrophication molc N eq	Freshwater eutrophication kg P eq	Marine eutrophication kg N eq
TOTAL	**269,501.76**	**70,449.14**	**0.00**	**1,068,760.66**	**0.01**	**0.04**	**40.92**	**2,352.44**	**110.67**	**463.73**	**330.40**	**178.25**	**67.26**
BUILDING CONSUMPTION		**70,449.14**	**0.00**	**1,068,760.66**	**0.01**	**0.04**	**40.92**	**2,352.44**	**110.67**	**463.73**	**330.40**	**178.25**	**67.26**
ELECTRIC ENERGY		70,449.14	0.00	1,068,760.66	0.01	0.04	40.92	2,352.44	110.67	463.73	330.40	178.25	67.26
THERMAL ENERGY		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WATER CONSUMPTION		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PRODUCT		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

INDEX | Instructions | 1.General data | 2.Data entry | 3.Results by area | Annex A | +

Figure 16 – Edufootprint toolkit results after implementing initiatives - Egypt

Table 5 - List of stakeholders- Egypt

Stakeholder	*Needed*	*Impact*	*Long term engagement*	*Short term engagement*
MED QUAD ENI CBC MED project	Technical skills, research, training, and project management & development.	Harmonization of efforts between stakeholders and optimization of solutions.	x	x
Alexandria Drinking Water Company	Coordination within the municipality and facilitate activities.	Support in public awareness, capacity building, and reaching the target audience.	x	x
New and Renewable Energy Authority	National energy management authority.	Provide energy data needed in analysis.	x	x
RCREEE, Regional Center for Renewable Energy and Energy Efficiency	Regional energy management authority.	Provide energy data needed in analysis.	x	x

9.2 ANEA – Italy

Figure 17 - Per capita CO_2eq emissions in the city of Napoli for 2005 (left) and 2014 (right)

Table 6 - List of Stakeholders - ANEA

Stakeholder	*Needed*	*Impact*	*Long term engagement*	*Short term engagement*
Municipality of Naples	To address several issues related to the CO2 emissions and energy consumption in the local context	Law enforcement and policy making	x	x
LUPT Centre	Technical skills and trainings	Help in local trainings and testing	x	x
EnergyMed 2023 Conference	For spreading awareness about the danger of the continuation of releasing CO2 at the current rate	Conducting seminars, to mitigate these issues	x	x
RENAEL Network		Introduce their clients on energy efficiency measures	x	x

Table 7 - CO_2 emissions per sector in Napoli - Italy

Category	*Reference CO_2 emissions di (2005)*	*Monitored CO_2 emissions (2014)*	*Emissions reduction (2014)*	*Estimated emissions reduction (2020 - PAES 2017)*
Buildings, equipment/installations and industries				
Public administration buildings, equipment/plants	18.326,48	17.748,18	578,30	16.870,66
Buildings, equipment/service sector/industry	818.497,81	833.471,24	- 14.973,43	250.624,73
Residential buildings	905.767,85	755.859,76	149.908,09	162.954,80
Public lighting	27.861,86	24.553,56	3.308,30	27.162,80
Subtotal	**1.770.454,00**	**1.631.632,74**	**138.821,26**	**457.612,99**
Transport				
Public transport	258.385,98	79.345,46	179.040,52	185.447,00
Private and commercial transport	884.573,39	848.343,97	36.229,42	107.000
Subtotal	**1.142.959,37**	**927.689,43**	**215.269,94**	**292.447,00**
Total	**2.913.413,37**	**2.559.467,67**	**353.945,70**	**750.059,99**
Hydroelectric	/	/	2.053,50	2.635,00
Total	**2.913.413,37**	**2.559.322,17**	**354.091,20**	**752.694,99**

Table 8 - Number of actions per sector in Napoli - Italy

Sector of intervention	*n.*	*%*
Building	14	16,28
Lighting	6	6,98
Mobility and transport	25	29,07
Renewable sources and cogeneration	13	15,12
Territorial planning and public green areas	20	23,26
Green procurement	3	3,49
Participation and sharing	1	1,16
Information and communication	2	2,33
Waste reduction and recycling	2	2,33
Total	**86**	**100**

Table 9 - Organization of 85 actions based on SEAP summary framework's field of action subdivision in Napoli - Italy

Action field	*n.*	*%*	*CO_2 reduction estimate (t/a)*	*%*
Buildings, equipment/plants and industries:	24	27.9	354,192.83	47.1
Municipal buildings, equipment/facilities (with integration)	11			
Tertiary buildings, attractions /Plants (with supplements)	5			
Residential buildings (with integration)	4			
Municipal public lighting	4			
Transportation	24	27.9	282,907.00	38.6
Public transport (with integration)	10			
Private and commercial transport – demand push/pull policies (with integration)	14			
Renewable energy production	15	17.4	40,595.16	5.4
Photovoltaic (with integration)	6			
Hydroelectric (ABC)	3			
Other	3			
Spatial planning and public green areas	21	24.4	/	/
Planning	11			
Standard of renovation and new development	3			
Public green areas	7			
Public procurement of products and services	3	3.5	75,000.00	10
Stakeholders' engagement	2	2.3	/	/
Other	4	4.6	/	/
ICT	2			
Waste recycling	2			
Total	**86**	**100**	**752,694.99**	**100**

9.3 IREC – Spain

Figure 18 - 2016 SEAP cover - Catalunya

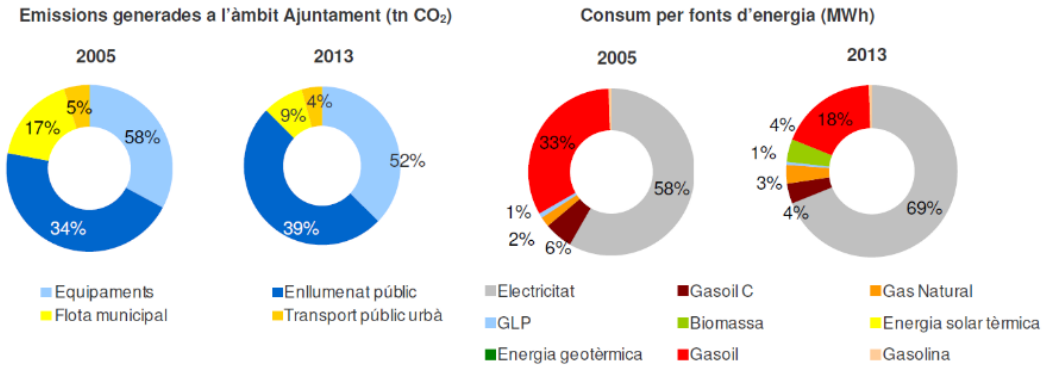


Figure 19 - Example on the evolution of emissions (left) and energy consumptions (right) due to the public facilities of Lloret de Mar - Catalunya

Taula 6.1. Estructura de les accions en sectors i camps d'acció.

Sector	Camp d'acció
1. Edificis, equipaments/instal·lacions	1.1. Edificis i equipaments/instal·lacions municipals
	1.2. Edificis i equipaments/instal·lacions del sector terciari (no municipals)
	1.3. Edificis residencials
	1.4. Enllumenat públic municipal
2. Transport	2.1. Flota municipal
	2.2. Transport públic
	2.3. Transport privat i comercial
3. Producció local d'energia	3.1. Hidroelèctrica
	3.2. Eòlica
	3.3. Fotovoltaica
	3.4. Cogeneració de calor i electricitat
4. Calefacció i refrigeració urbanes	4.1. Cogeneració de calor i electricitat
	4.2. Xarxa de calor
5. Planejament i ordenació del territori	5.1. Urbanisme
	5.2. Planificació dels transports i la mobilitat
	5.3. Normes per a la renovació i expansió urbana
6. Contractació pública de productes i serveis	6.1. Requeriments d'eficiència energètica
	6.2. Requeriments d'energies renovables
7. Participació ciutadana	7.1. Serveis d'assessorament
	7.2. Ajudes i subvencions
	7.3. Sensibilització i creació de xarxes locals
	7.4. Formació i educació
8. Altres sectors	8.1. Residus
	8.2. Altres

Font: Elaboració pròpia a partir de la Guia: Cómo desarrollar un plan de acción para la energía sostenible. Unió Europea: Comisión Europea; Centro Común de Investigación; Instituto para la Energía, 2010.

El pla integra les accions que s'han dut a terme durant el període 2005-2013, les quals es detallen a l'apartat 6.3 d'aquest document.

Figure 20 - Structure of the proposed actions sorted by category and subcategory

Sectors i camps d'acció	Accions	Responsable	Calendari	Cost (€	Estalvi d'energia estimat [MWh/any]	Producció d'energia estimada [MWh/any]	Estalvi d'emissions de CO_2 estimat [tCO_2/any]
EDIFICIS, EQUIPAMENTS/INSTAL·LACIONS							
Edificis i equipaments/ instal·lacions municipals	1.1.1. Substitució del balast convencional dels tubs fluorescents per balast electrònic a l'Ajuntament, Casa Cultura, Teatre Municipal, Oficina de Turisme i Museu del Mar, Museu Can Saragossa, CEIP Pere Torrent, CEIP Esteve Carles i CEIP Pompeu Fabra	Tècnics Serveis Públics	En execució	48.044	42,117	-	20,0
	1.1.2. Instal·lació de dispositius d'aturada automàtica de l'enllumenat a l'Ajuntament, Casa de Cultura, Teatre Municipal, Museu Can Saragossa, Institut escola Fenals i CEIP Àngels Alemany	Tècnics Serveis Públics	En execució	7.560	15,397	-	7,4
	1.1.3. Instal·lació de vàlvules termostàtiques en radiadors als CEIPs Àngels Alemany, Pere Torrent, Esteve Carles i Pompeu Fabra per a la millora del control de la temperatura interior	Tècnics Serveis Públics	En execució	24.596	44,075	-	3,8
	1.1.4. Substitució d'halògenes dicroiques de 50W per làmpades LED de 10W a l'Ajuntament, Museu Can Saragossa i Oficina de Turisme i Museu del Mar	Tècnics Serveis Públics i Servei Municipal de Manteniment	En execució	8.056	11,525	-	5,5
	1.1.5. Calorifugació dels conductes d'aigua calenta als CEIPs Pere Torrent, Esteve Carles i Pompeu Fabra	Tècnics Serveis Públics	En execució	7.893	28,298	-	1,1

Figure 21 - Example on a set of proposed actions on a given category, with the summary of KPIs as investment costs or expected savings

Table 10 - Summary of the mitigation actions in Lloret de Mar - Catalunya

Action	*Name*
	Energy transition
TE-1	Launch the municipal energy manager
TE-2	Draft the Public facilities' energy efficiency plan and execute the actions
TE-3	Public facilities' energy refurbishment (new market, Smart Center...).
TE-6	Expand the energy monitoring to all public facilities with more consumption
TE-9	Develop "EUROMAX 100/100" philosophy with schools. (EDUFOOTPRINT & PRIORITEE)
TE-12	Opening of the "Energy Transition Office".
TE-16	Energy transition assistance projects with tourism and service sector
TE-17	Renew public lighting by the preventive maintenance contract
TE-19	Promote the developing of LECs with the municipal roofs
	Sustainable mobility
MS-1	Launch the municipal mobility manager
MS-2	Plan the dematerialization, electrification and management of the municipal fleet
MS-3	Foster carsharing
MS-5	Implant on-demand bus for residential complex
MS-6	Enhance new express bus BRCat
MS-8	Develop SUMP 2020-2025 actions and actualize it in 2025
MS-9	Improve the bike paths
MS-14	Develop a logistic micro-platform pilot project for UFD in the Casc Antic
	Circular economy and zero waste
EC-1	Increase the selective collection with the PPR 2024
EC-4	Add a small mobile clean point for residential complex
EC-5	Promote the reduction of single-use products with the new market project
EC-6	Develop and implant the Touristic Sustainability Plan
EC-7	Impulse the excedent certification in the touristic establishment
	Sustainable water management
AIG-2	Draft and implementation of a drought plan
AIG-3	Boost of regenerated and phreatic water for green spaces and street cleaning
AIG-5	Draft of a new waste water and sewerage master plan

Nature and biodiversity protection	
NAT-1	Green urban master plan to increase sustainability: trees, urban green spaces, semi-natural spaces
NAT-3	Increase of surface and quality of green spaces
NAT-4	Promotion of city denaturalization including solutions adapted to public spaces and buildings
NAT-6	Optimization of irrigation systems: automatization, digitalization and remote managing, water consumption monitoring
NAT-16	Forestry management to prevent forest fires in public and private spaces through biomass production
Cross-cutting aspects	
TRANS-2	Citizen involvement strategy to boost climate action
TRANS-3	Draft and approval of a new civil protection master plan (DUPROCIM)

Table 11 - Energy consumption by the whole municipality (kWh i kWh/hab.) by energy sources in Lloret de Mar - Catalunya

kWh	*Electricity (Grid)*	*Natural Gas*	*Diesel C*	*LPG*	*Ren-energy (thermic)*	*Ren-energy (electric)*	*Gasoline*	*Diesel A*	***Total***
2005	171.761.100	128.146.540	51.987.93	14.433.150	0	33.137	71.204.580	233.035.340	**670.601.777**
2006	182.399.336	114.296.196	32.226.598	10.204.515	0	32.494	67.999.086	253.403.013	**660.561.239**
2007	186.965.068	119.949.417	33.147.125	11.729.020	0	31.469	72.837.188	317.747.839	**742.407.127**
2008	190.509.027	121.453.887	26.588.568	12.352.529	0	32.362	64.405.690	286.053.644	**701.395.707**
2009	187.643.353	122.164.205	20.436.987	10.848.228	570.000	39.051	57.184.852	239.989.668	**638.876.344**
2010	184.087.570	125.133.436	12.118.156	12.338.964	570.000	32.220	51.578.369	241.576.516	**627.435.232**
2011	182.099.068	117.574.910	12.601.795	9.126.355	570.000	32.220	46.094.136	242.141.561	**610.240.044**
2012	180.373.970	116.954.704	26.918.474	8.692.416	570.000	433.000	38.262.797	209.820.647	**582.026.008**
2013	172.012.906	117.399.385	23.499.138	7.846.950	570.000	433.000	33.887.949	206.838.761	**562.488.088**
2014	168.913.263	109.229.899	18.670.250	5.414.031	570.000	433.000	33.439.331	205.513.792	**542.183.565**
2015	174.903.759	111.360.384	16.221.445	9.237.079	570.000	433.000	34.683.443	241.927.562	**589.336.672**
2016	175.721.451	113.113.516	10.006.709	9.300.361	570.000	433.000	35.374.868	274.797.171	**619.317.075**
2017	179.033.776	112.039.941	8.963.117	9.644.137	570.000	433.000	34.783.583	301.179.398	**646.646.952**
2018	182.699.509	119.254.317	8.669.261	7.398.883	570.000	445.000	40.761.716	321.994.337	**681.793.023**
2019	184.075.677	113.802.541	6.876.401	4.696.884	570.000	457.000	43.406.866	343.317.567	**697.202.936**
2020	135.179.096	72.054.963	sd	sd	sd	sd	sd	sd	**207.234.059**

Table 12 - Energy consumption by the whole municipality (kWh i kWh/hab.) by sectors in Lloret de Mar -Catalunya

	kWh					kWh/hab.				
	Residential	*Tertiary*	*Transport*	*Renewable production*	***Total***	*Residential*	*Tertiary*	*Transport*	*Renewable production*	***Total***
2005	121.864.720	244.464.000	304.239.920	33.137	**670.601.777**	4.139	8.302	10.332	1	**22.775**
2006	108.354.692	230.771.953	321.402.099	32.494	**660.561.239**	3.311	7.051	9.820	1	**20.183**
2007	117.253.230	234.537.400	390.585.028	31.469	**742.407.127**	3.350	6.702	11.161	1	**21.213**
2008	124.139.348	226.764.663	350.459.334	32.362	**701.395.707**	3.290	6.010	9.288	1	**18.588**
2009	128.135.101	212.957.672	297.174.520	609.051	**638.306.344**	3.255	5.410	7.550	15	**16.230**
2010	128.344.043	205.334.084	293.154.885	602.220	**626.865.232**	3.225	5.160	7.367	15	**15.767**
2011	121.829.715	199.569.112	288.238.997	602.220	**609.637.824**	3.024	4.954	7.156	15	**15.149**
2012	121.895.027	211.040.538	248.087.443	1.003.000	**581.023.008**	2.985	5.168	6.075	25	**14.253**
2013	121.890.864	198.850.352	240.743.873	1.003.000	**561.485.088**	2.987	4.873	5.900	25	**13.786**
2014	113.461.122	188.734.673	238.984.769	1.003.000	**541.180.565**	2.938	4.886	6.187	26	**14.038**
2015	109.119.126	202.572.555	276.641.992	1.003.000	**588.333.672**	2.901	5.385	7.354	27	**15.667**
2016	106.722.709	201.388.341	310.203.025	1.003.000	**618.314.075**	2.881	5.437	8.374	27	**16.720**
2017	109.900.855	199.683.587	336.059.510	1.003.000	**645.643.952**	2.980	5.415	9.113	27	**17.535**
2018	118.393.807	199.284.521	363.099.695	1.015.000	**680.778.023**	3.170	5.336	9.722	27	**18.254**
2019	115.336.585	193.627.285	387.212.066	1.027.000	**697.202.936**	3.006	5.046	10.091	27	**18.169**
2020	110.578.020	96.656.039	sd	sd	**sd**	2.829	2.473	sd	sd	**sd**

Figure 22 - The municipal swimming pool taken during the visit in April 2023 in Lloret de Mar - Catalunya

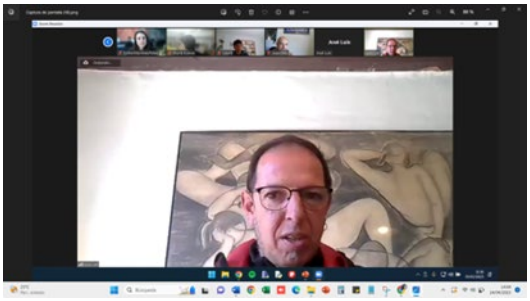


Figure 23 - Screenshot of one of the Spanish Living Lab sessions.

