



SOLE

High Energy efficiency
for the public stock Buildings
in Mediterranean

WP6 - CAPITALISATION

Output 6.3

SOLE CROSS BORDER POLICY
RECOMMENDATIONS

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SOLE

WP6 - CAPITALISATION

Output 6.3: SOLE Cross Border Policy Recommendations

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CONTENTS

SOLE Cross Border Policy Recommendations	1
Preface	4
Local findings & SWOT	5
ITALY	5
SPAIN	8
GREECE	11
JORDAN	13
TUNISIA	16
LEBANON	23
EGYPT	26
Future of Public Buildings	29
ITALY	29
SPAIN	38
Greece	40
Jordan	42
TUNISIA	45
LEBANON	48
EGYPT	50
Cross-border lessons & policy recommendations	52
ITALY	52
SPAIN	53
GREECE	55
JORDAN	56
Tunisia	57
Lebanon	58
EGYPT	59
CONCLUSION	60



PREFACE

The building sector is the largest energy consumer in the Mediterranean area. Most buildings are energy inefficient as lack of interventions over time have led to increase annual energy consumption and CO₂ emissions. To tackle these common challenges, SOLE supports cost-effective and innovative energy rehabilitations of public buildings. Through knowledge sharing on energy rehabilitation, the partners will define local plans adapted to each of the participating territories where pilot actions will be implemented. Besides these pilots, in order to reduce building energy consumption, SOLE will also intervene at two levels. First, by encouraging behavioral change in people, inspired by an Interreg experience (REBUS project). Secondly, by impacting on local policies through lobbying and advocacy to integrate the pilots' results in relevant policy frameworks.

SOLE's partners share common challenges such as climate conditions, building stock characteristics and energy consumption. There is a need for a public driven approach to plan and implement sustainable energy policies and action plans. Through its activities, the project will contribute to increase the penetration of renewable energies in the energy mix, improve people's behaviours in energy use and support policy reforms in the rehabilitation of public buildings and energy efficiency.

Through its capitalization activities, SOLE seeks to influence policy-makers in charge of the energy sector at two levels: local and Mediterranean. At a local level, it integrates the results of the pilot actions and behavioural change campaign into existing policies or at least taking them into account in defining new policies. At a wider level, integrating SOLE results into cross-border recommendations with the aim to deliver a strategic vision and a set of actions designed to influence and determine all major decisions and actions concerning green building rehabilitation.

This document includes the results of the work of the local stakeholder working groups conducted within the framework of WP6.

Policy makers, technicians, citizens can find in this document what is the state of the art of energy refurbishment policies in each SOLE country, how the main actors of civil society imagine the public building of tomorrow and what is the process to be activated to make public buildings resilient to climate change.

Finally, policy recommendations will be provided as a result of the transnational analysis carried out by the SOLE partners throughout the life of the project. The cross-border recommendations are addressed to policy makers of Mediterranean countries as a guideline to

support them in checking the effectiveness of energy policies in order to facilitate energy requalification interventions of public buildings.

LOCAL FINDINGS & SWOT

ITALY

The main negative aspects concerning pilot's implementation are related to external factors that occurred unfortunately during the period of commissioning of the pilot renovation work. I refer to the cost increases and delays in procurement of materials recorded as a consequence of the Covid 19 outbreak and the war in Ukraine. The increase in costs meant that the municipality needed to catch additional resources beyond those of ENI to carry out all the planned interventions. The shortage of raw materials led to delays in implementation compared to the initial work plan.

On the counterpart, there are a lot of positive elements to highlight.

The children and teachers immediately showed much enthusiasm partly due to their active involvement in the ACT GREEN campaign. They are happy to finally have a more comfortable environment. The construction site was closed at the end of April 2023 and these days (end May beginning of June 2023?) the children are returning to the classrooms. Just now when the hot weather is coming to Italy. Thanks to the replacement of glass with less leaky elements, they will have cooler rooms in the coming weeks than in past years. Already this winter they have had better heated rooms thanks to the new thermostatic valves. The municipality has had financial savings due to lower consumption from better control of the heating system.

The school was closed for two months, so families had to take their children to a school farther away from the neighborhood where San Polo School is located. Despite these inconveniences, families have very much welcomed the interventions made that ensure a healthier environment for their children.

Certainly, it was also an opportunity to involve families more actively in their children's school life and to convey to them the importance of education on a sustainable approach to the environment. Thanks to the ACT GREEN campaign we can notice also a new awareness in teachers who now have the right tools to teach small children (the citizens of the future) in a more



sustainable way by using the building as an example to explain to families and children how energy efficiency measures can improve the comfort of the place and help the environment.

I report what Italian stakeholders have indicated as path for the legislators for incentivizing energy transition and for promoting energy requalification of buildings:

Simplify bureaucratic procedures and reduce constraints on the installation of renewable energy systems;

complete the regulatory framework for the establishment and management of renewable energy communities by ensuring transparency rules for public entities;

facilitate the construction of interdisciplinary task forces to help public entities, and especially smaller municipalities, access economic incentives and implement energy upgrading projects;

adjust the content of training courses, both in schools and in the continuing education of professional bodies, to increase the skills of technicians on issues related to energy upgrading interventions in buildings.

Strengths	Weaknesses
<p>excellent performance of interventions due to the favorable climatic conditions</p> <p>rich entrepreneurial environment with expertise in elettromechanics, 'power electronics, ICT, home automation,</p> <p>Very high profile and internationally recognized know-how and expertise of the research institutes</p>	<p>Low specialization level of building sector</p> <p>Huge number of listed and historic buildings with intervention constraints</p> <p>Small-scale heritage energy upgrading interventions, which complicates any aggregation and standardization of projects aimed at an urban regeneration approach that would be more cost-effective and time-efficient for project implementation</p>
Opportunities	Threats
<p>Technological evolution: availability of low-cost technology for energy monitoring and building automation</p> <p>Compelling European standards on materials and processes</p>	<p>Legislative instability: Frequent modification of energy and environmental permitting and regulatory regimes</p>



Economic incentives (PNRR)	Poor coordination of national and local intervention instruments on energy efficiency and RES
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SPAIN

There are several positive aspects associated to the Andalusian pilot project. On one hand, we have been able to integrate diverse innovative solutions to improve energy efficiency in one pilot building. Both solutions to reduce energy consumption with the incorporation of improvements in air conditioning and lighting system, as well as to increase the contribution of renewable energies, improving at the same time the energy management of the building. All these solutions have been tested to check their extrapolation to other public buildings of the Andalusian regional government.

Another very positive aspect has been the involvement of all the Agency's staff. Since the pilot building is located in the Agency's own premises, the staff have been able to follow the evolution of the pilot project. In this sense, the Agency has organized specific sessions aimed at the Agency's employees to explain in detail the actions that were being taken in the pilot project and the expected results to reduce energy consumption and reduce the environmental impact. All this learning has been included as part of the WP5 awareness campaign.