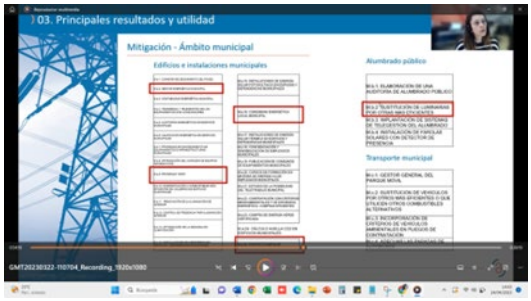


Figure 24 - Screenshot of one of the Spanish Living Lab sessions.

Figure 25 - Initial process meeting with the municipality representatives in Lloret de Mar - Catalunya

Figure 26 - Cover of the new SEACAP developed under the project framework

Table 13 - List of stakeholders - IREC

Stakeholder	*Needed*	*Impact*	*Long term engagement*	*Short term engagement*
Regional government and supra-municipality public entities	To address several issues related to the CO_2 emissions and energy consumption	Law enforcement, policy making and support to the local authorities and key stakeholders	X	X
Municipalities	For spreading awareness about the danger of the continuation of releasing CO_2 at the current rate	Help in local trainings, conducting seminars, to mitigate these issues	X	X
Consultancy entities and support companies	Technical skills and trainings	Training and testing	X	X

9.4 IVE – Spain

DETAILS OF THE APPLICANT MUNICIPALITY			EVALUATION OF MUNICIPALITY					
			SCORING (see sheet: Scoring logic)					EVALUATION COMMENTS
			Category A		Category B			General Comment
			30%	70%	70%	70%		
			100%	35%	30%	35%		
Partner	Name of Local Authority or Municipality	Population	A1. Governance Structure	B1. Ambitions and potential energy savings	B2. Stakeholder engagement	B3. Alignment with SEACAP 4 SDG objectives	FINAL SCORE	
PP7-IVE	Municipality of Riba-Roja de Turia	24.261	2	2	2	2	2	Good candidate (medium-sized municipality, high motivation) but they have the second most up-to-date SECAP of all candidates (2020).
PP7-IVE	Municipality of Teulada	10.722	2	2	2	2	2	Good candidate (rather small municipality, high motivation) but they have the most up-to-date SECAP of all candidates (2021).
PP7-IVE	Municipality of Bolbaite	1.347	2	2	2	2	2	Very small municipality. Its SECAP was updated in 2019.
PP7-IVE	Municipality of Alcoy	59.675	2,4	2	2	2,5	2,2425	Good candidate (one of the largest municipalities in the Comunitat Valenciana in terms of population: 12 / 542). High motivation. SEAP from 2013.
PP7-IVE	Municipality of Sax	9.696	2	2	2	3	2,245	Good candidate (rather small municipality). High motivation. Its SEAP is the oldest of all candidates (2011). To be assessed: room for improvement of its public building stock (considering the 2019 monitoring report).

Figure 27 - The scoring criteria

Table 14 - Total energy consumption of the Municipality of Sax – Valencia

2007 Total consumption (MWh)	**47,936.84**
2021 Total consumption (MWh)	**49,181.06**

Table 15 - Overall 2030 energy savings target of the municipality of Sax - Valencia

2030 Target Energy Savings (MWh)
15,579.47
32.5% of 2007 Consumption

Table 16 - Overall 2030 energy savings target based on year 2021 in Sax - Valencia

Target year (2030) Consumption (MWh)	*Energy savings target compared to 2021 (MWh)*
32,357.37	16,823.69
	34.21% of 2021 Consumption

Table 17 - Mitigation action plan targets, energy savings in Sax - Valencia

Area	*2021 Consumption (MWh)*	*2030 Consumption (MWh) target*	*2030 Total consumption savings*	*Total 2030 consumption savings vs. 2021 consumption*
			(MWh)	*(%)*
Areas that directly depend on the Town Council				
Municipal buildings, equipment, and facilities	1,338.68	824.20	514.48	38.43
Street lighting	956.58	526.12	430.46	45.00
Municipal and public transport	97.09	69.03	28.07	28.91
Total	**2,392.35**	**1,419.34**	**973,01**	**40.67**
Areas that do not directly depend on the Town Council				
Residential sector and services	43,016.43	27,063.85	*15,952.59*	37.08
Private and commercial transport	3,772.28	3,081.95	690.33	18.30
Total	**46,788.71**	**30,145.80**	**16,642.91**	**35.57**
Municipality total	**49,181.06**	**31,565.14**	**17,615.92**	**35.82**

Table 18 - Total CO_2 Emissions in the municipality of Sax – Valencia

2007 Total emissions (tCO_2)	**17,742.29**
2021 Total emissions (tCO_2)	**14,237.38**

Table 18 - Overall 2030 emissions reduction of the Municipality of Sax – Valencia

2030 Emission reduction target (tCO_2)
9,758.26
55% of 2007 Emissions

Table 19 - Overall 2030 energy savings target based on the year 2021 in Sax - Valencia

Target year (2030) Emissions (tCO2)	*Emissions Reduction compared to 2021 (tCO_2)*
7,984.03	6,253.35
	43.92% of 2021 emissions

Table 20 - Mitigation action plan targets, emissions reduction in Sax - Valencia

Area	*2021 Emissions (tCO2)*	*2030 Emissions (tCO2) target*	*2030 Total emissions reduction*	*2030 Total emissions reduction vs. 2021 emissions*
			(tCO2)	*(%)*
Areas that directly depend on the Town Council				
Municipal buildings, equipment, and facilities	101.54	0.00	101.54	100
Street lighting	0.00	0.00	0.00	0.00
Municipal and public transport	25.73	18.43	7.30	28.37
Total	**127.26**	**18.43**	**108.84**	**85.52**
Areas that do not directly depend on the Town Council				
Residential sector and services	13,137.97	7,693.68	5,444.29	41.44
Private and commercial transport	972.15	750.50	221.65	22.80
Local energy production	-	-	501.36	-
Total	**14,110.12**	**7,942.82**	**6,167.29**	**43.71**
Municipality total	**14,237.38**	**7,961.25**	**6,276.13**	**44.08**

Table 21 - Summary of mitigation targets in Sax - Valencia

Mitigation sectors	*Number of actions included in the plan*	*2030*		
		Energy savings (MWh/y)	*Renewable energy production (MWh/y)*	*Emission reduction (tCO_2/y)*
Municipal buildings	28	944.94	2,115.60	101.54
Third-party buildings and equipment/facilities (non-municipal)	3	1,305.56	668.74	645.77
Residential buildings	12	14,647.02	831.17	4,798.52
Industry	0	0.00	0.00	0.00
Transport	10	718.39	0.00	228.95
Local electricity production	2	0.00	1,686.07	501.36
Local heat/Cold production	0	0.00	0.00	0.00
Waste	0	0.00	0.00	0.00
Other	0	0.00	0.00	0.00
Total	**55**	**17,615.92**	**5,301.57**	**6,276.13**

Table 22 - Energy consumption and emissions of all sectors considered, year: 2007, population: 9,716 in Sax - Valencia

Areas that depend on the Town Council	*Consumption (MWh)*	*Emissions (tCO_2)*
Municipal buildings, equipment, and facilities	**1,753.89**	**635.69**
Electricity consumption	973.22	427.25
Diesel consumption	780.68	208.44
Street lighting	1,185.02	520.23
Municipal transport	**114.34**	**30.15**
Gasoline consumption	21.01	5.23
Diesel consumption	93.33	24.92
Total Areas that depend on the Town Council	**3,053.25**	**1,186.08**

Areas that do not depend on the Town Council	*Consumption (MWh)*	*Emissions (tCO_2)*
Residential sector	**29,283.12**	**10,894.60**
Electricity consumption	19,011.15	8,346.08
Natural gas consumption	0.00	0.00
LPG consumption	4,852.41	1,101.50
Diesel consumption	5,419.56	1,447.02
Biomass consumption	0.00	0.00
Services sector	**11,094.98**	**4,501.12**
Electricity consumption	9,329.51	4,095.75
Natural gas consumption	0.00	0.00
LPG consumption	1,650.24	374.60
Diesel consumption	115.22	30.76
Biomass consumption	0.00	0.00
Private and commercial transport	**4,505.49**	**1,160.50**
Gasoline consumption	2,359.48	587.51
Diesel consumption	2,146.01	572.99
Total areas that do not depend on the Town Council	**44,883.59**	**16,556.21**

Total in the municipality	**47,936.84**	**17,742.29**

Energy from renewable sources	68.65

Local electricity emission factor	0.439

Table 23 - Energy consumption and emissions of all sectors considered, year: 2021, population: 9,935 in Sax-Valencia

Areas that depend on the Town Council	*Consumption (MWh)*	*Emissions (tCO_2)*
Municipal buildings, equipment, and facilities	**1,338.68**	**101.54**
Electricity consumption	957.69	0.00
LPG Consumption	4.61	1.05
Diesel consumption	376.37	100.49
Street lighting	**956.58**	**0.00**
Municipal transport	**97.09**	**25.73**
Gasoline consumption	10.99	2.74
Diesel consumption	86.10	22.99
Total Areas that depend on the Town Council	**2,392.35**	**127.26**
Areas that do not depend on the Town Council		
Residential sector	**23,916.45**	**7,169.91**
Electricity consumption	16,701.22	5,488.94
LPG consumption	4,528.18	1,027.90
Diesel consumption	2,445.95	653.07
Biomass consumption	241.10	0.00
Services sector	**19,099.98**	**5,968.07**
Electricity consumption	15,922.30	5,232.95
LPG consumption	2,833.04	643.10
Diesel consumption	344.64	92.02
Private and commercial transport	**3,772.28**	**972.15**
Electricity consumption	62.19	20.44
Gasoline consumption	2,160.35	537.93
Diesel consumption	1,549.74	413.78
Total areas that do not depend on the Town Council	**46,788.71**	**14,110.12**
Total in the municipality	**49,181.06**	**14,237.38**
Energy from renewable sources	6,841.48	

Certified green energy purchases	1,914.27

Local electricity emission factor	0.329

Table 24 – Mitigation measures in Sax – Valencia

Code	*Mitigation measures:*
	Municipal buildings, equipment, and facilities
M.a.1.	SECAP monitoring committee
M.a.2.	Municipal energy manager
M.a.3.	Municipal energy accounting
M.a.4.	Telemetry and remote management of the most consuming equipment
M.a.5.	Energy audits in municipal buildings
M.a.6.	Energy rating in municipal buildings
M.a.7.	Municipal equipment and infrastructure maintenance program
M.a.8.	Optimization of its equipment consumption
M.a.9.	50/50 program
M.a.10.	Diversification towards more efficient power sources in municipal building boilers
M.a.11.	Renovation of indoor lighting
M.a.12.	Presence control for indoor lighting
M.a.13.	Optimization of air conditioning demand
M.a.14.	Aerothermal systems in municipal buildings and facilities
M.a.15.	Photovoltaic solar energy systems in municipal buildings and facilities
M.a.16.	Municipal local energy community
M.a.17.	Solar thermal energy systems in municipal buildings and facilities
M.a.18.	Awareness and sensitization of municipal employees
M.a.19.	Publishing of municipal equipment consumption
M.a.20.	Training courses on energy issues for municipal employees
M.a.21.	Study on the possibility of municipal teleworking
M.a.22.	Contracting with environmental and energy efficiency criteria. Efficient purchasing
M.a.23.	Certified green energy purchase
M.a.24.	Calculation of CO_2 footprint in municipal buildings
M.a.25.	Impulse project

Street lighting	
M.b.1.	Conducting a street lighting audit
M.b.2.	Replacement of luminaires by more efficient ones
M.b.3.	Implementation of lighting tele-management systems
M.b.4.	Installation of solar streetlights with presence detector
Municipal and public transport	
M.c.1.	General fleet manager
M.c.2.	Replacement of vehicles by more efficient vehicles or vehicles using other alternative power sources
M.c.3.	Incorporation of environmental vehicle criteria in procurement specifications
M.c.4.	Adapting bus stops
Municipal and public transport	
M.d.1.	Energy and climate change advisory service
M.d.2.	Awareness and sensitization campaign. Good housekeeping manual
M.d.3.	Insulation and enclosures renovation campaign
M.d.4.	Green energy purchasing campaign
M.d.5.	Campaign for diversification towards more efficient power sources
M.d.6.	Air-conditioning and aerothermal renovation campaign
M.d.7.	Home energy assessment visits
M.d.8.	Bioclimatic building ordinance
M.d.9.	Land use planning
M.d.10.	Tax credits on building permits for energy efficiency improvements
M.d.11.	Energy and carbon footprint
M.e.1.	Small energy audits in the service sector
M.e.2.	Green energy purchase campaign
M.e.3.	Municipal badge
Private and commercial transport	
M.f.1.	Sustainable urban mobility plan
M.f.2.	Renovation of vehicle fleet and promotion of vehicles using non-conventional power sources
M.f.3.	Electric vehicle charging stations network
M.f.4.	Bicycle path design
M.f.5.	Promotion of foot transportation. Specific signalization for walking routes
M.f.6.	New mobility concepts in the PGOU "Plan General de Ordenación Urbana"
Local energy production	

M.g.1	Small wind turbine power
M.g.2	Tax credit on building permits for the implementation of renewable energy and for dwellings with renewable energy consumption

Table 25 - Adaptation measures in Sax - Valencia

Code	*Adaptation Measures:*
A.1.	Plan for building refurbishment and urban regeneration and renovation
A.2.	Infrastructure refurbishment
A.3.	Reduction of soil sealing effect and increase in permeable areas
A.4.	Increase in green areas surface
A.5.	Improvements in municipal water management
A.6.	Water recycling
A.7.	Plans against forest fires
A.8.	Inclusion of climate risks in emergency plans and protocols
A.9.	Actions related to health and public awareness and sensitization
A.10.	Actions against heat waves
A.11.	Social services mobilization and support in detection of energy inaccessibility
A.12.	Local products consumption

Table 26 - List of stakeholders - IVE

Stakeholder	*Needed*	*Impact*	*Long term engagement*	*Short term engagement*
National government	To address several issues related to the CO_2 emissions and energy consumption	Support to regional governments Law and regulations Financial support	X	X
Regional government		Support to municipalities and local ecosystems Exemplary role Dissemination	X	X
Municipalities		Covenant of mayor's adhesion Adoption of EE and RE measures Awareness campaigns Communication	X	X

Industry	Promote the benefits of its innovative products and establish relations with public entities	New products and solutions	X	
ESCOs	Financing	Financing	X	
Building owners	To facilitate working on the buildings	Students and patients will be benefit from the applied measures	X	X

9.5 LCEC – Lebanon

Table 27 - Energy mix of Jdeideh El Chouf - Lebanon of BEI 2016

MWh/sector	*Electricity*	*LPG*	*Heating Oil*	*Diesel*	*Gasoline*	*Fire Wood*	*Solar thermal*
Municipal buildings and facilities	7.00	0.00	14.80	0.00	0.00	0.00	0.00
Public lighting	211.40	0.00	0.00	0.00	0.00	0.00	0.00
Residential buildings	21,241.00	6,640.00	25,523.00	0.00	0.00	3,662.00	218.00
Tertiary buildings and facilities	13,946.00	15,878.0	24,984.00	0.00	0.00	0.00	0.00
Municipal fleet	0.00	0.00	0.00	95.00	28.00	0.00	0.00
Public transport	0.00	0.00	0.00	80.00	137.00	0.00	0.00
Private and commercial transport	0.00	0.00	0.00	301.00	7,206.00	0.00	0.00
Total	**35,405.40**	**22,518.0**	**50,521.80**	**476.00**	**7,371.00**	**3,662.00**	**218.00**

Table 28 - Stakeholders in the SEACAP 4 SDG project - LCEC

Stakeholder	*Needed*	*Impact*	*Engagement*	
			Long term	*Short term*
Ministry of Energy and Water (MEW)	To address several issues related to the CO_2 emissions and energy consumption	Law enforcement and policy making	X	X
Industrial Research Institute (IRI)	Technical skills and trainings	Training and testing	X	X
Municipalities	For spreading awareness about the danger of the continuation of releasing CO_2 at the current rate	Help in local trainings, conducting seminars, to mitigate these issues	X	X
ESCOs	To abide with laws and regulations	Introduce their clients on energy efficiency measures	X	X
Ministry of Education and Higher Education (MeHe)	To facilitate working with schools and technical academies	Ensure access to affordable, reliable and sustainable energy (given electricity shortage in Lebanon + price increase)	X	X
Ministry of Health (MoH)	To provide healthcare centers or hospitals to apply EE and EC measure	Ensure access to affordable, reliable and sustainable energy (given electricity shortage in Lebanon + price increase)	X	X
Building owners	To facilitate working on the buildings	Students and patients will be benefit from the applied measures	X	X

Table 29 - Updated energy mix of Jdeideh El Chouf - Lebanon of BEI 2022

MWh/sector	*Electricity*	*LPG*	*Heating Oil*	*Diesel*	*Gasoline*	*Fire Wood*	*Solar thermal*	*Solar PV*
Municipal buildings and facilities	3.85	0.00	3.36	0.00	0.00	0.00	0.0	8.82
Public lighting	35.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential buildings	25,753.05	6,640.00	36,093.75	0.00	0.00	4,760.44	218.00	5,433.89
Tertiary buildings and facilities	18,238.19	15,878.10	17,459.60	0.00	0.00	0.00	0.00	202.16
Municipal fleet	0.00	0.00	0.00	76.80	20.97	0.00	0.00	0.00
Public transport	0.00	0.00	0.00	60.04	103.65	0.00	0.00	0.00
Private and commercial transport	0.00	0.00	0.00	301.47	7,206.07	0.00	0.00	0.00
Total	**44,031.03**	**22,518.10**	**53,556.71**	**438.31**	**7,330.68**	**4,760.44**	**218.00**	**5,644.87**

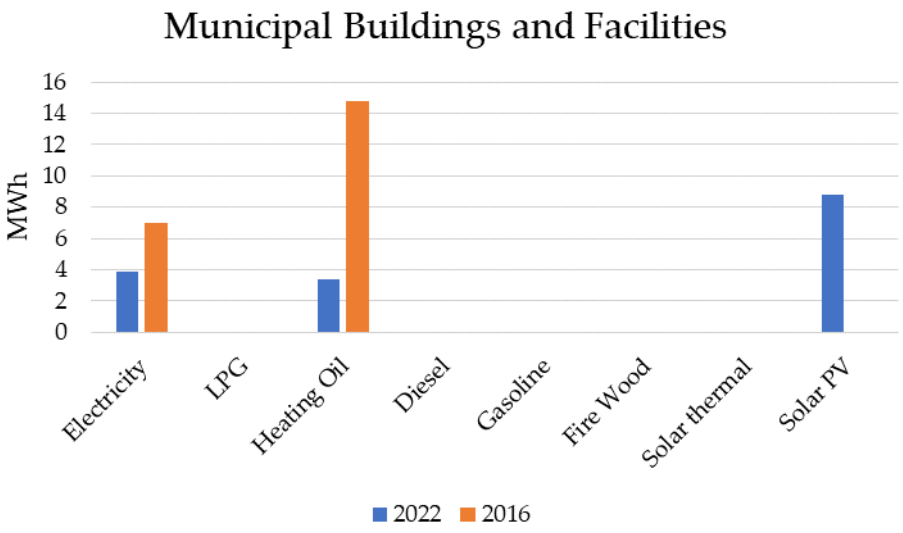


Figure 28 - Comparison of baselines in the municipal buildings and facilities in Jdeideh El Chouf - Lebanon

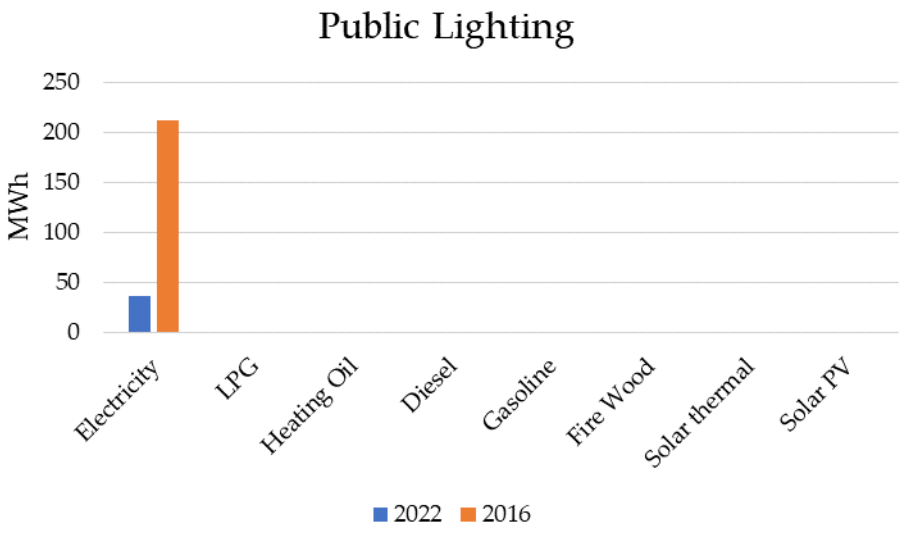


Figure 29 - Comparison of baselines in public lighting sector in Jdeideh El Chouf - Lebanon

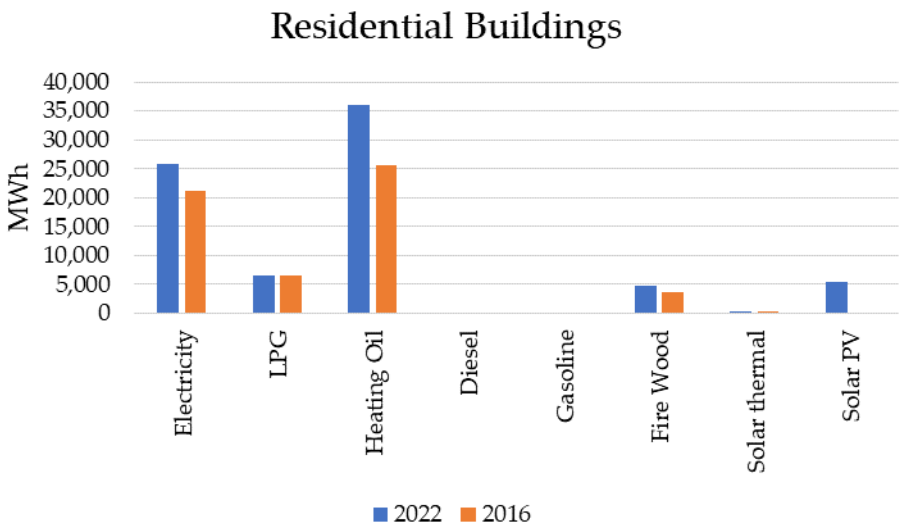


Figure 30 - Comparison of baselines in residential buildings in Jdeideh El Chouf - Lebanon

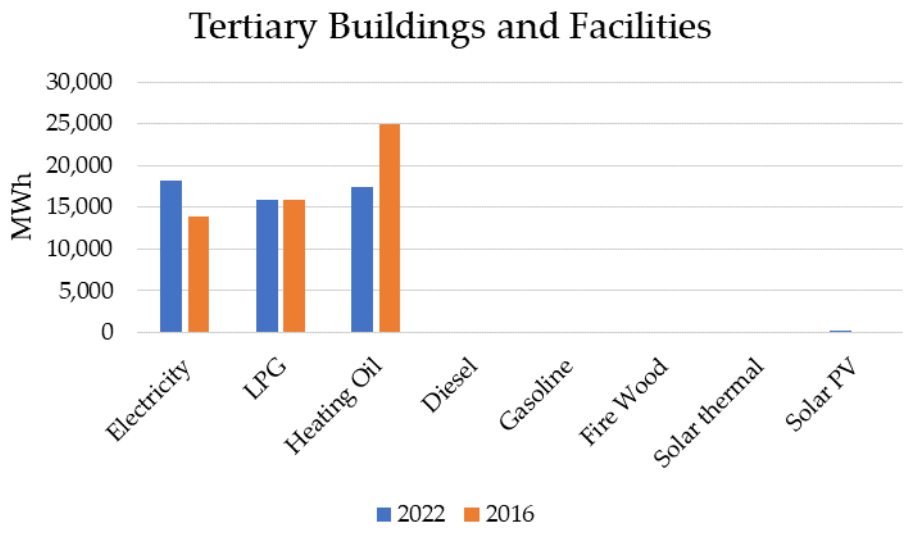


Figure 31 - Comparison of baselines in tertiary buildings and facilities in Jdeideh El Chouf - Lebanon

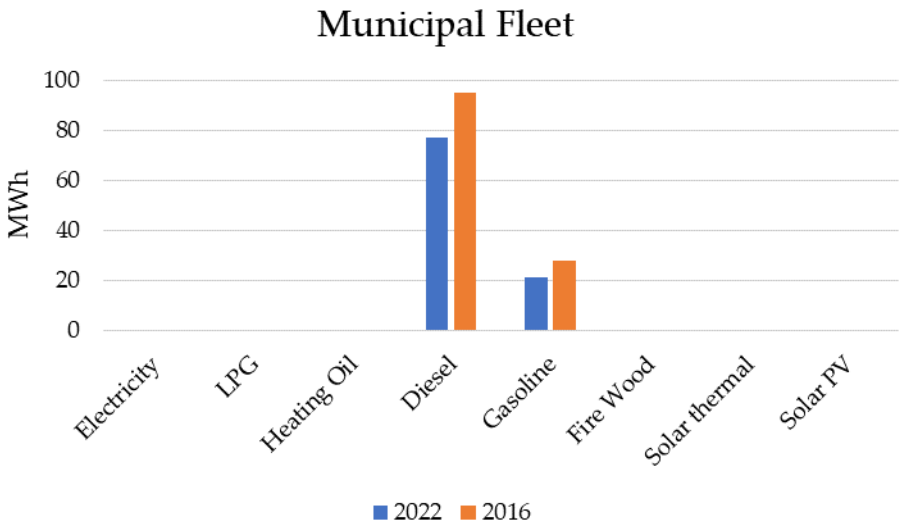


Figure 32 – Comparison of baselines in the municipal fleet in Jdeideh El Chouf - Lebanon

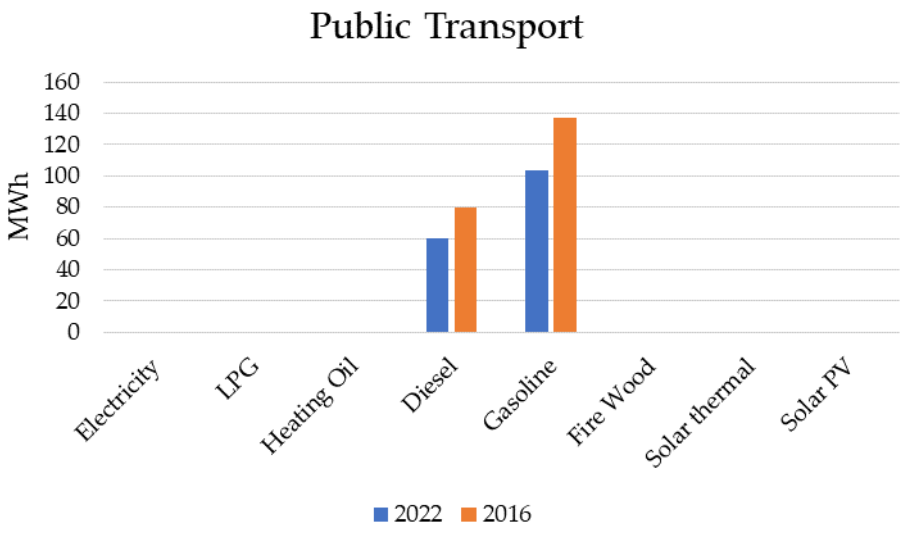


Figure 33 – Comparison of baselines in the public transport sector in Jdeideh El Chouf - Lebanon

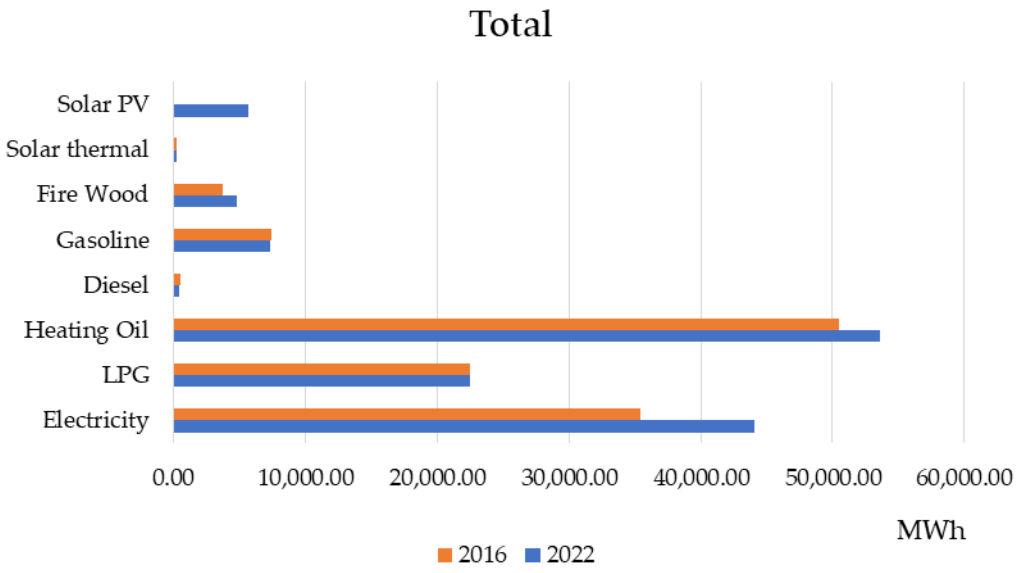


Figure 34 – Energy mix comparison in the baselines of 2016 and 2022 in Jdeideh El Chouf – Lebanon

Table 30 - Summary of CO_2 emissions in Jdeideh El Chouf - Lebanon

Sector	*Final energy emissions [Tons CO_2 equivalent/year]*									
	Electricity (EDL+ Diesel generators)	*Fossil fuels*					*Renewable energies*		*Non-energy sources*	***Total***
		LPG	*Heating oil*	*Diesel*	*Gasoline*	*Fire Wood*	*Solar thermal*	*Solar PV*		
Municipal buildings										
Main municipal building	2.59	0.00	0.90	0.00	0.00	0.00	0.00	0.00	0.00	**3.49**
Public lights										
Public lights	24.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**24.18**
Residential sector										
Residential Building	17,331.80	1,507.28	9,637.03	0.00	0.00	1,970.82	0.00	0.00	0.00	**30,446.94**
Tertiary sector										
Public buildings & facilities	1.15	0.00	2.14	0.00	0.00	0.00	0.00	0.00	0.00	**3.29**
Commercial buildings	12,132.84	3,603.85	4,642.22	0.00	0.00	0.00	0.00	0.00	0.00	**20,378.92**
Educational buildings (schools)	22.96	0.48	17.36	0.00	0.00	0.00	0.00	0.00	0.00	**40.79**
Irrigation facilities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Water & waste manageme-nt facilities	117.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**117.34**
Subtotal	**12274.29**	**3604.33**	**4661.72**	**0**	**0**	**0**	**0**	**0**	**0**	**20,540.34**
Transportation										
Municipal fleets	0.00	0.00	0.00	20.51	5.22	0.00	0.00	0.00	0.00	**25.73**
Public transport	0.00	0.00	0.00	16.03	25.81	0.00	0.00	0.00	0.00	**41.84**

Private and commercial	0.00	0.00	0.00	80.49	1,794.31	0.00	0.00	0.00	0.00	**1,874.80**
Subtotal for energy sources	**0.00**	**0.00**	**0.00**	**117.03**	**1,825.34**	**0.00**	**0.00**	**0.00**	**0.00**	**1,942.37**
Non-Energy Sources										
Waste Water treatment Plant	0.00	0.00	0.00	0.00	0.00	151.79	0.00	0.00	151.75	**303.54**
Livestock breeders	0.00	0.00	0.00	0.00	0.00	23.00	0.00	0.00	23.00	**46.00**
Solid waste separation Plant	0.00	0.00	0.00	0.00	0.00	1,031.00	0.00	0.00	1,035.00	**2,066.00**
Subtotal for non-energy sources	0.00	0.00	0.00	0.00	0.00	1,205.79	0.00	0.00	1,209.75	**2,415.54**
Total	**29,632.88**	**5,111.61**	**14,299.64**	**117.03**	**1,825.34**	**3,176.61**	**0.00**	**0.00**	**1,209.75**	**55,372.86**

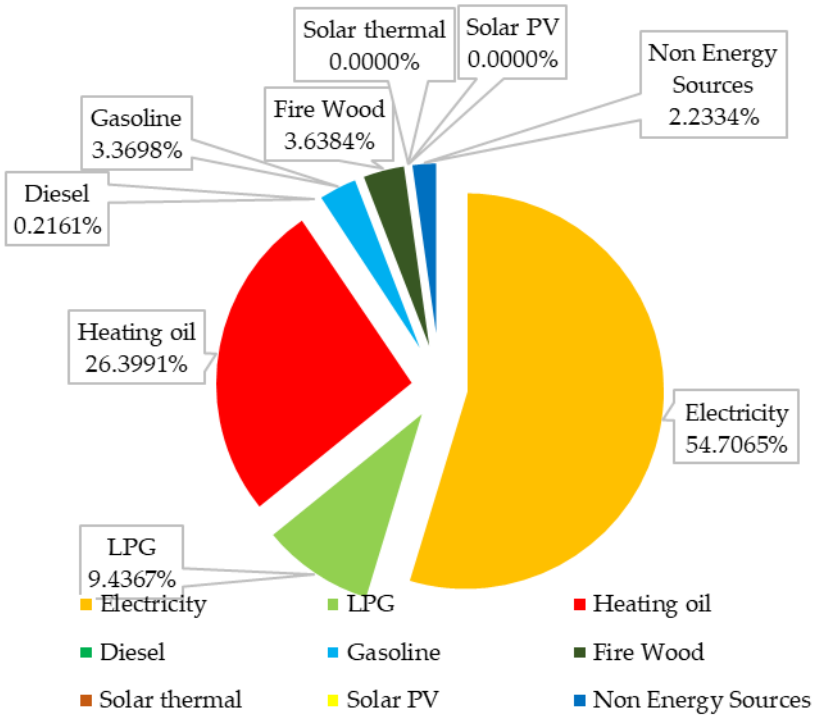


Figure 35 - The CO_2 emissions per sector Jdeideh El Chouf - Lebanon

Table 31 - Summary of the mitigation actions in Jdeideh El Chouf - Lebanon

Action No.	*Action*	*2016 Emission Reductions (Tons CO_2 eq)*	*2022 Emission Reductions (Tons CO_2 eq)*	*Status of action*	*Achieved savings so far (Tons CO_2 eq)*
Municipal Buildings					
1	Green procurement procedures for municipal buildings	0.70	1.27	In progress	0.00
2	Replacing the existing non efficient lamps with LED Lamps in Jdeideh El Chouf municipal buildings	5.60	5.6	Completed	5.60