But, as a negative aspect is to highlight the extension in the deadlines; on one hand, the Agency's recruitment deadlines for the different services and works have been longer than planned. This has been due to the fact that some of the tendering processes for the contracting of certain services were null, since there was no company that applied, being necessary the repetition of the tender with the consequent delay in the deadlines. Highlight, above all, the delay associated with the legalization of the project and the permits of the municipality for the start of the work. This issue has required the Agency to dedicate specific resources to the dialogue with the different actors of the city council to reduce the deadlines, especially with the local authorities that legalize the installation.

Another aspect that has motivated the delay in the work execution, is also the delay in the reception of materials and equipment by the company that performs the work. The delay is due to the lack of the supplies and materials of the work. This problem is not specific to this project and is affecting all construction projects in Andalusia and in the rest of Spain, associated with the Ukraine's war and other issues at world level.

As mentioned in the previous question, there is currently a problem in construction works associated with the shortage of supplies of materials and equipment for the works, which sometimes delays in execution and on the other hand, the inflation, with a significant price increase. In this sense, the regional government of Andalusia approved a regulation to address this issue, so that in public procurements for the improvement of public buildings in Andalusia, the increase in costs associated with the inflation of materials, supplies and equipment will be accepted.

The regulations were approved to compensate construction companies working with the Andalusian Regional Government for the extra cost linked to the increase in material prices, motivated by the transport strike in the last year and the effects of the Russian invasion in Ukraine.

The regulations of the Regional Government of Andalusia complemented the Government of Spain's previously approved rule, but with some limitations. Thus, the Andalusian decree law includes works in execution in 2021, as well as works of less than one year's duration. In addition, it extends the works with the right to revision of their prices, including all types of materials used, and not only the four included in the state regulations (bituminous, steel, aluminum and copper).

And with regard to the improvement of energy efficiency in buildings, there are numerous regulatory measures developed in Spain derived from the implementation of the European energy efficiency directive and the Energy Performance of Buildings Directive. These directives are from 2012 and 2010 respectively and although they were partially amended in 2018, they currently require a thorough update in order to adapt them to the current circumstances. This update, which is expected soon, will have an impact on national and regional regulations, as it is mandatory to transpose them. In other words, we need to finish shaping the European legislative framework to define regional legislative frameworks. Thus, a rapid approval and transposition of European legislation is the legislative recommendation we see most urgent for energy efficiency sector.

Strengths

- *Political consensus of the Andalusian regional government on the need for an adaptation of the building towards a more sustainable and efficient model*
- *A regional energy strategy approved by the regional government of Andalusia in July 2022 that prioritizes the energy rehabilitation of buildings.*
- *A long experience in Andalusia for the development of renewable energy and energy efficiency projects, and in rehabilitation and urban regeneration processes, promoted by the Regional Government of Andalusia and by numerous municipalities.*
- *The launch of REDEJA, a network created by the regional government of Andalusia for the energy management of public buildings of the regional Government. This network is led by the Andalusian Energy Agency, which has achieved to implement numerous energy efficiency measures in public buildings, in addition to optimizing all energy contracts.*
- *Solid public training structure to retrain workers in the short and medium term, as well as reference university centers with a significant number of graduates with appropriate skills*
- *Social consensus and good predisposition among public workers to improve environmental quality, due to its positive impact in terms of the economic savings, higher quality of life, health and well-being.*
- *Other strengths associated with the construction sector itself in Andalusia:*
 - *Extensive and well positioned sector, with an important business vertebration and organized around business associations, also having highly qualified companies (tractors)*
 - *High quality and international impact of scientific production, with a consolidated system of Science, Technology and Innovation and Technology Centers leading in their areas of specialization*

Weaknesses



- *Limitation of the current legal framework for energy rehabilitation and urban regeneration. As mentioned above, European, national and regional regulations must be updated in line with the current world situation, promoting the reform and transformation of public buildings from net zero buildings into zero or positive-consumption buildings.*
- *Poor maintenance of public buildings and scarce culture about energy rehabilitation, not taking full advantage of their potential to undertake more comprehensive and efficient solutions.*
- *Significant training gaps for public workers related to energy efficiency and possibilities for improvement*
- *Significant gaps in R & D & I to promote innovative projects in public buildings: scarcity of economic, human and material resources, a small number of innovative companies that can undertake it*
- *Difficulty of financing to undertake new construction or rehabilitation of public buildings. Public budgets are limited and must address other priorities*
- *Other weaknesses associated with the construction sector itself in Andalusia:*
 - *Excessive atomization of the sector, which hinders its ability to diversify and access new markets. Need for further integration of the value chain (clusterisation of the sector)*
 - *Low level of industrialization, mainly in SMEs and micro-SMEs, which translates into low productivity and competitiveness of the sector*
 - *Professional intrusiveness, black economy and unfair competition practices*

Opportunities

- *Energy rehabilitation and urban regeneration will be a basic pillar of public policies for the coming years present at all levels of government: European, national and regional.*
- *High potential to implement energy efficiency and renewable energy measures in public buildings of the regional government of Andalusia*
- *High potential for innovation and modernisation of public buildings, through the incorporation of new technologies, new materials and construction techniques*
- *In this regard, the EU is committed to innovation in order to improve the stock of buildings and housing, through the development of innovative solutions under Horizon Europe programme, budgeted with 95,5 billion euros.*
- *New niches for public employment with needs of qualified personnel for the proper energy management of public facilities (new figures, such as energy auditor or energy manager)*
- *New financial instruments linked to energy performance contracts or white certificates*

Threats

- *Delay at European level in the implementation of the amendments to the European directives on energy efficiency and energy performance of buildings*
- *Delay at national level in the transposition of the objectives set out in the European directives resulting from these amendments. Clear and effective commitment of national and regional policies is needed*
- *Insecurity and uncertainty in maintaining the current situation of supply shortages and significant inflation, which can stop the investments in construction or sustainable rehabilitation*

- *Lack of publicly available resources and resources in vocational training and accreditation that are deemed necessary to achieve the expected objective in the European Union*
- *And in the case of public housing, social problems to access these homes and face energy costs. Increasing inequalities and increasing energy poverty due to cost increases*
- *Other threats associated with the construction sector itself in Andalusia:*
 - *Possible speculative practices after a reactivation of the sector, with special attention to the processes in neighborhoods of the existing city, with a clear threat to gentrification*
 - *Growing international competition in terms of resources, talent, technology and attracting investment in R & D & I*

GREECE

Throughout the completion of our pilot project, there were positive and negative experiences. First of all we became more familiar with the Greek treaty, in relation to the existing legislation and the cooperation of the various bodies. As the integration of such a project requires a series of actions, the collaboration with a number of bodies and the ensuring of many approvals, the planning and the participation in all the processes required to complete the project, was in itself very constructive and useful. In this direction, it was also very crucial to be informed about other similar programmes currently being implemented (especially) in Athens. The same could also be mentioned about the promotion of the development and use of financial instruments and the technologies that are most applicable in the context of the energy transition in our country. As the number of energy saving interventions increases over time, it becomes easier to compare and select the best proposals and solutions.