3	Energy manager appointment in the municipality	0.10	0.18	In progress	0.00
4	Awareness raising activities for municipal employees	0.30	0.54	In progress	0.00
5	5 kWp PVs in municipal building's roof	4.70	4.70	Completed	4.70
6	Social media portal creation portal creation	0.00	0.00	Completed	0.00
	Subtotal	**11.40**	**12.29**		**10.30**
	Street lighting				
1	Street lighting upgrade	46.00	42.68	In progress	0
2	Astronomical timers	32.6	22.76	In progress	0
	Subtotal	**78.6**	**65.44**		**0**
	Residential Buildings				
1	Awareness raising activities for the community about (RE &EE)	1,107.70	2,192.98	In progress	0
2	Promotion of Green Buildings' concept	2,880.00	5,372.86	In progress	0
3	Campaign for promoting and replacing high energy label equipment	3,024.00	5,372.86	In progress	0
4	3.6 MW Photovoltaics in residential rooftops	2,658.50	4,288.42	21.1% completed	750
5	Replacing existing electric water heater with solar collectors	1,218.50	2,253.13	In progress	0
6	Replacement of old diesel space heater with more efficient	4,837.00	3,854.81	In progress	0
7	Use the insulation on rooftops	184.60	174.12	In progress	0
8	Replacement of single glazing with double	738.50	673.26	In progress	0
9	Initiatives to support the citizens' actions (EE and RE)	369.20	866.59	In progress	0
10	Awareness raising activities for the residents' associations and NGOs	1,476.90	2,599.77	In progress	0
	Subtotal	**18,494.90**	**27,648.80**		**750**
	Tertiary Sector				
1	Promotion of using insulation for buildings	2,105.60	5,235.26	In progress	0

2	Photovoltaics on rooftops	1,504.00	2,826.60	40 kWp installed	36.3
3	Replacement of existing lamps with LEDs	240.60	608.67	In progress	0
4	Replacement of single glazing with double	601.60	1,095.60	In progress	0
5	Replacement of existing air conditioners with more efficient ones	60.20	121.73	In progress	0
6	Installation of lighting motion sensors	30.10	243.47	In progress	0
7	Awareness raising activities about EE	718.00	304.33	In progress	0
8	PV for water pumping station	25.40	25.40	20 KWp installed	18.27
9	The 100% commitment campaign for schools for PV	16.20	16.42	In progress	0
10	PV for WWTP	117.80	94.00	90 KWp installed - completed	94.00
11	Upgrade water facilities	60.20	69.57	In progress	0
12	Use the efficient diesel space heater instead of traditional	3,008.10	2,201.31	In progress	0
	Subtotal	**8,487.80**	**12,842.38**		**148.57**
Transport sector					
1	Replacement of old municipal gasoline cars with new efficient cars	24.00	14.92	In progress	0
2	Municipal fleet maintenance	9.00	7.46	In progress	0
3	Eco-driving seminar for the municipal fleet drivers	2.70	2.83	In progress	0
4	Information events on the new vehicle technologies	48.00	35.39	In progress	0
5	Promotion of walking and car sharing and carpooling campaigns	120.10	84.94	In progress	0
6	Improvement/development of parking infrastructure	30.00	21.23	In progress	0
7	Promotion of using school buses rather than private cars	15.00	17.94	In progress	0
8	Awareness campaign for preventive maintenance for cars	15.00	14.16	In progress	0

9	Eco-driving for public transportation	90.10	65.61	In progress	0
10	Cycling promotion and creation of related infrastructure	75.10	67.98	In progress	0
	Subtotal	**429.00**	**332.46**		**0**
Local Renewable Energy Production					
1	PV farm 0.3 MW	353.85	353.85	In progress	0
	Subtotal	**353.85**	**353.85**		**0**
Waste Management					
1	Awareness raising campaigns to reduce the amounts of discarded food	60.90	124.00	In progress	0
	Subtotal	**60.90**	**124.00**		**0**
Agriculture sector					
1	Planting forest trees	1,085.00	1,085.00	In progress	0
	Subtotal	1,085.00	1,085.00		0
Total		**29,001.45**	**42,464.22**		**908.87**

Figure 36 – The PV system in the Waste Water Management Plant in Jdeideh El Chouf - Lebanon

Figure 37 – The Moukhtara Official Public High School in Jdeideh El Chouf - Lebanon

Figure 38 - Development Services Center in Moukhtara in Jdeideh El Chouf – Lebanon

Figure 39 - Mawkif Baqaata in Jdeideh El Chouf - Lebanon

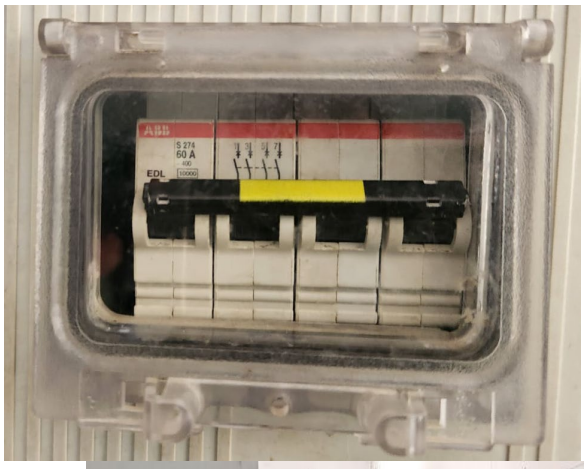


Figure 40 – The second site visit to the school in Jdeideh El Chouf - Lebanon

Figure 41 - The second site visit to the DSC in Jdeideh El Chouf - Lebanon

Figure 42 - The third site visit in Jdeideh El Chouf - Lebanon

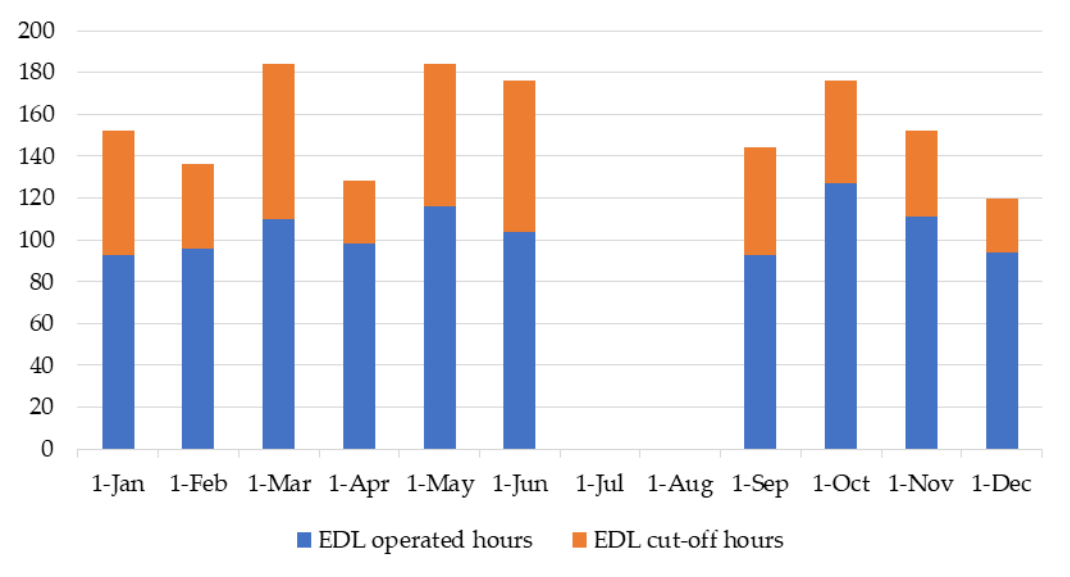
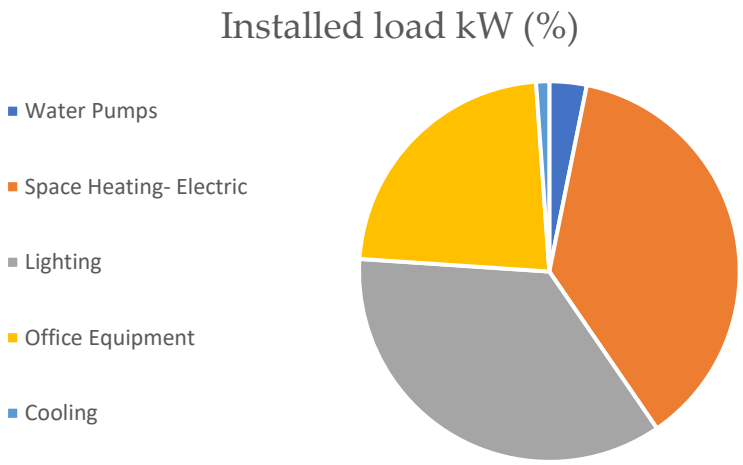


Figure 43 - EDL cut-off hours over the baseline year in MHS – Lebanon

Table 32 - Electricity consumption breakdown per category for the MHS - Lebanon

Category	*Installed Load*		*Energy Consumption*	
Unit	kW	%	kWh	%
Water Pumps	1.36	3%	138	0.93%
Space heating- electric	16.0	37%	2,759	18.57%
Lighting	15.3	36%	10,571	71.16%
Office Equipment	9.8	23%	1,328	8.94%
Cooling	0.48	1%	59	0.40%
Total	**42.94**	**100%**	**14,855**	**100%**



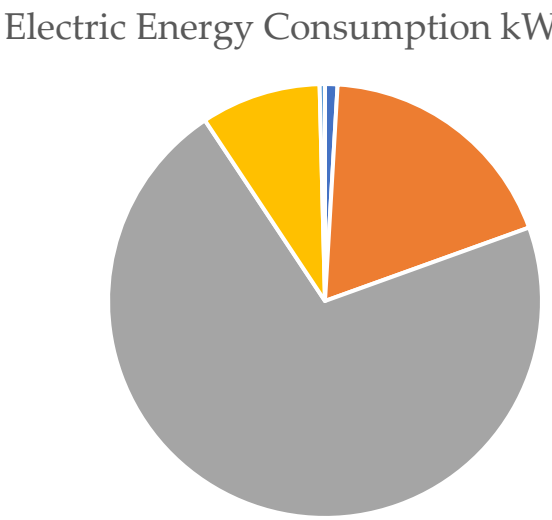


Figure 44 – The installed load and electric energy consumption in the MHS – Lebanon

Table 33 - Proposed measures for the MHS - Lebanon

Action	*Savings (€)*	*Avoided CO_2 emissions*
Employee awareness and engagement	-	-
Green procurement for technical equipment	-	-
Lighting control	359	1,176.1
Lighting retrofit	37	122.5
Waste heat recovery from coolant	1,527	1,823
Photovoltaic driven electricity generation	2,304	7,575

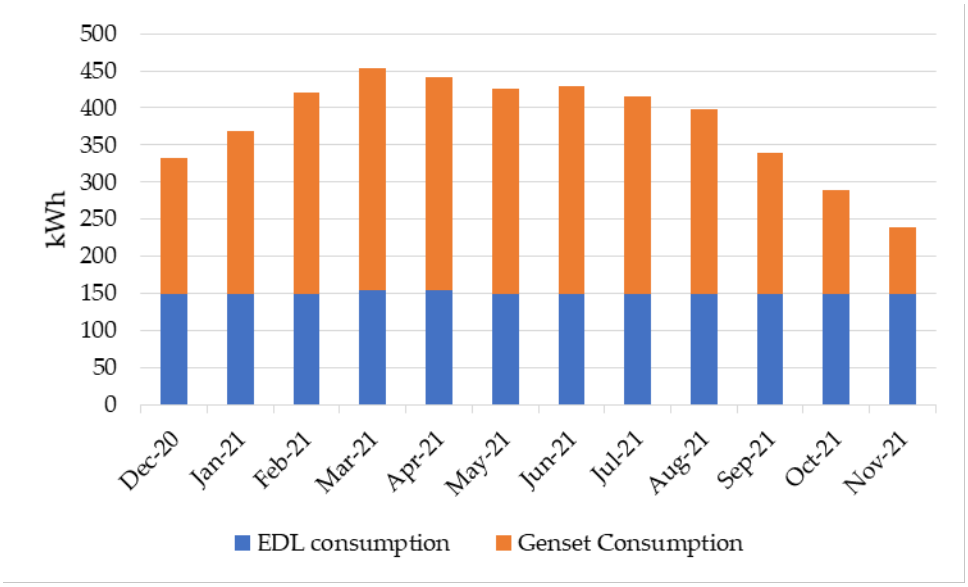
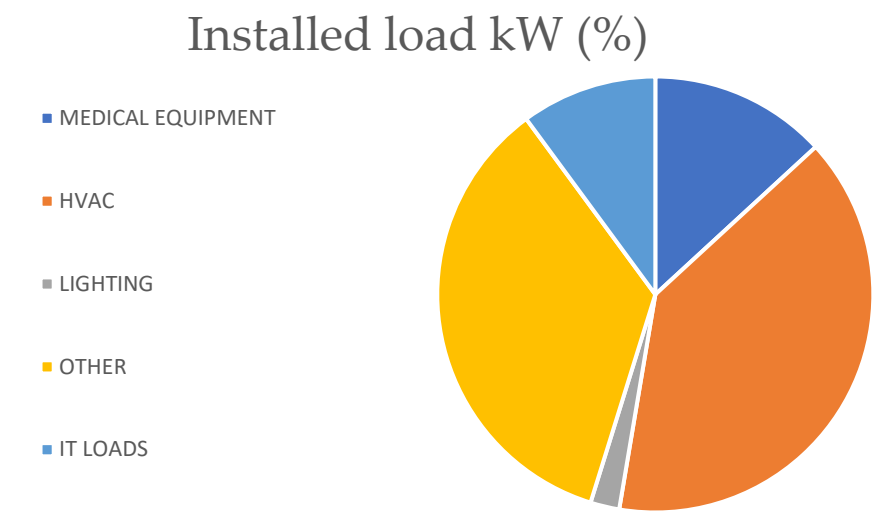


Figure 45 - DSC electrical energy consumption (2020-2021) - Lebanon

Table 34 - Electricity consumption breakdown per category in the DSC - Lebanon

Category	*Installed load*		*Electrical energy consumption*			
Unit	kW	%	kWh	€	kg. CO_2	%
Medical equipment	3.00	13%	1,810.00	128	1,297.18	40%
HVAC	9.00	40%	342	24	245.10	8%
Lighting	0.49	2%	656	46	470.14	14%
Other	8.00	35%	1,410.00	100	1,010.51	31%
IT Loads	2.30	10%	337	24	241.52	7%
Total	**22.79**	**100%**	**4,555.00**	**322**	**3,264.44**	**100%**



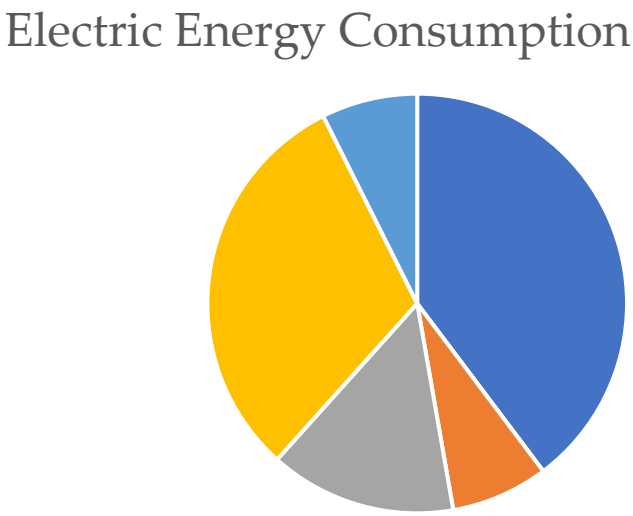


Figure 46 - The total load installed and the electric energy consumed in the DSC – Lebanon

Table 35 - Proposed measures for the DSC - Lebanon

Title	*Savings (€)*	*Avoided CO_2 emissions*
Employee awareness and engagement	-	-
Motion detector in individual offices	39.41	118.38
Lighting retrofit	67.20	201.88
Improve building insulation	82.01	246.37
Solar PV installation	1,093.20	3,284.16
Use of wood pellets instead of diesel in heaters	22.99	59.33

Table 36 - Implemented actions in Jdeideh El Chouf - Lebanon

Action name	*Capacity*	*Emissions avoided (Tons CO_2 eq)*
Lighting retrofit in the municipal buildings	-	5.6
PVs in municipal building's roof	5 kWp	4.7
Social media portal creation portal creation	-	-
Solar PV for The Jdeideh Women's Organization	40 kWp	36.3
PV for water pumping station	20 kWp	18.27
PV for WWTP	90 kWp	94

9.6 MEDREC – Tunisia

Figure 47 - City Hall of the municipality of Bizerte - Tunisia

ANNEE	(KWh)	DT HTVA	DT/kwh	kwh/m²
2 015	41 815	12 251,70	0,293	24,67
2 016	34 646	10 101,65	0,292	20,44
2 017	44 808	13 227,79	0,295	26,44

Figure 48 - Consumption and annual energy cost in Bizerte - Tunisia

Table 37 - Stakeholders MEDREC

Stakeholder	*Role*
National Heritage Institute (INP)	Safeguarding, protection, restoration and exhibition of documents of the pilot building of Bizerte
The National Agency for Energy Management (ANME)	Feedback on the measures/process proposed for the pilot building selected
Société de Gestion de Technopole de Bordj Cedria	Feedback on the measures/process proposed for the pilot building selected