On the other hand, the experience on our local project had also some disadvantages and it could be argued that the fact that its planning began during the pandemic, made it difficult from the outset to develop. But apart from the conditions under which the project started to develop, it could be argued that the most difficult experience was dealing with administrative procedures and bureaucratic obstacles. As the pilot project is developed on a listed building, the already difficult context of completing international procurement tenders in Greece, was further complicated by the need for additional approvals. Within this framework and fearing of further delays, it could be mentioned that we have not had the opportunity to experiment, seek and propose even more innovative and more advanced solutions. Finally, as a general comment, we would say that the time given under the given circumstances and the domestic legislative framework was very limited for the completion of the Greek project.

In Greece so far, interventions and work on energy saving have been dealt with in a relatively fragmented way. As the main energy saving programmes in Greece, SAVE I and SAVE II, are related to the upgrading of apartments, it could be argued that till now a large proportion of interventions are characterised from a non-integrated approach. In this context, it seems appropriate that the Greek

state should find ways to address the difficulties that arise from the lack of a holistic approach and the weakness of planning large-scale interventions. As the multiple ownership in private property (apartment blocks, blocks with offices etc.) is a parameter that characterizes the Greek cities, it could be argued that at the moment the public sector could play an important role towards accelerating action to address climate change. From neighbourhood squares to schools and institutions, Greek legislation should outline a framework for energy retrofit changes, financing and use in an energy-efficient and cost-effective way.

At the same time more attention should be paid in order to overcome difficulties and delays related with the construction actions for the energy upgrading of buildings. The fact that the Greek licensing procedure requires lots of approvals and the involvement of several authorities, creates a bureaucratically complex environment and makes it difficult to quickly complete the permitting of upgrading works. Thus, Greek legislation should also face the slow procedures and obstacles and create a clear and straightforward licensing system.

In the direction of supporting the energy upgrading of buildings, more financial instruments and incentives for both private and public property should also be designed. In addition it would be important to strengthen the involvement of stakeholders (civil society, etc.) who can play a crucial role in terms of consulting and support. At this moment, both the design of policies for energy upgrading and saving and interventions should be supported by specialised teams and consultants to promote and accelerate the issue of energy transition.

SWOT analysis of energy efficiency in public buildings in Athens	
<p>STRENGTHS</p> <ul style="list-style-type: none"> - Large stock of public buildings that could be upgraded in terms of energy efficiency; - The stock of public buildings enables the creation of comprehensive interventions; - Raising awareness of climate change issues, particularly among younger people; 	<p>WEAKNESSES</p> <ul style="list-style-type: none"> - A very small percentage of public buildings have been upgraded; - A small percentage of private buildings and apartments have been upgraded; - The large amount of listed buildings make the energy upgrade difficult; - Difficulty absorbing funds; - Low percentage of financial incentives and funds; - Multi-ownership making broad interventions difficult;

OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> - Energy upgrading as a key parameter for the re-use of inactive building stock; -Development of expertise; - Cooperation between different parties and actors, between the private and public sector; - positive results in reducing energy consumption; - Behavioural changes in relation to energy waste; 	<ul style="list-style-type: none"> - Reducing awareness on consumption issues - Lack of synergy between the various parties; - Lack of expertise; - Bureaucracy and slow procedures;

JORDAN

Throughout the execution of the pilot actions at Iskan Al-Faiha'a school we have had a lot of positive experiences due to the fact that the project have helped in creating a healthy and comfortable educational environment for the current and upcoming generations of young students, and also increase their awareness towards energy management as well as the importance of the rational use of energy, which was clear in the feedbacks that we received from the school's staff, students and members of the local community, they expressed a lot of gratitude for this project and also they gave us huge support in the implementation phase.

Especially that this project was comprehensive as we provided an efficient lighting system for the school, heating and cooling system with the latest available technologies, installed thermal insulation layers to prevent the heat leakages and the most important thing is that we turned the energy source in the school into renewable. This is what makes this experience most valuable as we rarely get a chance to implement all types of energy measures in the same facility which gave us a technical experience in the best practice to implement these systems.

Furthermore, this experience has allowed us to analyze many other measures that can be implemented to enhance the energy profile in the public buildings as well as reducing the environmental impact such as installing an electric vehicles charger depending renewable sources and water harvesting system which will contribute in energy and water security in our country.

Last but not least, it was crucial for us to implement all the pilot actions while taking into consideration the highest safety standards in order to maintain the wellbeing of the young boys and girls, as this experience among side others have taught us how to be accurate in assessing all the risks and applying all safety measures to avoid them.

On the other hand, we've had some negative experiences during the implementation of the project, one of which is that the Tender for implementing EE & RE interventions was announced after around one year of carrying out detailed energy assessment for the school. During this period, it was found that throughout the year the doors of some classes were damaged, and as new insulation and cooling and heating system is installed, the damage doors would severely affect the efficiency of these system.

We've also faced a delay in connecting the PV system to the electrical grid due to outstanding electricity bills on the school which the MOE did not have the financial capabilities to settle them.

The energy efficiency of public buildings is a crucial area in which Jordan can make a significant impact on reducing energy consumption and greenhouse gas emissions. To achieve this, there are several legislative recommendations that need to be implemented in the public buildings sector.

Firstly, the government should establish energy efficiency standards for public buildings, including schools, hospitals, government offices, and other public facilities. These standards should set clear targets for energy savings and establish a framework for implementing energy efficiency measures across the public buildings sector. The standards should be regularly reviewed and updated to reflect advances in technology and building practices.

Secondly, the government should require all new public buildings to meet minimum energy efficiency standards. This will help to reduce energy consumption in the public buildings sector and promote the adoption of energy-efficient technologies. The energy efficiency standards should be regularly updated to reflect advances in technology and building practices, and compliance should be enforced through regular inspections.

Thirdly, the government should provide more financial incentives for energy efficiency investments in public buildings, such as grants and low-interest loans. These incentives will help to overcome the high initial costs of energy efficiency measures and encourage public institutions to invest in these technologies. The incentives should be designed to target specific sectors, such as schools or hospitals, and should be regularly reviewed to ensure they are effective.

Fourthly, the government should implement an enforcement system to ensure compliance with the strategic vision laid out in the National Energy Efficiency Action Plan (NEEAP) developed for Jordan in 2011 for the period 2012-2014, the second NEEAP for the period 2018-2020 and the third NEEAP is currently under development. Additionally, the government should enforce the Green Building

Guideline and rating system for Jordan (Jordan's Building Codes), which contains parameters and credits that are suitable for Jordan's climate, resources, legislation, policies, building techniques, and strategies. Implementing an enforcement system will ensure that public buildings meet the energy efficiency standards set out in these guidelines and policies, and will create a regulatory environment that encourages energy efficiency and promotes sustainable development.

Strengths	Weaknesses
<ul style="list-style-type: none"> • High potential for solar and wind energy. • Significant energy efficiency potential. • Availability of updated building codes. • The continuous development of NEEAPs. • Availability of energy statistics and data. • Enforcement of energy labeling for household appliances. • Legal framework. • Local financial support (JREEEF/MEMR, Central Bank of Jordan). • Availability of skilled ESCOs and engineers. • Availability of providing incentives for green buildings (i.e extra roof construction). • Tax exemption for EE & RE equipment and systems. • Market demand for efficient buildings. 	<ul style="list-style-type: none"> • Lack of building codes enforcement. • Lack of incentives for existing building. • Lack of Energy performance certification scheme for buildings. • Unclear financial support mechanism. • Lack of skilled contractors in implementing energy-efficient buildings. • Insufficient local manufacturers of efficient equipment. • Unaffordability of buying efficient buildings for a wide variety of people. • Lack of accurate data on building energy performance (baseline). • Lack of energy storage capabilities. • Lack of sufficient public awareness of benefits of efficient buildings.
Opportunities	Threats
<ul style="list-style-type: none"> • Global trends for mitigating climate change impact. • Availability of international funds and grants. • Technology advancement. • Escalation in energy prices. • Regional power interconnection. 	<ul style="list-style-type: none"> • Regional political situation-influx of refugees. • Dependence on imported energy/oil. • Fluctuation in fuel/energy prices. • Grid technical capacity for absorbing RE generation.

TUNISIA

Since the beginning of the 21st century, Tunisia has experienced a continuous energy deficit, which reached 4.62 million toe in 2021, i.e. 47.55% of the country's primary energy demand. 1

In order to limit the negative impact of this critical and persistent energy situation and the associated climate change effects, as well as to achieve the United Nations Sustainable Development Goals (SDGs), Tunisia has developed a new energy vision at the beginning of the second decade of this century, based on a balance between the following three dimensions:

- Energy security,
- Energy equity and governance, and
- Sustainable development. 2

In this context, Tunisia developed a National Energy Transition Policy in 2014, which aims to: a) reduce the country's primary energy consumption by 30% in 2030 compared to the BAU scenario, by scaling up the implementation of Energy Efficiency programmes in the buildings, transport, industry and agriculture sectors; b) increase the share of Renewable Energy in the national electricity mix to 35% in 2030 compared to 2010, by scaling up the implementation of the Tunisian Solar Plan.3

Tunisia has also increased its Nationally Determined Contribution (NDC) to mitigate the climate change effects by ratifying the Paris Agreement in 2016. In this context, in 2021 the country increased its ambitious target to reduce its carbon intensity by 45% in 2030 compared to 2010. 4 The energy sector is a major contributor to this goal. It will reduce its carbon intensity by 44% in 2030 compared to 2010. 5 The buildings sector alone contributes a quarter of the energy sector's emissions reductions in the period 2021-2030 through energy efficiency measures. 6 It should be highlighted that the buildings sector accounts for 35.9% of the country's final energy consumption in 2021, ahead of the transport and industry sectors. 7 It is also the first consumer of electricity in the country in 2021, with a share of 59.5%. 8 Buildings in the service sector, including municipal buildings, account for 23.4% of the final energy consumption and 44.3% of the electricity consumption of the whole buildings sector in 2021. 9

Today, energy consumption represents a heavy financial burden for Tunisian municipalities, with energy bills accounting for up to a third of municipal budgets. Electricity consumption for public lighting accounts for the lion's share of the bill (up to 90% of the bill), followed by fuel consumption for the vehicle fleet (up to 30% of the bill), then energy consumption for municipal buildings (up to 10% of the bill). It is therefore important for municipalities today to engage in the energy transition in particular, and in mitigating climate change and achieving the SDGs in general, given the important role that cities and local communities can play at the local level in these areas.

Existing municipal buildings are generally characterised by low energy efficiency, both for the building envelope and for the general equipment used for lighting, heating/cooling, etc., resulting in high energy consumption of these buildings compared to similar highly energy efficient buildings.

Given the temperate and mild climate that prevails in most regions of Tunisia, it is easy to maintain a good level of thermal comfort in municipal buildings throughout the year and to reduce their energy consumption by improving the energy efficiency of both the building envelope and the energy equipment of the building. Such improvements in the energy efficiency of municipal buildings will benefit both the municipality, by generating financial resources that can be used to finance the necessary development investments for the region, and the inhabitants of the region, by encouraging them to improve the energy efficiency of their homes/buildings, based on the best practices adopted in municipal buildings.

opportunities and appropriate solutions

Existing municipal buildings are generally characterised by a low energy efficiency of the building envelope, which makes it impossible to achieve acceptable thermal comfort conditions inside the building without relying on mechanical and/or electrical equipment (for heating, cooling, and ventilation). This often results in high energy consumption due to the high thermal comfort needs of the building (for heating and cooling) on the one hand, and the low energy efficiency of the associated equipment used on the other. Failure to take into account the climatic characteristics of the site when designing the buildings has also contributed to this situation, as has the failure to use building materials and architectural elements (e.g., windows, doors, solar shading, etc.) that would allow the building envelope to be highly energy efficient and thus provide acceptable thermal comfort conditions, either naturally or without the permanent use of energy-intensive mechanical and/or electrical equipment.

Existing municipal buildings offer significant potential for energy savings. Municipalities can reduce the energy bills of their buildings by up to 80% through a combination of complementary energy measures, including rationalising energy use, improving the energy efficiency of the building envelope and equipment, and using renewable energy systems.

Energy rationalisation measures can reduce the building's energy consumption by up to 20%. These measures mainly consist of:

- the adoption of simple energy saving behaviours by the building occupants, such as "switching off unused/unnecessary lighting", and
- the appointment of an Energy Manager and energy management of the building.

Energy efficiency measures of the building envelope can reduce the building's heating and cooling energy consumption by up to 50%. These measures mainly consist of:

- Thermal insulation of roofs,
- Thermal insulation of external walls,
- Replacing low energy efficient windows with new high energy efficient double-glazed windows, and
- Protecting windows exposed to unwanted sunlight with solar shading.

Energy efficiency measures of the building equipment can reduce the building's energy consumption by up to 30%. These measures mainly consist of:

- Replacing low energy efficient lighting fixtures with high energy efficient ones, such as LED fixtures, making good use of daylight and using appropriate controls, such as occupancy sensors,
- Replacing low energy efficient heating/cooling equipment with new high energy efficient equipment.

The use of renewable energy systems can reduce the building's energy bill, and reduce the municipality's dependence on fossil fuels, which contribute significantly to global warming. The renewable energy measures consist mainly of:

- the use of grid-connected photovoltaic systems for electricity generation, and
- the use of solar thermal systems for water heating.

Institutional framework

Since the 1980s, Tunisia has put in place the first foundations of its institutional framework for energy conservation in general, and energy efficiency and renewable energy in particular, in all sectors of the economy, especially the building sector. In 1985, it created the National Agency for Energy Conservation (ANME).