The National Federation of Municipalities (FNCT)	Feedback on the measures/process proposed for the pilot building selected
Green Building Council (TGBC)	Feedback on the measures/process proposed for the pilot building selected
Startup dB.Sense	Proposing new approaches to promote sustainable behaviors of building users
Students/professors and researchers	Definition and evaluation of innovative renovation measures based on the latest technological developments and while using advanced softwares
Building energy managers and users	Co-creation of the renovation process

Figure 49 - Local training on "LL methodology and Selected Reference Projects outcomes" in Bizerte - Tunisia

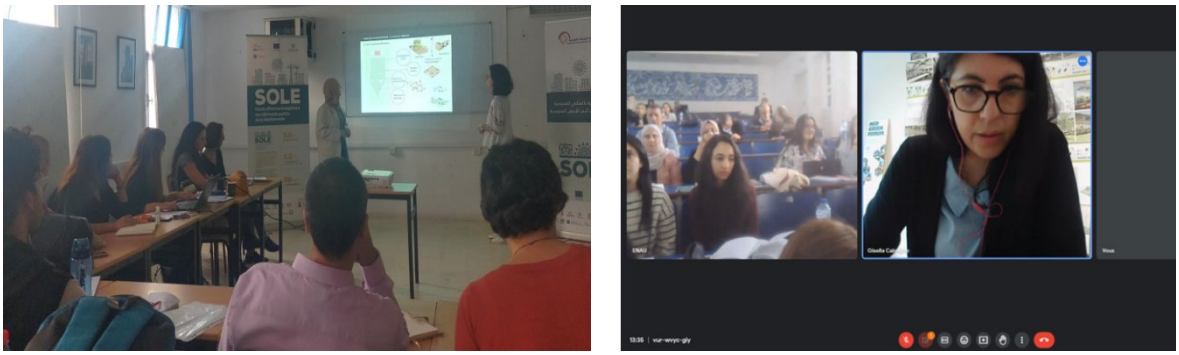


Figure 50 - Challenge for innovative and cost-effective renovation solutions for public buildings in Tunisia

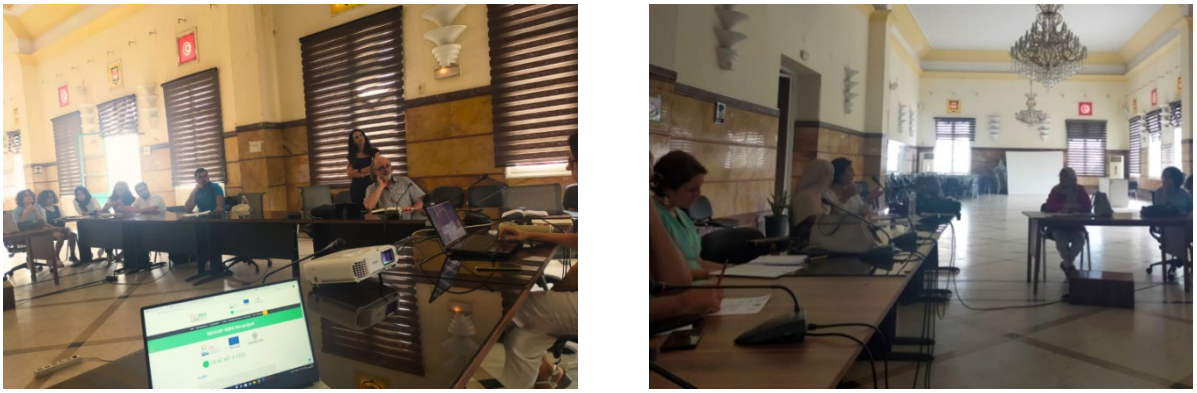


Figure 51 - Workshop on "Building energy renovation measures implementation based on a Living Lab approach in Bizerte - Tunisia

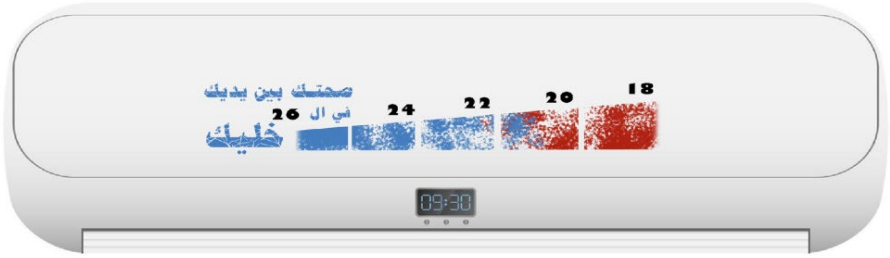


Figure 52 - Green Nudge Challenge results – Tunisia

Figure 53 - Pilot building: real (left), digital twin (right) Municipality of Bizerte - Tunisia

SEACAP 4 SDG

KEY PERFORMANCE INDICATORS KPIs				
ENERGY PERFORMANCE INDICATORS	Total annual primary energy consumption	kWh/m2/yr	203.9047619
		kWh/yr	371514.47
	Annual final energy consumption for space heating	kWh/m2/yr	813.3
		kWh/yr	24232.6
	Annual final energy consumption for space cooling	kWh/m2/yr	37.84
		kWh/yr	68944.48
	Annual final energy consumption for lighting	kWh/m2/yr	34.495
		kWh/yr	62849.89
ENVIRONMENTAL INDICATORS	Total annual CO2 emissions	kg/m2/yr	19.78
		kg/yr	36039.16
COST INDICATORS	Annual total energy-related operational cost	DT/m2/yr	28.518
		DT/yr	51959.796

Figure 54 - Key performance indicators of the pilot building - baseline case - Tunisia

Figure 55 – Field visits to the municipality of Bizerte – Tunisia

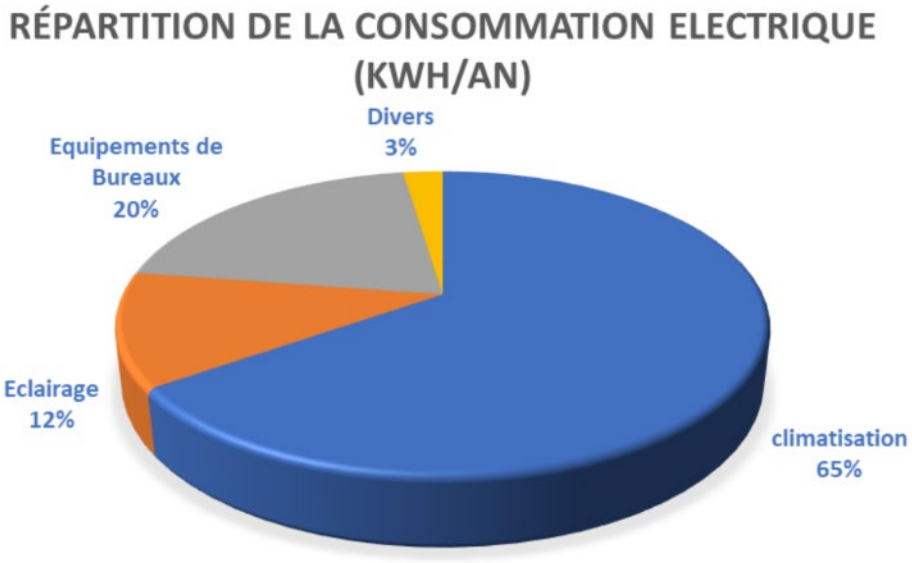


Figure 56 – Breakdown of the pilot building energy consumption by use in 2017 of Municipality of Bizerte - Tunisia

SEACAP 4 SDG

RETROFIT				MINOR RETROFIT	MEDIUM RETROFIT		MAJOR RETROFIT	DEEP RETROFIT
SHORT DISCRIPTION				Installation of a photovoltaic system (25 kWp)	gaz heating	LED lightning	windows(double glaze) + wall isolatin (u=0.24)+ceiling	photovoltaic (25KWp)+ Gaz heating + LED + windows (double glaze)+ insulation walls and ceiling (u=0.24)
KEY PERFORMANCE INDICATORS KPIs	ENERGY PERFORMANCE	Total annual primary energy consumption	kWh/m2/yr	156.52	187.885	162.85	181.9047	80.78095
			kWh/yr	285186.381	342326.75	296725.7	331430.4	147182.8
		Annual final energy consumption for space heating	kWh/m2/yr	13.3	13.3	13.3	10.54	10.54
			kWh/yr	24232.6	24232.6	24232.6	19203.88	19203.88
		Annual final energy consumption for space cooling	kWh/m2/yr	22.84	37.84	37.84	31.376	31.376
			kWh/yr	41614.48	68944.48	68944.48	57167.07	57167.07
		Annual final energy consumption for lighting	kWh/m2/yr	29.595	34.495	17.24	34.495	17.24
			kWh/yr	53922.09	62849.89	31411.28	62849.89	31411.28
		Annual electricity consumption	kWh/m2/yr	65.74	72.34	68.4	76.4	28.72
			kWh/yr	119778.28	131803.4	124624.8	139200.8	52327.84
		Annual consumption of fossil fuel	kWh/m2/yr	0	813.3	0	0	10.54
			kWh/yr	0	24232.6	0	0	19203.88
		Annual generation of Renewable Energy	kWh/m2/yr	19.9	0	0	0	19.9
			kWh/yr	36257.8	0	0	0	36257.8
	ENVIRONMENTAL	Total annual CO2 emissions	kg/m2/yr	15.18	19.72	15.8	17.64	9.02
			kg/yr	27657.96	35929.84	28787.6	32140.08	16434.44
		Annual CO2 emissions from electricity consumption	kg/m2/yr	15.18	16.71	13.66	17.64	6.63
			kg/yr	27657.96	30445.62	24888.52	32140.08	12079.86
		Annual CO2 emissions from fossil fuels consumption	kg/m2/yr	0	3.01	0	0	2.4
			kg/yr	0	5484.22	0	0	4372.8
	COST INDICATORS	Annual total energy-related operational cost	DT/m2/yr	21.9	22.31	22.77	25.44	9.94
			DT/yr	39901.8	40648.82	41486.94	46351.68	18110.68
		Annual electricity cost	DT/m2/yr	21.9	24.08	22.77	25.44	9.56
			DT/yr	39901.8	43873.76	41486.94	46351.68	17418.32
		Annual fossil fuel cost	DT/m2/yr	0	0.48	0	0	0.38
			DT/yr	0	874.56	0	0	692.36
		Total investment	DT	87500	30000	1000	250000	368500
	PERFORMANCE	Total annual primary energy savings	kWh/m2/yr	47.38	16.0196	41.04761	22	123.1238
			kWh/yr	86328.09	29187.72	74788.76	40084	224331.5
			%	23.23680523	7.856416	20.13078	10.78935	60.38299
		Annual final energy savings for space heating	kWh/m2/yr	0	0	0	2.76	2.76
			kWh/yr	0	0	0	5028.72	5028.72
			%	0	0	0	20.75187	20.75
		Annual final energy savings for space cooling	kWh/m2/yr	15	0	0	6.464	6.464
			kWh/yr	27330	0	0	11777.40	11777.40
			%	39.64059197	0	0	17.08245	17.08245
		Annual final energy savings for lighting	kWh/m2/yr	4.9	0	17.255	0	17.255
			kWh/yr	8927.8	1.0278	0.013370	0	31438.61
			%	14.2049572	0	50.021		50.021

Key Performance Indicators (KPIs) Impacts								
ENERGY	Annual electricity savings	kWh/m2/yr	19.9	13.3	17.24	9.24	56.92
		kWh/yr	36257.8	24232.6	31411.28	16835.28	103708.2
		%	23.23680523	15.530126	20.13078	10.78935	66.46
	Annual savings of fossil fuel consumption	kWh/m2/yr	0	-13.3	0	0	-10.54
		kWh/yr	0	-24232.6	0	0	-19203.88
		%	0				
	Annual increase of Renewable Energy generation	kWh/m2/yr	19.9	0	0	0	19.9
		kWh/yr	36257.8	0	0	0	36257.8
		%	100				100
ENVIRONMENTAL	Total annual avoided CO2 emissions	kg/m2/yr	4.6	0.06	3.98	3.98	10.76
		kg/yr	8381.2	109.32	7251.56	7251.56	19604.72
		%	23.25581395	0.303336	20.12133	20.121	54.39
	Annual avoided CO2 emissions from electricity consumption	kg/m2/yr	4.6	3.07	6.12	6.12	13.15
		kg/yr	8381.2	5593.54	11150.64	11150.64	23959.3
		%	23.25581395	15.52072	30.94034	30.9	66.48
	Annual avoided CO2 emissions from fossil fuels consumption	kg/m2/yr	0	-3.01	0	0	-2.4
		kg/yr	0	-5484.22	0	0	4372.8
		%					
COST INDICATORS	Annual savings of total energy-related operational cost	DT/m2/yr	6.618	6.208	5.748	3.078	18.578
		DT/yr	12057.996	11310.97	10472.85	5608.116	33849.1
		%	23.20639596	21.76870	20.15569	10.79	65.14
	Annual electricity cost savings	DT/m2/yr	6.618	84.438	5.748	3.078	18.958
		DT/yr	12057.996	8086.036	10472.85	5608.116	34541.4
		%	23.20639596	15.56210	20.15569	10.79	66.477
	Annual fossil fuel cost saving	DT/m2/yr	0	-0.48	0	0	-0.38
		DT/yr	0	-874.56	0	0	-692.36
		%					
	Simple Payback period	yr	7.23	2.65	0.1	44.64	10.85
	Total investment cost per total annual energy saved	DT/(kWh of energy saved)	1.01357501	1.027829	0.0318356	6.236902	1.642657
	Total investment cost per sq.m.	DT/m2	48.02414929	16.46542	0.548847	137.2118	202.25

Figure 57 - Different retrofits energy consumptions, CO_2 emissions and cost savings and their impact in Bizerte - Tunisia

9.7 NERC – Jordan

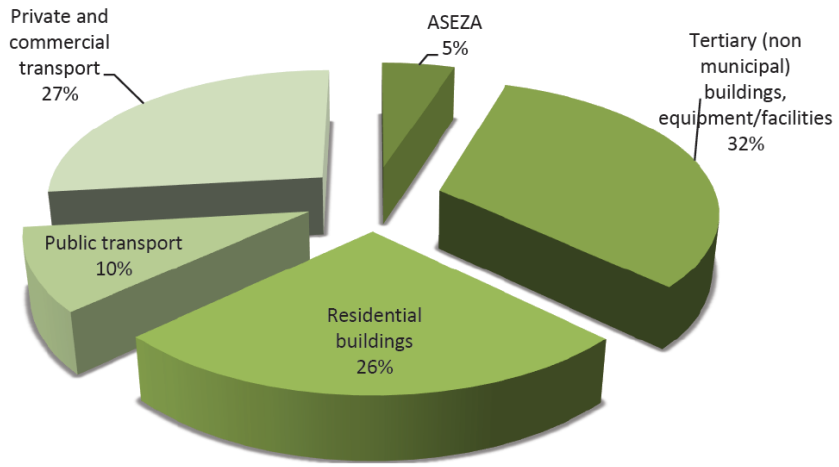


Figure 58 - Energy consumption allocation per sector in ASEZA - Jordan

MWh Sector	Electricity	LPG	Heating Oil	Diesel	Gasoline	Kerosene	Solar thermal
Municipal Buildings, Equipment, Facilities	12,804						
Public Lighting	12,630						
Residential Buildings	143,634	21,811	3,883			803	22,481
Tertiary Buildings, Equipment, Facilities	217,555	14,541	5,876				
Municipal fleet				9,300	2,153		
Public Transport				531	73,784		
Private & Commercial Transport				143,764	54,742		

Figure 59 - Total energy consumption per sector and energy source in ASEZA - Jordan

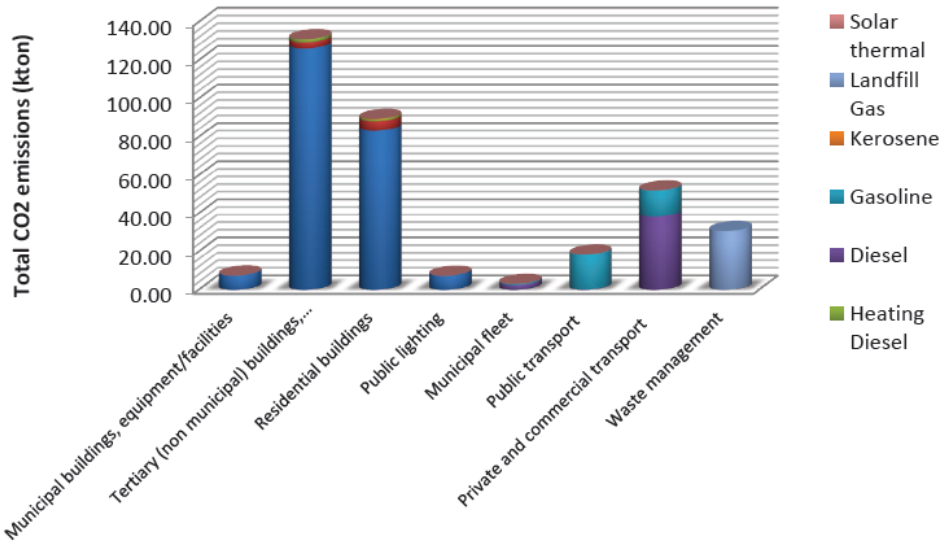


Figure 60 - Total CO_2 emissions per sector and fuel in ASEZA - Jordan

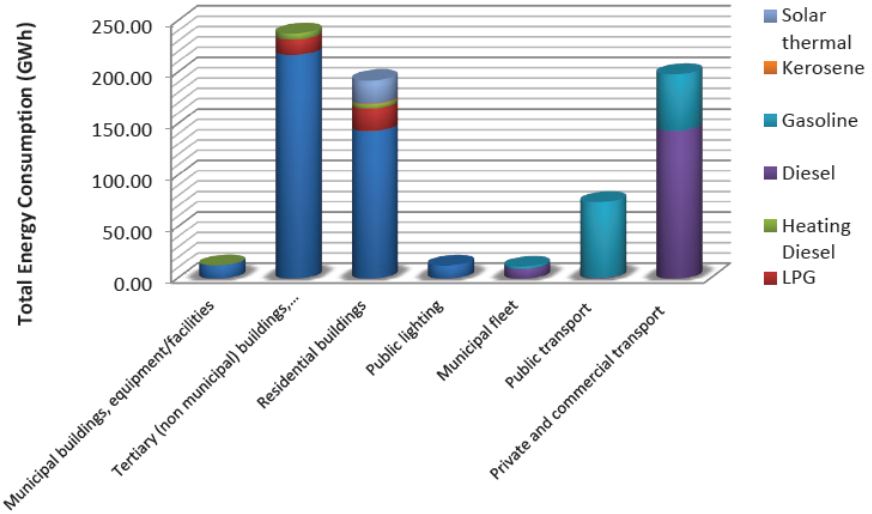


Figure 61 - Energy consumption per sector and fuel in ASEZA- Jordan

Table 38 - Energy consumption and CO_2 emissions for the base year and 2030 BAU in ASEZA- Jordan