The institutional framework for energy efficiency in municipal buildings in Tunisia is composed of the two ministries in charge of the energy and buildings sectors and the ANME (the right arm of the ministry in charge of the energy sector, in the field of energy transition). The responsibilities of these structures include the development and implementation of national policies and strategies (in partnership with other stakeholders), the development of technical, regulatory and incentive frameworks, the enactment of legislation, capacity building of all stakeholders and the dissemination of best practices for energy efficiency in buildings. It also includes the Tunisian Company for Electricity and Gas (STEG). Its responsibilities include participating in the development and implementation of national policies, strategies and programmes, as well as the development and implementation of technical, regulatory and incentive frameworks; setting electricity and gas tariffs that encourage the rational use of energy and the improvement of energy efficiency in buildings; and conducting energy awareness campaigns for its customers.

The institutional framework also includes the Tunisian Orders of Architects and Engineers. Their responsibilities include participating in the development and implementation of national policies, strategies and programmes, as well as the development and implementation of technical, regulatory and incentive frameworks; building capacity; and disseminating of best practices for energy efficiency in buildings. It also includes municipalities. Their responsibilities include implementing national policies, strategies and programmes, enforcing technical and regulatory frameworks, raising awareness among stakeholders and disseminating best practices for energy efficiency in buildings at the local level. It also includes the Credit and Support Fund for Local Communities (CPSCL), which is responsible for granting loans to municipalities for the construction of buildings in general; the Training and Support for Decentralisation Centre (CFAD), which is responsible for building the capacity

of municipal staff and elected municipal officials in various areas of municipal activity (including energy transition in municipalities in general); and the National Federation of Tunisian Municipalities (FNCT), a non-governmental organisation whose mandate includes supporting the capacity of municipalities in the field of energy transition in general at the local level.

This institutional framework lacks a central structure within the Ministry responsible for municipalities to oversee the energy transition in municipalities in general. The absence of ANME offices in all regions of the country, which are relatively close to the municipalities, is also a weakness, as the current ANME offices are not able to provide the necessary technical assistance to all municipalities. Therefore, at the institutional level, it is necessary to create a central structure within the Ministry in charge of the municipalities, to monitor the extent to which they are implementing the national energy transition policy at the local level and to help them find appropriate solutions to overcome the obstacles they may encounter. It is also necessary to strengthen the presence of the ANME in all regions of the country, which can be done through the widespread adoption of the Relay Expert function, which is currently being tested by the ANME.

Regulatory Framework

Since the 1980s, Tunisia has established a regulatory framework for energy conservation (energy efficiency improvements and the use of renewable energy) in buildings in the residential and service sectors in general, which has evolved over time.

The regulatory framework for energy efficiency in buildings in the service sector consists of the Energy Conservation Law (Article 4: related to mandatory and periodic energy audit, Article 5: related to mandatory prior consultation (mandatory on drawing energy audit) and Article 10: related to thermal regulation for new buildings) and the subsequent regulatory texts.

The mandatory and periodic energy audit applies to existing municipal buildings of all types (offices, cultural, commercial, sports, etc.) and is mainly regulated by Decree No. 2269 of 31 July 2009, amending Decree No. 2144 of 2 September 2004, which establishes the subjection of energy-consuming establishments to mandatory and periodic energy audit, the content of the audit and its periodicity, the types of energy-consuming projects that are subject to mandatory prior consultation, the methods for carrying them out, as well as the conditions for exercising the activity of expert auditors. The current threshold of 500 toe (annual primary energy consumption of the building) for subjecting existing buildings to the mandatory and periodic energy audit procedure is considered high for several types of municipal buildings (offices, cultural, commercial, sports, etc.). Therefore, it is important to lower this threshold in order to cover the largest number of existing municipal buildings with high energy consumption by the mandatory and periodic energy audit procedure.

The mandatory on drawing energy audit applies to new municipal buildings of all types (offices, cultural, commercial, sports, etc.) and is regulated by the above-mentioned Decree (No. 2269 of 31 July 2009) and the Order of the Minister of Industry, Energy and Small and Medium Enterprises of 11 June 2007 approving the technical specifications for the on drawing energy audit in the residential and service sectors. The current threshold of 200 toe (expected annual primary energy consumption of

the building) for subjecting new buildings to the mandatory on drawing energy audit procedure is considered rather high for certain types of municipal buildings (especially offices and cultural buildings). Therefore, it is necessary to lower this threshold in order to cover the largest number of new municipal buildings, which are expected to have a high annual energy consumption, by the mandatory on drawing energy audit procedure. Also, the current criterion for assessing the obligation to carry out the mandatory energy audit procedure should be simplified in terms of its compatibility with the type of building, e.g. by adopting the criterion of the covered area of the building in m² for office buildings.

In addition, it is important to strengthen the commitment to apply energy audit and on-drawing energy audit procedures for existing and new municipal buildings whose energy consumption (expected energy consumption) reaches the audit threshold. It is also recommended to apply these two procedures on a voluntary basis for municipal buildings whose energy consumption (expected energy consumption) does not reach the audit threshold, given the possibility to also benefit from possible financial incentives through the Energy Transition Fund (FTE).

The thermal regulation of new buildings currently applies only to new municipal buildings of the office or similar type. It is regulated by the Joint Ministerial Order of the Minister of Equipment, Housing and Territorial Development and the Minister of Industry, Energy and Small and Medium Enterprises of 23 July 2008, laying down minimum technical characteristics for energy savings in projects for the construction and extension of office and similar buildings, and the Ministerial Order amending it of 17 December 2010. The absence of thermal regulation texts for the remaining types of municipal buildings (cultural, commercial, sports, etc.) is considered a deficiency at the level of the regulatory framework, which currently does not require these types of buildings to comply with minimum technical characteristics of energy efficiency at the time of construction.

Incentives

The regulatory framework for energy conservation in buildings has been accompanied by the implementation of an incentive framework, which has evolved over time to encourage more and wider improvements in energy efficiency and the use of renewable energy in existing and new buildings in the residential and service sectors in general.

The incentive framework for energy efficiency in buildings in the service sector is mainly based on grants and loans provided by the FTE in the following areas: mandatory and periodic energy audit for existing buildings, mandatory on-drawing energy audit for new buildings, energy rehabilitation of existing buildings, construction of new buildings and extension of existing buildings with high energy efficiency and use of high energy efficiency equipment, use of cold storage equipment, use of natural gas refrigeration equipment, use of cogeneration equipment, implementation of energy management systems. Government Decree No. 2017-983 of 26 July 2017 sets out the rules for the organisation and management of the FTE and the way in which it intervenes.

FTE subsidies are granted for the implementation of intangible investments (feasibility studies, accompanying measures, etc.) up to 70% of the investment costs, with a ceiling of between 30 and 70 kTND, and for tangible investments up to 30-40% of the investment costs, with a ceiling of between 100 and 200 kTND in the above-mentioned areas of energy efficiency. However, the current ceilings for grants for intangible and tangible investments are quite low for municipal buildings and need to be increased. In addition, the current procedures for obtaining these grants are complex and cumbersome and need to be reviewed and simplified.

FTE loans are granted for financial investments in the above-mentioned areas of energy efficiency, with a ceiling of between 80 and 600 kTND and on favourable terms (interest rate = 5%; repayment period = maximum of 7 years; grace period = maximum of 2 years). These loans are granted with a joint contribution from a credit institution of at least the same value and provided that the total value of the loan does not exceed 50% of the investment costs. All these grants and loans apply to municipal buildings.

However, it should be stressed that the FTE loans are not yet operational, which makes the establishment of loans procedures and the acceleration of their implementation very important and a priority in order to facilitate access to finance for municipalities. The CPSCl can play the role of credit institution with regard to the necessary co-financing with the FTE.

The CPSCl provides loans to municipalities to finance projects of a local nature, such as "office buildings" and "maintenance & upkeep", on favourable terms (interest rate = 7%; repayment period = 15 years; grace period = 1 year). Municipalities can benefit from this type of loan to finance energy efficiency measures in buildings as part of public investment for the construction of a new building or the rehabilitation of an existing office building owned by the municipality, or as part of the general maintenance and upkeep of existing municipal buildings. However, municipalities did not actually receive such loans from the CPSCl for energy efficiency investments in municipal buildings. In this context, it should be stressed that the conditions for obtaining loans from the CPSCl exclude many municipalities due to their low financial capacity to repay. It is therefore important to review the granting of loans by the CPSCl to municipalities and/or to set up a special financing mechanism to finance energy efficiency investments in municipal buildings in particular, in a way that ensures that municipalities with low financial capacity are not excluded.

It is also possible to upscale the energy efficiency in municipal buildings by extending the intervention of the National Energy Transition Programme in Public Enterprises (TEEP), which aims to equip the buildings owned by these entities with grid-connected PV systems for self-consumption of electricity and the implementation of energy efficiency measures, to municipal buildings, as they are not covered by the programme. Municipalities can also benefit from international funds to improve the energy efficiency of some of their buildings by participating in international cooperation projects aimed at energy transition and reducing greenhouse gas emissions in public buildings in general.

Human Capacity

Human capacity is an essential link in the value chain for improving energy efficiency in buildings. Most Tunisian municipalities today lack the necessary human capacity in energy efficiency and renewable

energy in buildings, despite the existence of governmental and non-governmental institutions responsible for strengthening the capacity of municipalities in these two areas in particular.

The CFAD, as a government institution attached to the Ministry responsible for municipalities, is responsible for strengthening the human capacity of municipal staff and elected members in the various fields of municipal activity. However, its interventions do not permanently cover the areas of energy efficiency and the use of renewable energy in buildings, especially municipal buildings. The ANME, as the main government institution in the field of energy transition, also carries out awareness-raising, training and exchange activities, particularly in the fields of energy efficiency and the use of renewable energy in municipal buildings, but its interventions are punctual. The FNCT, as a non-governmental organisation, also carries out some awareness-raising, training and exchange of experience activities on improving energy efficiency and the use of renewable energy in municipal buildings. These interventions are also punctual, although the FNCT has recently launched a project for an academy for training in the various fields of municipal activity. In addition, there are several international cooperation projects that raise awareness and provide specific training to municipalities on energy efficiency and the use of renewable energy in municipal buildings.

The lack of permanent coordination between these capacity building actors has led to the dispersion of efforts and the use of multiple resources, as well as limiting the effectiveness and efficiency of the municipal capacity building programmes implemented by these institutions. It is therefore necessary to coordinate all the capacity building activities in order to develop continuous awareness-raising and training programmes on energy efficiency and renewable energy in municipal buildings, under the leadership of the CFAD. This will make it possible to combine efforts, to make better use of existing resources and to achieve effective and efficient implementation of capacity building programmes through their complementarity. It is also necessary to support the Training Academy Project within the FNCT to assist government institutions in capacity building of municipalities.

Building the capacity of municipalities is not enough to scale up energy efficiency and the renewable energy in municipal buildings. Municipalities also need specific external technical support to implement specific energy efficiency measures in their buildings. This requires the availability of specialised expertise at the local level to provide advice, technical assistance and support to municipalities when needed.

Although, the ANME contributes to the provision of technical assistance to municipalities, its interventions remain limited in view of its limited human resources, the large number of municipalities in Tunisia, and their geographical distribution. In this context, the ANME has launched a pilot experience for a Relay Expert function in the field of energy transition in municipalities in general, to be represented in the interior regions of the country. This pilot experience has produced good results in terms of providing advice, technical assistance and close support to municipalities. Therefore, and given the current lack of local expertise in energy efficiency and renewable energy in buildings in general in many interior regions of the country, it is important to support this successful pilot experience and create a national network of ANME Relay Experts in energy transition in municipalities. It is also important to train local private experts to provide advice, technical assistance and support to municipalities on energy efficiency and renewable energy in municipal buildings upon request.

It is also recommended to set up a permanent networking mechanism for municipalities (e.g. a dynamic e-platform, organisation of regular events, etc.) to exchange experiences and share best practices on improving energy efficiency and the use of renewable energy, especially in municipal buildings. The FNCT is well placed to oversee this mechanism.

LEBANON

Following the SOLE pilot project implementations in Lebanon, those are the lessons learnt:

Positive experiences:

- Successfully achieving the project goals and objectives (until now).
- Receiving positive feedback from stakeholders and end-users.
- Building strong relationships with project team members, partners and stakeholders.
- Learning new skills and gaining valuable experience.
- Improving the local community or environment.

Negative experiences:

- Facing unexpected challenges and obstacles that hinder the project progress.
- Dealing with conflicts among team members or stakeholders.
- Failing to meet project goals and objectives until receiving full transfer of amount.
- Experiencing financial and resource constraints, thus delay in project execution.

One legislative recommendation that is crucial for the energy efficiency sector in Lebanon is the implementation of mandatory energy efficiency standards and regulations for buildings. This recommendation is of utmost importance due to the significant energy consumption and associated greenhouse gas emissions resulting from inefficient buildings. Here are the key reasons why this legislative measure is urgent:

1. **Energy Consumption Reduction:** Buildings in Lebanon account for a significant portion of energy consumption, primarily due to inadequate insulation, inefficient lighting, and outdated HVAC systems. Implementing mandatory energy efficiency standards for buildings would require new constructions and major renovations to meet specific energy performance criteria. This would result in reduced energy consumption, lower energy bills for occupants, and a substantial decrease in greenhouse gas emissions.
2. **Economic Benefits:** Energy efficiency standards can have positive economic impacts. By improving the energy performance of buildings, occupants can enjoy lower energy bills, leading to increased disposable income. Additionally, the implementation of energy efficiency measures can generate new job opportunities in sectors such as construction,

retrofitting, and energy auditing. These economic benefits can contribute to the overall development of Lebanon's economy.

3. **Environmental Impact:** Lebanon faces significant environmental challenges, including air pollution and climate change. Improving energy efficiency in buildings can contribute to reducing the country's carbon footprint. By implementing energy efficiency standards, Lebanon can move towards a more sustainable and greener future, aligning with international climate commitments and protecting the environment for future generations.
4. **Health and Comfort:** Inefficient buildings often suffer from poor indoor air quality and inadequate thermal comfort. Implementing energy efficiency standards would promote the use of proper insulation, ventilation systems, and efficient lighting, enhancing the indoor environment. This can lead to improved health outcomes, increased productivity, and enhanced overall comfort for building occupants.