Total	*Baseline*	*Forecasted by 2030*
Energy consumption (MWh)	740,293	1,325,124
$CO_{2\,eq}$ emissions (tons)	339,676	608,021

Table 39 - List of stakeholders - NERC

Name of stakeholder	*Type of stakeholder*	*Description of stakeholder*	*Roles of stakeholder*
RSS/NERC	Local Project Partner	The Royal Scientific Society is the largest applied research institution, consultancy, and technical support service provider in Jordan and is a regional leader in the fields of science and technology.	It is the project partner and coordinator of project activities in Jordan as well as WP5 leader.
ASEZA	Institutional decision makers	It is the selected municipality to implement SECAP project activities.	ASEZA is the governing part in Aqaba and decision-making entity that facilitates the implementation of SEACAP. Participating in the living lab is vital for implementation and achieving SEACAP goals.
NEPCO	National and Regional Energy Management Authority	National Electric Power Company (NEPCO) is responsible for managing and operating the electrical System, transmission of electric power, and bulk supply.	NEPCO facilitates the process of data collection regarding the final energy consumption in various sectors.
ECOSOL	External Entity	Eco Engineering and Energy Solutions "EcoSol" is a leading energy, water and sustainability consulting headquartered in Amman- Jordan. EcoSol has been involved in developing sustainable solutions in Jordan and the Middle East to help clients in meeting the sustainability aspects in a	External entity conducts the energy audit, and establishes required documents and reports and part of the LL.

		techno-economical and cost-effective way.	
Ministry of Education	Socio-economic operators	Schools are the targeted end uses to implement the SEACAP project and schools and are governed by the Ministry of Education	The LL-Jor is determined to implement the LL in educational buildings. Therefore, the ministry of education is a key stakeholder in implementation of measures.
EDCO	National and Regional Energy Management Authority	Electric Distribution Company (EDCO) is Responsible of Managing and Operating the Electrical System, Transmission of Electric Power, and Bulk Supply.	Will facilitate the process of data collection regarding the final energy consumption in various sectors

Sector	FINAL ENERGY CONSUMPTION [MWh]															
			Fossil fuels								Renewable energies					Total
	Electricity	Heat/cold	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 INDUSTRIES																
Municipal buildings, equipment/facilities	12,804.00			0.00	0.00											12,804.00
Tertiary (non municipal) buildings, equipment/facilities	217,555.00			14,541.00	5,876.39											237,972.39
Residential buildings	143,634.00			21,811.50	3,882.59					803.08				22,480.87		192,612.04
Public lighting	12,630.00															12,630
Industry — Non-ETS																0.00
Industry — ETS (not recommended)																0.00
Subtotal	386,623.00	0.00	0.00	363,52.50	9,758.98	0.00	0.00	0.00	0.00	803.08	0.00	0.00	0.00	22,480.87	0.00	456,018.43
TRANSPORT																
Municipal fleet						9,300.00	2,152.80									11,452.80
Public transport						531.08	73,783.66									74,314.73
Private and commercial transport						143,764.09	54,742.43									198,506.51
Subtotal	0.00	0.00	0.00	0.00	0.00	153,595.16	130,678.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	284,274.04
OTHER																
Agriculture, Forestry, Fisheries																0.00
TOTAL	386,623.00	0.00	0.00	36,352.50	9,758.98	153,595.16	130,678.88	0.00	0.00	803.08	0.00	0.00	0.00	22,480.87	0.00	740,292.47

Figure 62 - Final energy consumption ASEZA - Jordan

Table 40 - Mitigation actions in ASEZA - Jordan

Nb.	*Actions*
	Municipal Buildings
1	Energy manager appointment in ASEZA
2	Establishment of an Energy Saving Department
3	Awareness raising activities for ASEZA employees
4	Adoption of bioclimatic principles in ASEZA buildings /Strict application of green building codes in ASEZA buildings
5	Promotion of recycling
6	Awareness raising campaigns to reduce the organic content of waste
7	Green Municipal Building and Eco Science Park Awareness Raising
8	Landfill
9	Web portal creation
	Residential Buildings
6	Awareness raising activities for modification of the residents' consumption behavior
7	Promotion of Green Buildings' concept / Strict application of the building code
8	Campaign for promoting high energy label equipment and other awareness activities
9	Replacing existing electric water heater with solar collectors
10	Replacement of single glazing with double/Window shading
	Tertiary Sector
11	Seminars and trainings on selected professional groups
12	Promotion of green buildings concept/ Strict application of the Building Code
13	Campaign for promoting high energy label equipment
14	Replacing existing electric water heater with solar collectors
15	Installation of lighting automations & thermostats
16	External shading installation
	Transport
17	Replacement of the existing ASEZA vehicles with new, more efficient vehicles
18	Eco-driving seminars for the drivers of the ASEZA fleet
19	Information events on the new vehicle technologies
20	Promotion of walking and car sharing and carpooling campaigns
21	Promotion of eco-driving for the private and commercial transport
22	Promotion of eco-driving for public transport's drivers
23	Installing solar systems on the buses related to Aqaba Company for transportation and logistics
	Local Electricity Production
24	1 MW PVs in solar power plant
25	0.1 MW PVs in the Marine Visitors' Center

Table 41 - Adaptation actions in ASEZA - Jordan

Nb.	*Actions*
	Public Health
1	Health action plan for the extreme events (Strategic)
2	Developing an early warning system to alert citizens in the case of extreme weather events (Alert/Communication)
3	Frequent monitoring of water and air quality (Technical)
	Infrastructure
4	Water management plan (Strategic)
5	Modelling predicted supply changes in the electricity from the locally available RES (Strategic)
	Built Environment
6	Enforcement of building codes for more energy efficient and heat tolerant structures (Strategic)
7	Integrated land use planning with zoning system depending on the different areas (Strategic)
8	Increasing the amount of shade and green areas in the city by planting trees and using green pavements to reduce the heat island effect (Technical)
	Economy
9	Adoption of integrated land use planning for the tertiary sector (Strategic)
10	Educating tourists on ways to conserve natural resources (Educational)
	Biodiversity
11	Educating the citizens on biodiversity and how to maintain it (Educational)
12	Trees planting (Technical)

Load Name	Qty	Total Rated Power	Loading Factor	Working Hours			Annual Consumption and Cost		% of Total Loads
		[kW]	%	Hours	Days	Weeks	Consumption [kWh/year]	Cost [JOD/year]	
Lighting[1]	160	9.0	100%				10,000	2,684	11%
Split Units fans	39	1.6	100%	5	6	22	10,296	2,763	11%
AC Exterior Units[2]	18	252.7					59,922	16,082	67%
PCs	11	3.9	100%	1	4	36	554	149	0.6%
Pumps	2	3.04	100%	3	5	36	1,642	441	2%
Others	-	-	100%	-	-	-	7,650	2,053	8%
Total	**-**	**270**					**90,065**	**24,171**	**100%**

Figure 63 - Detailed Electrical Breakdown for Jordan Boys' High School

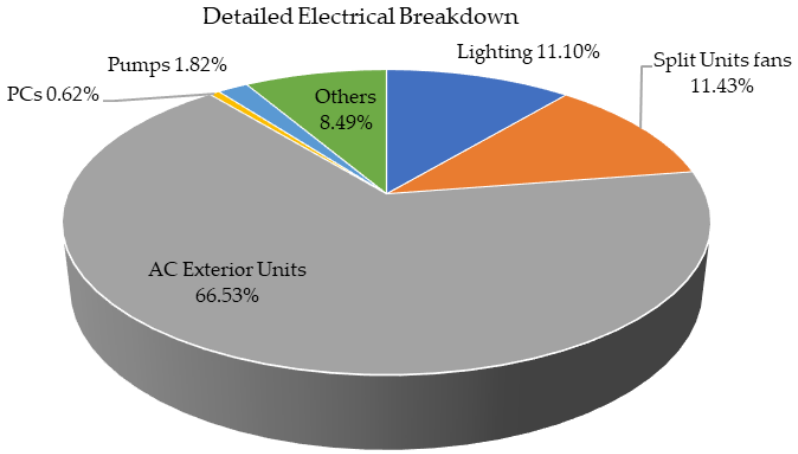


Figure 64 - Detailed electrical breakdown (%) for Jordan Boys' High School

Load Name	Qty	Total Rated Power	Loading Factor	Working Hours			Annual Consumption and Cost		% of Total Loads
		[kW]	%	Hours	Days	Weeks	Consumption [kWh/year]	Cost [JOD/year]	
Lighting	316	11.3					10,719	2,871	17%
Split Units fans	40	6.0	100%	5	6	22	3,960	1,061	6%
AC Exterior Units	15	166.2					42,424	11,364	65%
PCs	15	8.3	100%	1	6	36	1,782	477	3%
Pumps	5	10.1	100%	2	5	36	3,618	969	6%
Others	-	-					2,360	632	4%
Total	-	**202**					**64,862.53**	**17,374.04**	**100%**

Figure 65 - Detailed electrical breakdown for Jordan Girls' High School

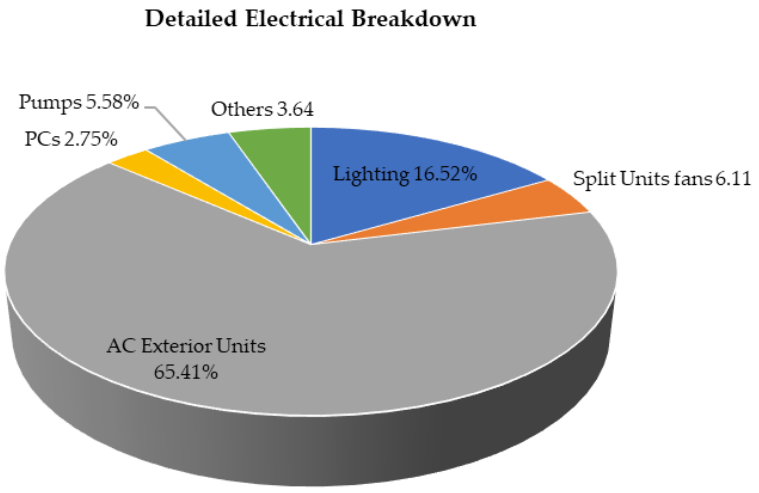


Figure 66 - Detailed electrical breakdown (%) for Jordan Girls' High School

Load Name	Qty	Total Rated Power	Loading Factor	Working Hours			Annual Consumption and Cost		% of Total Loads
		[kW]	%	Hours	Days	Weeks	Consumption [kWh/year]	Cost [JOD/year]	
Lighting	531	21.8					22,137.54	5,929.7	18%
Split Units fans	79	11.85	76%	5	6	22	5,950.80	1,594.0	5%
AC Exterior Units	19	212.0					87,036.69	23,313.6	72%
PCs	15	8.3	100%	1	6	33	1,633.50	437.5	1%
Pumps	5	10.1	100%	2	5	36	3,618.00	969.1	3%
Others	-	-					232.88	62.4	0.19%
Total	-	**256**					**120,609.41**	**32,306.36**	**100%**

Figure 67 - Detailed electrical breakdown for Jordan Mixed Elementary School

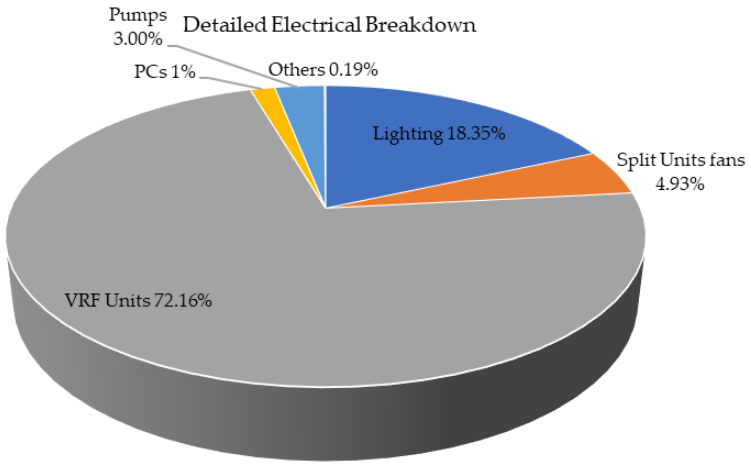


Figure 68 - Detailed electrical breakdown (%) for Jordan Mixed Elementary School

Table 42 – EMOs "Energy Management Opportunities" for Jordan Boys' High School 2023

Code	*EE measure*
EMO-01	Replace the existing conventional lighting by a higher efficiency LED tube lighting
EMO-02	Modify lighting control circuits to allow partial lighting at the classrooms
EMO-03	Automatic control of lighting and AC system using occupancy sensors
EMO-04	Installing a Wi-Fi smart switch to automatically deactivate power supply upon the conclusion of the school day

Table 43 - Technical and financial results for Jordan Boys' High School

Total Investment	*JOD*	*1,860*
Cost savings	JOD	2,634
Payback period	Years	0.7
Electricity savings	kWh	9,813
Electricity savings	%	10.9%
CO_2 reduction	kg	4,499.4

Table 44 - EMOs for the Jordan Girls' High School

Code	*EE measure*
EMO-05	Replace the existing conventional lighting by a higher efficiency LED tube lighting
EMO-06	Automatic control of lighting and AC system using occupancy sensors
EMO-07	Installing a Wi-Fi smart switch to automatically deactivate power supply upon the conclusion of the school day

Table 45 - Technical and financial results for Jordan Girls' High School

Total investment	*JOD*	*3,700*
Cost savings	JOD	2,233
Payback period	Years	1.7
Electricity savings	kWh	8,320
Electricity savings	%	12.8%
CO_2 reduction	kg	3,814.9

Table 46 - EMOs for Jordan Mixed Elementary School

Code	*EE measure*
EMO-08	Replace the Existing conventional Lighting by a Higher Efficiency LED Tube Lighting
EMO-09	Automatic control of lighting and AC system using Occupancy Sensors
EMO-10	Installing a Wi-Fi smart switch to automatically deactivate power supply upon the conclusion of the school day

Table 47 - Technical and financial results for Jordan Mixed Elementary School

Total Investment	**JOD**	**5,230**
Cost savings	JOD	6,382
Pay Back Period	Years	0.8
Electricity savings	kWh	23,781
Electricity savings	%	19.72%
CO_2 reduction	kg	10,903.8

9.8. UPatras – Greece

	Electric Energy (MWh)	Oil (MWh)	Biomass-Wood (MWh)	Total (MWh)
Municipal Buildings & facilities	29,007.78	3,865.84	0.00	**32,873.62**
Houses	75,282.00	122,207.78	38,644.76	**236,134.54**
Tertiary sector	4,900.00	7,953.00	0.00	**12,853.00**
Total	**109,189.78**	**134,026.62**	**38,644.76**	**281,861.16**

Figure 69 - Energy consumption by category of buildings in the Municipality of Aigialeia - Greece

	Energy Consumption (MWh)	CO2 emissions (tons)
Electricity	109,189.78	61,146.28
Heating oil	134,026.62	35,785.11
Biomass	38,644.76	7,728.95
Total	**281,861.16**	**104,660.34**

Figure 70 - Energy consumption and CO_2 emissions by source in Aigialeia – Greece

	Electricity (MWh)	CO2 emissions (tons)
Municipal Buildings & facilities	29,007.78	16,244.36
Houses	75,282.00	42,157.92
Tertiary sector	4,900.00	2,744.00
Total	**109,189.78**	**61,146.28**

Figure 71 - Energy Consumption and CO_2 emissions by form of building in Aigialeia - Greece

	Oil (MWh)	CO2 emissions (tons)
Municipal Buildings & facilities	3,865.84	1,032.18
Houses	122,207.78	32,629.48
Tertiary sector	7,953.00	2,123.45
Total	**134,026.62**	**35,785.11**

Figure 72 - Oil consumption and CO_2 emissions per building type in Aigialeia – Greece

	Biomass (wood) (MWh)	CO2 emissions (tons)
Municipal Buildings & facilities	0.00	0.00
Houses	38,644.76	7,728.95
Tertiary sector	0.00	0.00
Total	**38,644.76**	**7,728.95**

Figure 73 - Energy consumption and CO_2 emissions from Biomass by form of building in Aigialeia – Greece

CO2 emissions (tons)	
Municipal Buildings & facilities	**17,276.54**
Houses	**82,516.69**
Tertiary sector	**4,867.45**
Total	**104,660.68**