To effectively implement mandatory energy efficiency standards for buildings in Lebanon, the legislative recommendation should include clear guidelines, enforcement mechanisms, and compliance monitoring. It is essential to engage relevant stakeholders, including architects, engineers, construction firms, and policymakers, in the development and implementation process. Additionally, public awareness campaigns and incentives for building owners and developers can further encourage compliance and promote the adoption of energy-efficient practices.

By prioritizing this legislative recommendation, Lebanon can significantly improve its energy efficiency performance, reduce its reliance on imported energy, mitigate environmental impacts, and enhance the overall quality of buildings and the well-being of its citizens.

SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) of energy efficiency in public buildings in Lebanon:

Strengths:

1. **Government Commitment:** The Lebanese government has shown commitment to promoting energy efficiency in public buildings through various initiatives and policies.
2. **High Energy Consumption:** Public buildings in Lebanon often have high energy consumption, which presents a significant opportunity for energy efficiency improvements.
3. **Potential Cost Savings:** Energy efficiency measures can lead to cost savings in public buildings by reducing energy bills and operational expenses.
4. **Public Awareness:** There is a growing awareness among the public and stakeholders about the importance of energy efficiency, creating a favorable environment for implementation.

Weaknesses:

1. **Lack of Implementation:** Despite the commitment, the implementation of energy efficiency measures in public buildings has been slow and inconsistent.
2. **Limited Funding:** Insufficient funding and budget constraints pose a challenge to the implementation of energy efficiency projects in public buildings.
3. **Technical Expertise:** There may be a lack of technical expertise and knowledge among relevant stakeholders in designing and implementing energy efficiency measures.
4. **Resistance to Change:** Resistance to change and lack of awareness among building occupants and administrators can hinder the adoption of energy-efficient practices.

Opportunities:

1. **Retrofitting Potential:** Many existing public buildings in Lebanon require retrofitting to improve energy efficiency, presenting a significant opportunity for energy-saving measures.
2. **Partnerships and Funding:** Collaboration with international organizations, donors, and private sector entities can provide funding and technical expertise for energy efficiency projects in public buildings.
3. **Policy Support:** Continued support from the government through policies, incentives, and regulations can drive energy efficiency implementation.
4. **Job Creation:** Energy efficiency initiatives can create new job opportunities in fields such as construction, retrofitting, and energy auditing

Threats:

1. **Lack of Enforcement:** Weak enforcement mechanisms and monitoring of energy efficiency regulations may hinder compliance and undermine the effectiveness of initiatives.
2. **Economic Constraints:** Economic challenges in Lebanon may divert resources away from energy efficiency projects, making it difficult to allocate sufficient funding.
3. **Technological Obsolescence:** Rapid technological advancements in energy efficiency may render implemented measures obsolete if not continuously updated.
4. **Political Instability:** Political instability and uncertainty can disrupt long-term planning and hinder the implementation of energy efficiency projects.

To overcome these challenges and leverage the opportunities, it is crucial for Lebanon to prioritize energy efficiency in public buildings by allocating adequate funding, strengthening enforcement mechanisms, promoting awareness and capacity-building initiatives, and fostering partnerships with international organizations and private sector entities.

EGYPT

Energy efficiency activities gradually started in Egypt in response to the energy critical situation after the 1973 war. This addressed energy efficiency on both levels of supply and demand.

On the supply side, the use of natural gas was encouraged instead of other fossil fuel sources as well as moving to efficient electric generation technologies such as combined cycle and using improved optimal dispatch schemes.

The use of natural gas for transport was also highly encouraged, and the government had initiated using natural gas in public transport as well as it initiated a program to transfer taxi cars to the use of natural gas through attractive financing schemes. Additionally On the demand side the use efficient equipment at the industrial, commercial and residential levels was inspired as well, through showing both the technical and financial benefits; this also included the energy efficiency labels on white goods.

Furthermore, laboratories for testing for energy efficiency for weight goods as well as other equipment such as lamps and lighting systems were established and given some legislative support. Accredited are primarily at the energy research centers of at the different universities, as well as the testing centers for associated with the Agency for codes and standers also at the center of imports and exports as well as at the Renewable Energy authority (NREA). Legislative supports for these laboratories to conducted testing are provided, and there is room for further developments in this regard to include more testing facilities as well as more update energy efficiency standers.

Furthermore, the uses of solar water heaters at the domestic levels were announced through a ministerial legislation by the housing authority, but this did see limited applications due to the lack of after installation services, etc. and it was revoked after a while.

In addition to the aforementioned, gradual energy tariff re-structuring reforms did take place under demand side management initiatives to support the transfer towards energy efficiency both at the levels of fossil fuels including natural gas as well as electricity. Tariffs for fossil fuels, liquid and natural gas, are updated on periodical basis every three months while for the electricity tariffs it is announced up to year 2025. Traiffs for fossil fuels are based on both the supply pressure as well the type of ened users while for electricity is premirly based on the level o supply voltages; additional all tariffs fuels and electricity do have the main target of covering cost as well some deman side objective which premirly trage energy conservation as well peak reduction.

Positive experience during the execution of Alexandria University, Faculty of Engineering (at Mechanical Engineering Department) PV and EE pilot local project

- The involvement of the staff of the faculty of engineering (faculty and technical staff) in the process (bid evaluation, revising the design, communicating with the local electric



distribution utility and proposing some alternative solutions whenever installation limits arise).

- The university did procure by itself the efficient lighting elements and used them and did not wait for procurement process of the fund.
- The university did start a procurement process for buying one additional cable and associated electric switch to facilitate expansion of the pilot PV implantation instead of the proposed Building Integrated Photo Voltic (BIPV) system on the facade of the mechanical emerging department.

Challenging experience during the execution of Alexandria University, Faculty of Engineering (at Mechanical Engineering Department) PV and EE pilot local project

- The red tap procedures for:
- Accessing the site for installation (restricted time scheduling time and limited durations).
- Lengthy procurement process.
- The building at which the pilot project was implemented had an architecture design, which posed a limitation on the BIPV system.

What legislative recommendation do you see most urgent for energy efficiency sector in your country?

- To have energy audits mandatory on periodical basis for public buildings and industrial activities.
- To set specific energy consumption targets for different types of uses of energy and to update these targets regularly on the bases of market and peer (comparable) averages.
- To have the use of solar water heaters mandatory for new buildings and possible existing building whenever possible.
- Work on applying the Energy Service Company (ESCO) model for conducting energy efficiency applications.

What legislative recommendation do you see most urgent for Renewable sector in your country?

- To keep on announcing new phases for the Feed in Tariff (FiT) scheme both on the large scale as well as the small, micro and medium scales.
- To apply the quota scheme which was referred to in the law for prompting RE developments (law 203, year 2014).
- To expand on applying the IPP scheme (less than a handful implementations are there).
- Reduce that the state-owned transmission network be the off taker of the RE production and transfer that to IPP projects and handover the transmission company to be an Independent System Operator (ISO).