Figure 74 – CO_2 emissions per building type in Aigialeia - Greece

Table 48 - List of stakeholders - UPatras

Stakeholder	*Expected role within the project*	*Expected role after the project*
University of Patras (UPatras)	Project partner, implementation of activities, knowledge dissemination	Continued expertise contribution, collaborations in future projects
Municipality of Aigialeia	Active participation, energy efficiency implementation, sustainability model	Sustain adopted practices, model for others, local development
MES Energy S.A.	Expertise provider, guidance, assessments, support	Offer consultancy, expand energy practices
Regional Administrations (Regions)	Support, collaboration with partners	Collaboration for regional development, energy efficiency
Other Municipalities in Greece	Knowledge sharing, potential adoption	Incorporate lessons, enhance energy management
Residents and Local Communities	Participation in campaigns, behavior change	Continue energy-efficient behaviors, conservation
Local Businesses and Organizations	Participate in workshops, adopt measures	Integrate energy-efficient practices, benefit economically
Government Authorities and Regulatory Bodies	Support, guidance, regulatory framework	Continue policy support, advance energy initiatives
Educational Institutions	Collaboration in workshops, knowledge sharing	Integrate energy concepts, research, education
NGOs and Community Groups	Collaborate in initiatives, awareness campaigns	Sustain community engagement, promote responsibility

Building No	Building name	Building floor area (m^2)	Absolute values of Classification Criteria (CC) (previous to PBT classification)						
			Building type / use	Nº of floors	Construction type			Heating system	Cooling system
					Roof geometry	Roof material	Structure/ Framework		
1	1st professional highschool of Aigio	6832	A or B level education	1	Inclined	Roman tiles	Reinforced concrete-bricks	Oil boiler	Local A/C units
2	Municipal office of Akrata	200	Office	1	Inclined	Roman tiles	Masonry	Oil boiler	Local A/C units
3	Municipal office of Sympoliteia	660	Office	2	Inclined	Roman tiles	Masonry	Oil boiler	Local A/C units
4	Municipal office of Aigeira	140	Office	2	Horizontal	Concrete-based conventional type	Masonry	Oil boiler	Local A/C units
5	Municipal office of Diakopto	440	Office	2	Horizontal	Concrete-based conventional type	Reinforced concrete-bricks	Oil boiler	Local A/C units
6	1st Elementary school of Aigio	770	A or B level education	2	Horizontal	Concrete-based conventional type	Reinforced concrete-bricks	Oil boiler	Local A/C units
7	2nd Elementary school of Aigio	1100	A or B level education	2	Horizontal	Concrete-based conventional type	Reinforced concrete-bricks	Oil boiler	Local A/C units
8	1st junior highschool of Aigio	1850	A or B level education	2	Horizontal	Concrete-based conventional type	Reinforced concrete-bricks	Oil boiler	Local A/C units
9	Junior highschool of Akrata	1115	A or B level education	1	Inclined	Roman tiles	Masonry	Oil boiler	Local A/C units
10	1st senior highschool of Aigio	4450	A or B level education	3	Horizontal	Roman tiles	Reinforced concrete-bricks	Oil boiler	Local A/C units

Figure 75 - List of PB "Public Building" & CC "Classification Criteria" Absolute values

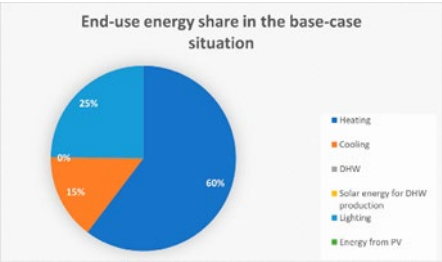
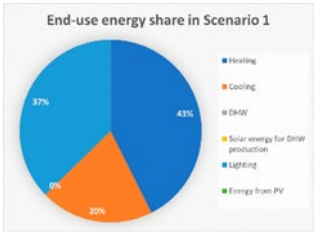
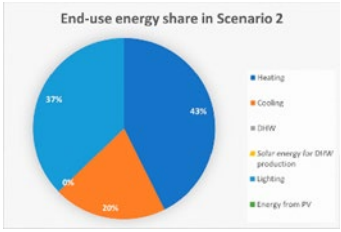
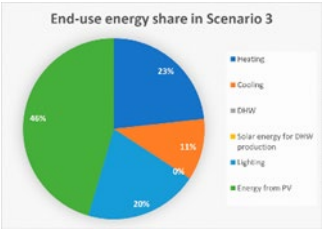
Building No	Building name	Classification Criteria (CC) into Public Building Typologies (PBT)					Public Building Typology (PBT)
		Building type / use (CC1)	Nº of floors (CC3)	Construction type (CC5)	Heating system (CC6)	Cooling system (CC7)	
1	1st professional highschool of Aigio	A or B level education	<=3	Heavy structure (concrete, brick-wall)	Oil boiler	Local heat pump	PBT1
2	Municipal office of Akrata	Office	<=3	Very heavy structure (e.g. masonry)	Oil boiler	Local heat pump	PBT2
3	Municipal office of Sympoliteia	Office	<=3	Very heavy structure (e.g. masonry)	Oil boiler	Local heat pump	PBT2
4	Municipal office of Aigeira	Office	<=3	Very heavy structure (e.g. masonry)	Oil boiler	Local heat pump	PBT2
5	Municipal office of Diakopto	Office	<=3	Heavy structure (concrete, brick-wall)	Oil boiler	Local heat pump	PBT3
6	1st Elementary school of Aigio	A or B level education	<=3	Heavy structure (concrete, brick-wall)	Oil boiler	Local heat pump	PBT1
7	2nd Elementary school of Aigio	A or B level education	<=3	Heavy structure (concrete, brick-wall)	Oil boiler	Local heat pump	PBT1
8	1st junior highschool of Aigio	A or B level education	<=3	Heavy structure (concrete, brick-wall)	Oil boiler	Local heat pump	PBT1
9	Junior highschool of Akrata	A or B level education	<=3	Very heavy structure (e.g. masonry)	Oil boiler	Local heat pump	PBT4
10	1st senior highschool of Aigio	A or B level education	<=3	Heavy structure (concrete, brick-wall)	Oil boiler	Local heat pump	PBT1

Figure 76 - Classified stock of the 10 priority buildings of the Municipality of Aigialeia (screenshot from the PBT-Library tool).

Table 49 - Energy retrofit scenarios considered for the selected ambassador buildings.

	Scenario 1 IMPULSE- *wise*	*Scenario 2*	*Scenario 3*
Interventions	*Retrofit level: Medium*	*IMPULSE-Wise*	*IMPULSE-Wise*
		Retrofit Level: Major	Retrofit Level: Deep
Envelope interventions	C	C	C
Roof thermal insulation: graphite-based EPS 7 cm	C	C	C
Wall thermal insulation: graphite-based EPS 7 cm	C	C	C
Windows replacement: low-e double-glazed 4-18-4 mm, aluminum frame with thermal break	C	C	C
Systems interventions	-	C	C
Installation of a central heat-pump for heating and cooling	-	C	C
Fixtures' replacement with LED (prescribed based on lumens minimum requirements)	-	C	C
RES integration	-	-	C
Grid-connected PV (installed power prescribed based on the electricity demand after energy efficiency interventions)	-	-	C
Built on top of the former scenario.			

Table 50 - State KPIs for the PBT1's ambassador building in the base case and for the retrofit scenarios - Greece

KPI	Base-Case Situation	Scenario 1 IMPULSE-Wise Retrofit Level: Medium	Scenario 2 IMPULSE-Wise Retrofit Level: Major	Scenario 3 IMPULSE-Wise Retrofit Level: Deep
Electricity consumption (kWh/m^2)	20.4	19.6	12.0	2.0
Fossil fuel consumption (for heating purposes) (kWh/m^2)	31.0	14.6	0.0	0.0
RES consumption (kWh/m^2)	0.0	0.0	0.0	10.0
End-use energy share				
Annual total emissions CO_2 (kg/m^2)	20.5	15.7	7.2	1.2
Investment cost (EUR)	Not applicable	138,263.0	153,862.0	177,807.0
Annual energy cost (EUR)	9369.0	6724.0	2765.0	462.0
Simple payback period (yrs)	Not applicable	>50	23.9	20.7

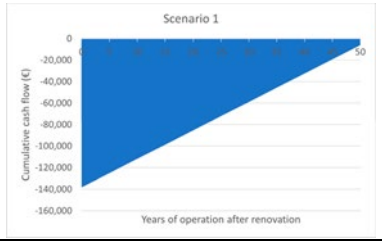
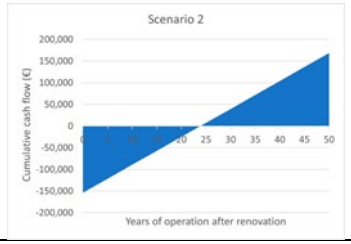
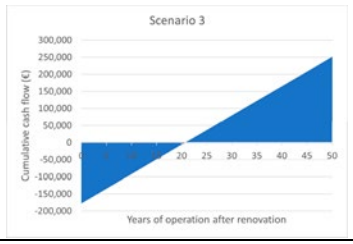
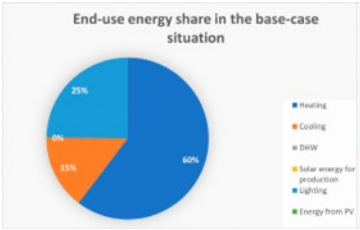
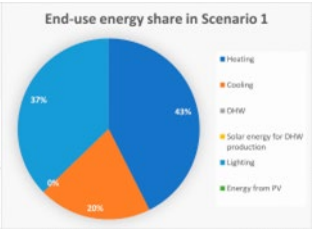
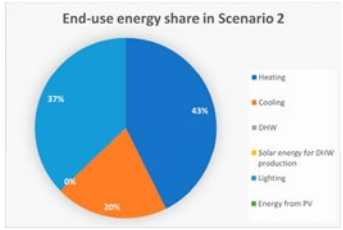
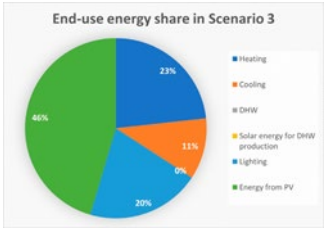
Annual cumulative cash flow (EUR)	Not applicable		 

Table 51 - State KPIs for the PBT2's ambassador building in the base case and for the retrofit scenarios - Greece

KPI	Base-Case Situation	Scenario 1 IMPULSE-Wise Retrofit Level: Medium	Scenario 2 IMPULSE-Wise Retrofit Level: Major	Scenario 3 IMPULSE-Wise Retrofit Level: Deep
Electricity consumption (kWh/m^2)	20.4	19.6	12.0	2.0
Fossil fuel consumption (for heatingpurposes) (kWh/m^2)	31.0	14.6	0.0	0.0
RES consumption (kWh/m^2)	0.0	0.0	0.0	10.0
End-use energy share	 			

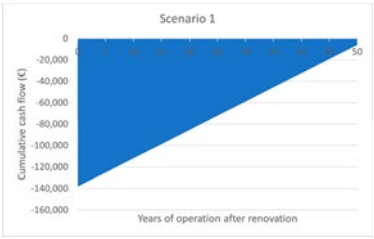
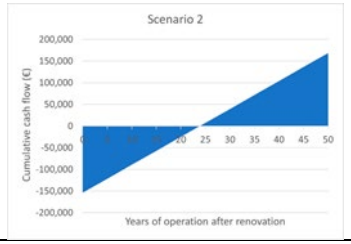
Annual total emissions CO_2 (kg/m^2)	20.5	15.7	7.2	1.2
Investment cost (EUR)	Not applicable	138,263.0	153,862.0	177,807.0
Annual energy cost (EUR)	9369.0	6724.0	2765.0	462.0
Simple payback period (yrs)	Not applicable	>50	23.9	20.7
Annual cumulative cash flow (EUR)	Not applicable			

Table 52 - State KPIs for the PBT3's ambassador building in the base case and for the retrofit scenarios - Greece

KPI	**Base-Case Situation**	**Scenario 1 IMPULSE-Wise Retrofit Level: Medium**	**Scenario 2 IMPULSE-Wise Retrofit Level: Major**	**Scenario 3 IMPULSE-Wise Retrofit Level: Deep**
Electricity consumption (kWh/m^2)	78.6	74.7	38.5	2.0
Fossil fuel consumption (for heatingpurposes) (kWh/m^2)	75.0	35.3	0.0	0.0
RES consumption (kWh/m^2)	0.0	0.0	0.0	36.5

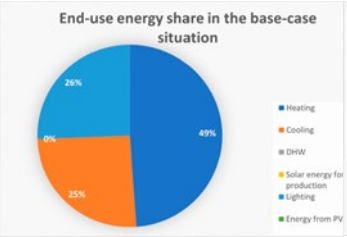
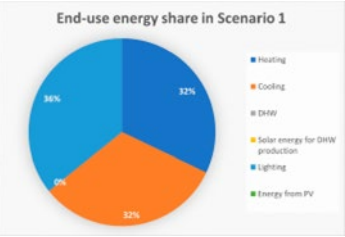
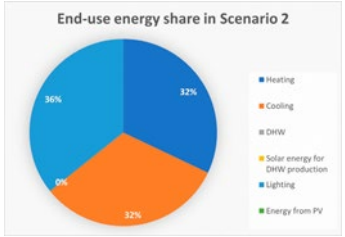
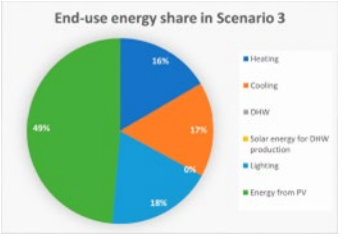
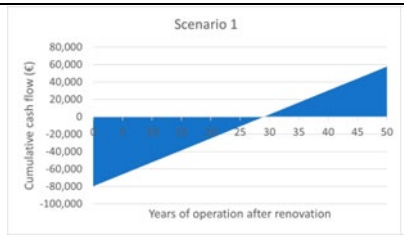
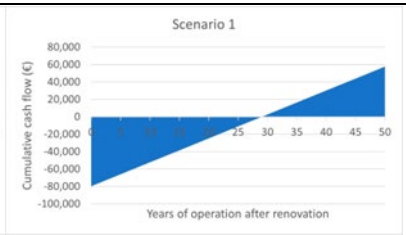
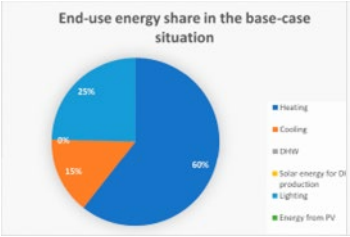
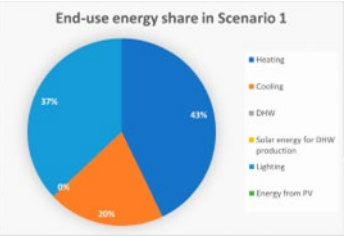
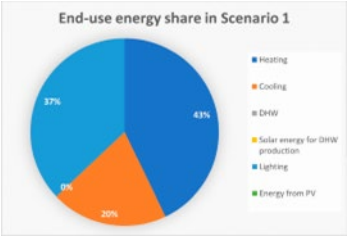
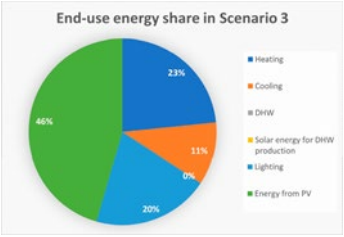
				
(kg/m^2)	67.2	54.3	23.2	1.2
Investment cost (EUR)	Not applicable	79,836.0	87,431.0	120,142.0
Annual energy cost (EUR)	11,769.0	9018.0	3555.0	185.0
Simple payback period (yrs)	Not applicable	29.0	10.7	10.7
Annual cumulative cash flow (EUR)	Not applicable			

Table 53 - State KPIs for the PBT4's ambassador building in the base case and for the retrofit scenarios - Greece

KPI	Base-Case Situation	Scenario 1 IMPULSE-Wise Retrofit Level: Medium	Scenario 2 IMPULSE-Wise Retrofit Level: Major	Scenario 3 IMPULSE-Wise Retrofit Level: Deep
Electricity consumption (kWh/m^2)	20.8	20.0	12.3	2.0
Fossil fuel consumption (for heatingpurposes) (kWh/m^2)	32.0	15.0	0.0	0.0
RES consumption (kWh/m^2)	0.0	0.0	0.0	10.3
				
(kg/m^2)	21.0	16.0	7.4	1.2
Investment cost (EUR)	Not applicable	141,491.0	211,356.0	236,289.0
Annual energy cost (EUR)	9743.1	6978.0	2873.0	468.0
Simple payback period (yrs)	Not applicable	>50	34.2	28.1

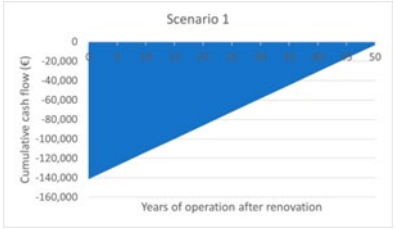
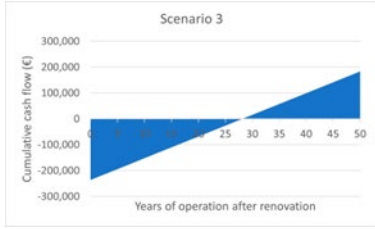
Annual cumulative cash flow (EUR)	Not applicable			

Table 54 - Calculated KPIs in the base case and for the retrofit scenarios for the whole building stock Greece

KPI	*Base-Case Situation*	*Scenario 1 IMPULSE-Wise Retrofit*	*Scenario 2 IMPULSE-Wise*	*Scenario 3 IMPULSE-Wise*
		Level: Medium	*Retrofit Level: Major*	*Retrofit Level: Deep*
Electricity consumption (kWh)	444,816.80	426,691.40	252,441.00	351,140
Fossil fuel consumption (for heating purposes) (kWh)	626,742.00	294,568.70	0	0
Annual total emissions CO_2 (tons)	433.5	334.9	152.1	21.2
Investment cost (k EUR)	-	2260.6	2596.6	3062.7
Annual energy cost (k EUR)	179	129.8	53	7.4
Simple payback period (years)	-	46	20.6	17.8

KPIs for the base-case scenario		Ambassador_PBT1
Building name		2nd Elementary school of Aigio
Building floor area (m^2)		1100
Annual electricity consumption	$kWh/m^2/yr$	20.40
	kWh/yr	22,440.00
Annual consumption of fossil fuel	$kWh/m^2/yr$	31.00
	kWh/yr	34,100.00
Annual generation of Renewable Energy	$kWh/m^2/yr$	0.00
	kWh/yr	0.00
Total annual CO_2 emissions	$kg/m^2/yr$	20.48
	kg/yr	22,526.99
Annual total energy-related operational cost	National Currency/m^2/yr	8.52
	National Currency/yr	9 369.42

KPIs for the deep-retrofit scenarios		Ambassador_PBT1		
Retrofit scenario		Scenario1_PBT1	Scenario2_PBT1 (optional)	Scenario3_PBT1 (optional)
Building name		2nd Elementary school of Aigio		
Building floor area (m^2)		1100		
Annual electricity consumption	$kWh/m^2/yr$	2.00		
	kWh/yr	2 200.00	0.00	0.00
Annual consumption of fossil fuel	$kWh/m^2/yr$	0.00		
	kWh/yr	0.00	0.00	0.00
Annual generation of Renewable Energy	$kWh/m^2/yr$	9.97		
	kWh/yr	10,968.93	0.00	0.00
Total annual CO_2 emissions	$kg/m^2/yr$	1.21		
	kg/yr	1 325.94	0.00	0.00
Annual total energy-related operational cost	National Currency/m^2/yr	0.42		
	National Currency/yr	462.00	0.00	0.00
Total investment cost	National Currency	177,807.47		
Simple Payback period	yr	20.70		

Figure 77 - Sample of PBT1 ambassador's KPIs inserted in the IMPULSE KPIs' processor (screenshot from the tool; clarification: white cells: inserted; colored cells: automatically calculated in the tool)

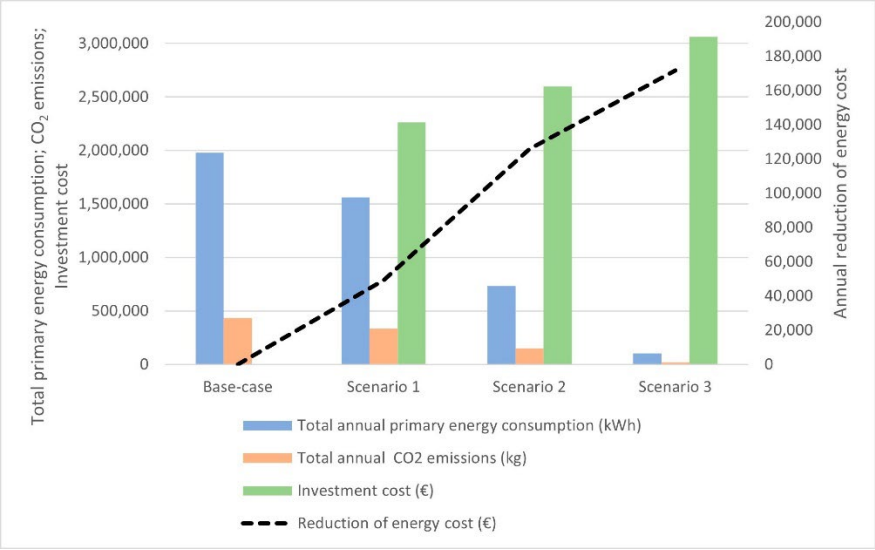


Figure 78 - Energy, environmental and economic impacts for the various renovation scenarios studied for the whole building stock – Greece

Table 55 - Combinations of weights tested in the PLUGIN tool and corresponding indices of preferences

Combination	*Weights*	*Road map duration (years)*	*Standard deviation of projects' number*	*No. of years with at least two buildings being retrofitted*
Comb1	DCI: 30% DC2: 10% DC3: 60%	6	1.03	5
Comb2	DCI: 10% DC2: 30% DC3: 60%	6	1.03	5
Comb3	DCI: 60% DC2: 10% DC3: 30%	7	1.91	2
Comb4	DCI: 10% DC2: 60% DC3: 30%	7	1.91	2
Comb5	DCI: 30% DC2: 60% DC3: 10%	6	0.82	3
Comb6	DCI: 60% DC2: 30% DC3: 10%	6	0.82	3

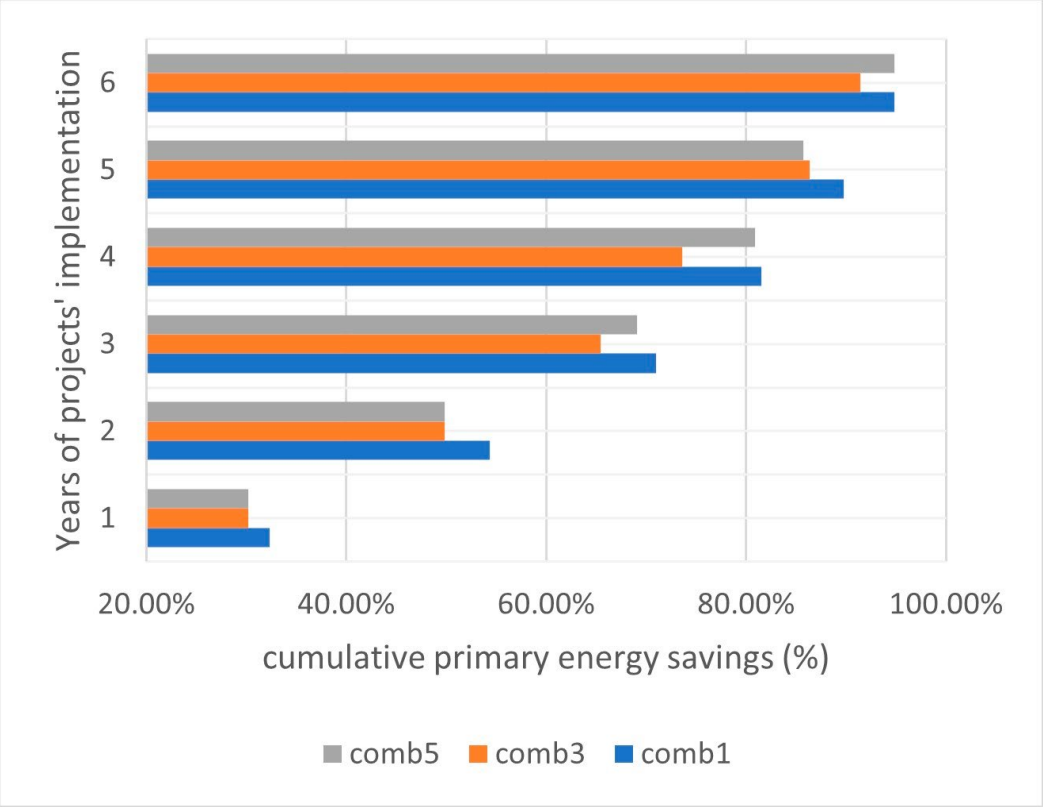
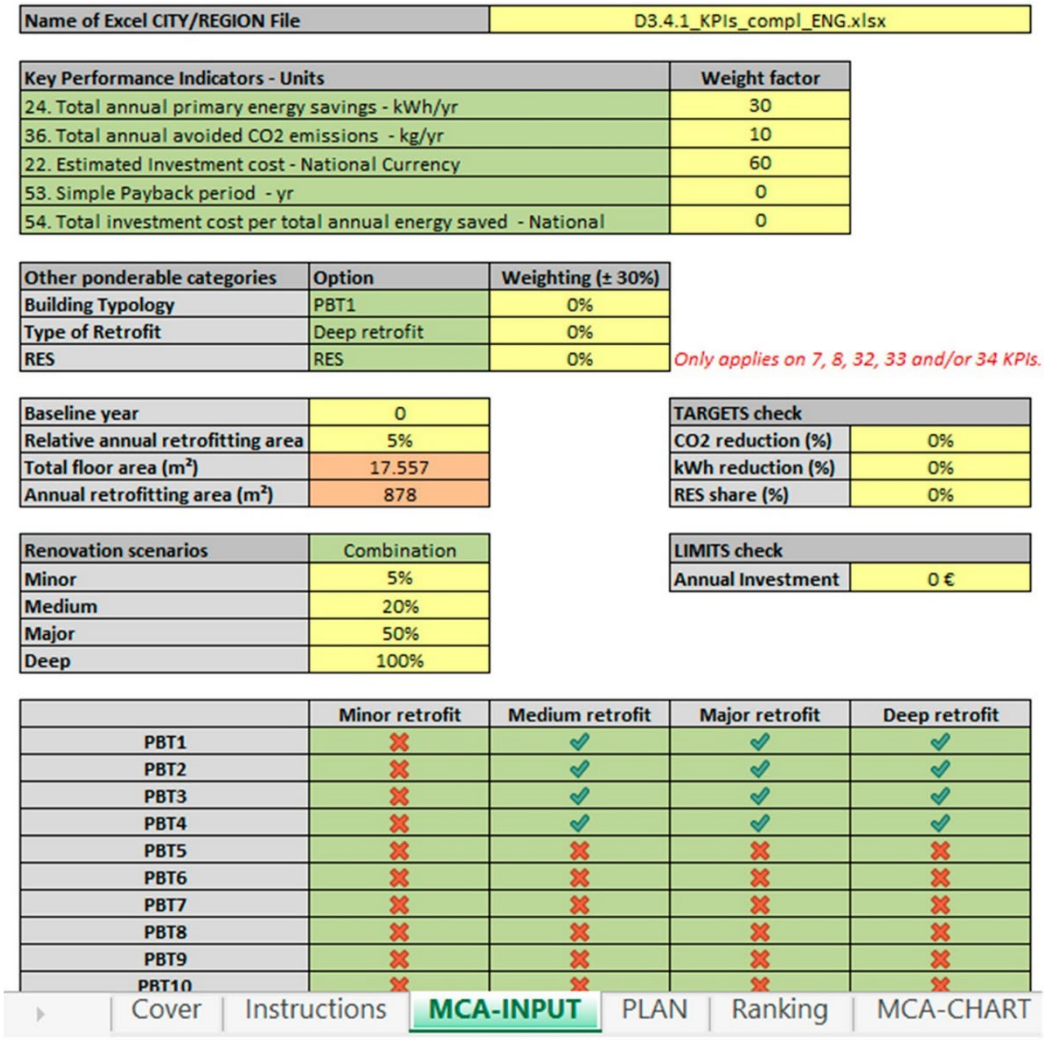


Figure 79 - Cumulative primary energy savings for each year of project implementation obtained for the different combinations of decision criteria weights



Name of Excel CITY/REGION File	D3.4.1_KPIs_compl_ENG.xlsx

Key Performance Indicators - Units	Weight factor
24. Total annual primary energy savings - kWh/yr	30
36. Total annual avoided CO2 emissions - kg/yr	10
22. Estimated Investment cost - National Currency	60
53. Simple Payback period - yr	0
54. Total investment cost per total annual energy saved - National	0

Other ponderable categories	Option	Weighting (± 30%)
Building Typology	PBT1	0%
Type of Retrofit	Deep retrofit	0%
RES	RES	0%

Only applies on 7, 8, 32, 33 and/or 34 KPIs.

Baseline year	0
Relative annual retrofitting area	5%
Total floor area (m²)	17.557
Annual retrofitting area (m²)	878

TARGETS check	
CO2 reduction (%)	0%
kWh reduction (%)	0%
RES share (%)	0%

Renovation scenarios	Combination
Minor	5%
Medium	20%
Major	50%
Deep	100%

LIMITS check	
Annual Investment	0 €

	Minor retrofit	Medium retrofit	Major retrofit	Deep retrofit
PBT1	✗	✓	✓	✓
PBT2	✗	✓	✓	✓
PBT3	✗	✓	✓	✓
PBT4	✗	✓	✓	✓
PBT5	✗	✗	✗	✗
PBT6	✗	✗	✗	✗
PBT7	✗	✗	✗	✗
PBT8	✗	✗	✗	✗
PBT9	✗	✗	✗	✗
PBT10	✗	✗	✗	✗

Cover | Instructions | MCA-INPUT | PLAN | Ranking | MCA-CHART

Figure 80- Multi-criteria assessment scheme setup for the considered building stock of the Municipality of Aigialeia (screenshot from the KPI processor's PLUGIN tool)

ANNUAL RETROFIT PLAN					
		Years	1	2	3
Annual	Floor area retrofitted	m²	6,942	4,580	980
Annual	Annual investment	NC	1,162,994	739,936	289,432
Annual	Savings - currency	NC/yr	59,757	39,869	29,236
Annual	Savings - CO2	tCO2/yr	141	96	72
Annual	Savings - kWh	kWh/yr	640,782	435,284	329,561
Accumulated	Floor area retrofitted	m²	6,942	11,522	12,502
Accumulated	Investment	NC	1,162,994	1,902,931	2,192,362
Accumulated	Savings - currency	NC/yr	59,757	99,627	128,863
Accumulated	Savings - CO2	tCO2/yr	141	237	309
Accumulated	Savings - kWh	kWh/yr	640,782	1,076,066	1,405,627
	Share of PEC from RE	%	5.09%	7.65%	9.26%
		1	PBT2 - Municipal office of Aigeira - Medium Retrofit	PBT2 - Municipal office of Aigeira - Deep retrofit	PBT2 - Municipal office of Akrata - Deep retrofit
		2	PBT2 - Municipal office of Aigeira - Major Retrofit	PBT2 - Municipal office of Akrata - Major Retrofit	PBT2 - Municipal office of Sympoliteia - Deep retrofit
		3	PBT2 - Municipal office of Akrata - Medium Retrofit	PBT1 - 1st senior highschool of Aigio - Deep retrofit	PBT3 - Municipal office of Diakopto - Major Retrofit
		4	PBT1 - 1st professional highschool of Aigio - Deep retrofit		
		Years	4	5	6
Annual	Floor area retrofitted	m²	2,070	1,870	1,115
Annual	Annual investment	NC	331,751	302,273	236,289
Annual	Savings - currency	NC/yr	18,351	15,143	9,275
Annual	Savings - CO2	tCO2/yr	45	36	22
Annual	Savings - kWh	kWh/yr	208,339	163,550	100,038
Accumulated	Floor area retrofitted	m²	14,572	16,442	17,557
Accumulated	Investment	NC	2,524,114	2,826,387	3,062,676
Accumulated	Savings - currency	NC/yr	147,214	162,357	171,631
Accumulated	Savings - CO2	tCO2/yr	354	390	412
Accumulated	Savings - kWh	kWh/yr	1,613,966	1,777,517	1,877,554
	Share of PEC from RE	%	10.57%	11.34%	11.56%
		1	PBT3 - Municipal office of Diakopto - Deep retrofit	PBT1 - 1st Elementary school of Aigio - Major Retrofit	PBT4 - Junior highschool of Akrata - Deep retrofit
		2	PBT1 - 1st junior highschool of Aigio - Deep retrofit	PBT1 - 1st Elementary school of Aigio - Deep retrofit	
		3		PBT1 - 2nd Elementary school of Aigio - Deep retrofit	

Figure 81 - The produced renovation road map for the considered building stock (screenshot from the KPIs processor's PLUG-IN)

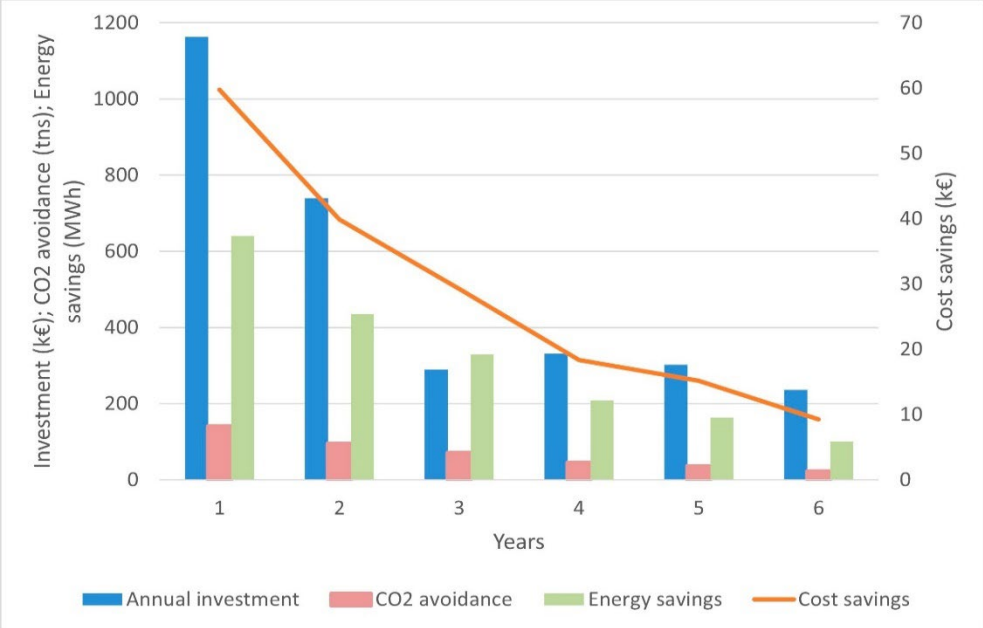


Figure 82 - Annual performance of the suggested gradual renovation plan for the studied building stock

ENI CBCMED
Cooperating across borders in the Mediterranean

Project funded by the EUROPEAN UNION

REGIONE AUTÒNOMA DE SARDIGNA
REGIONE AUTONOMA DELLA SARDEGNA

SEACAP 4 SDG

Figure 83 - Local Living Lab - Greece