SWOT analysis of energy efficiency in public buildings in your territory.

Strengths

- High potential for achieving reduction of energy consumption through:



- No cost and low-cost opportunities
- Available human-power which are capable for conducting basic and complicated implementations
- Reasonable knowledge for EE technologies both on the thermal and electrical parts.
- Availability of a number implementations on a demo as well as commercial scales.
- Readiness of some national and regional financing institutions.

Weaknesses,

- Lack of Effective Actions by the Government to Address EE and RE
- Limited Energy Pricing Policy with frequent interruptions.
- Weak Legal and Regulatory Framework
- Lack of an Institutional Champion to Lead and Promote EE
- Absence of widespread policies, Incentives and financial measures
- Lack of Dedicated Funding to Promote and Support EE Activities
- Limited widespread information and awareness. on it

Opportunities,

- Available competitive markets for different products.
- Potential local manufacturing of a number of EE related equipment.
- Possible establishment of joint ventures EE & RE activities with regional countries.
- Potential for benefiting from carbon reduction schemes.

Threats,

- International economical instabilities
- Lack of foreign currency which are needed for some imports

FUTURE OF PUBLIC BUILDINGS

ITALY

We have organized **2 meetings** named **SOLE Energy Talks** in Florence (22/02/2023 – 24/03/2023). Both meetings were **in presence**: we have decided for only a physical participation for facilitating discussion and debate. What we wanted was a heterogenic group – we have invited qualified persons from:

- Public regional and national authorities
- Municipalities
- Universities and Research centers
- Industrial Associations
- Professional Associations
- SMEs
- Start-ups

Both meetings were led by **a facilitator** and **a designer**: keywords and concepts were translated in form of live sketches, diagrams and maps on a screen. The facilitator helped the discussion between stakeholders on some questions:

- What will public buildings be like in 2030? And in 2050?
- Will energy communities catch on?
- What are the main energy requalification opportunities for public buildings under the Italian National Recovery and Resilience Plan and the European funds?
- How is it possible to implement energy requalification interventions on historic public buildings, considering architectural and urban constraints?
- What are the most effective methods to encourage the virtuous behavior of users of public buildings to contain energy consumption?

The goal was to **identify a common ground between technological solutions and the regulatory framework** in order to **facilitate** the implementation of the necessary **energy requalification interventions** on public buildings to achieve the climate goals for 2030 and 2050.

We have proposed to the participants of the first session 4 thematic, that we imagine as the walls of the building of the future. These thematic are presented through questions to the public.

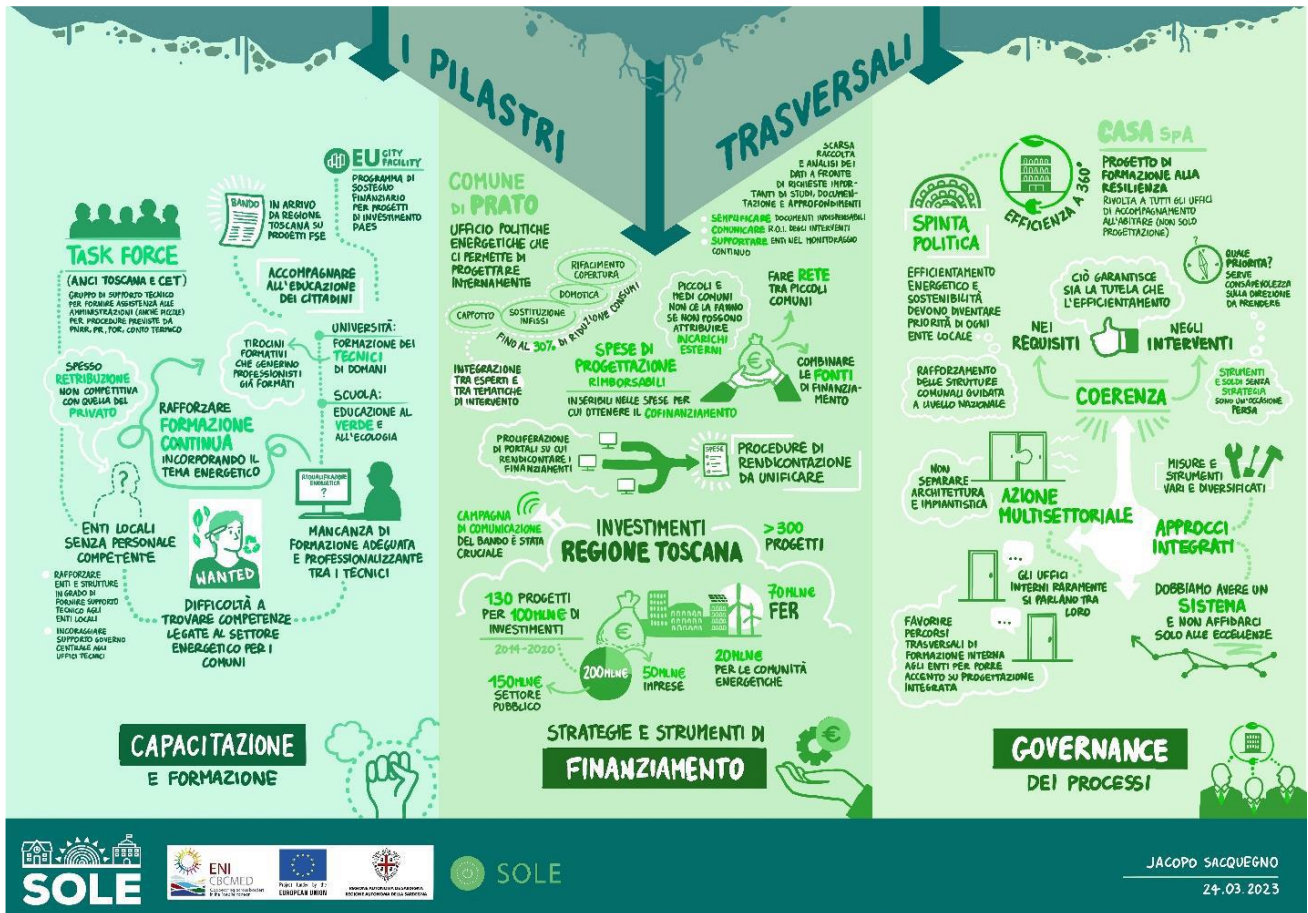
- **How to requalified historical buildings?**
- **What are the most promising and applicable technologies for energy monitoring and consumption reduction?**
- **How the Renewable Energy Communities will change the energy habits and what are their possible development?**
- **How energy habits of the users of the building affect the consumption? How we can intervene to promote the behavioral change?**

The participants of the second session, that were in part the same of the first meeting, were invited to discuss about three additional thematic, that we consider transversal respect the first thematic; capacity building, economic incentives, governance.

We asked them to answer to the following questions:

- **What could be the strategies for the capacity building of public entities and private citizens for raising awareness among sustainable approaches?**
- **What are the most fruitful economic instruments for incentive the energy requalification of the buildings?**
- **How we can improve the governance of the energy requalification interventions?**

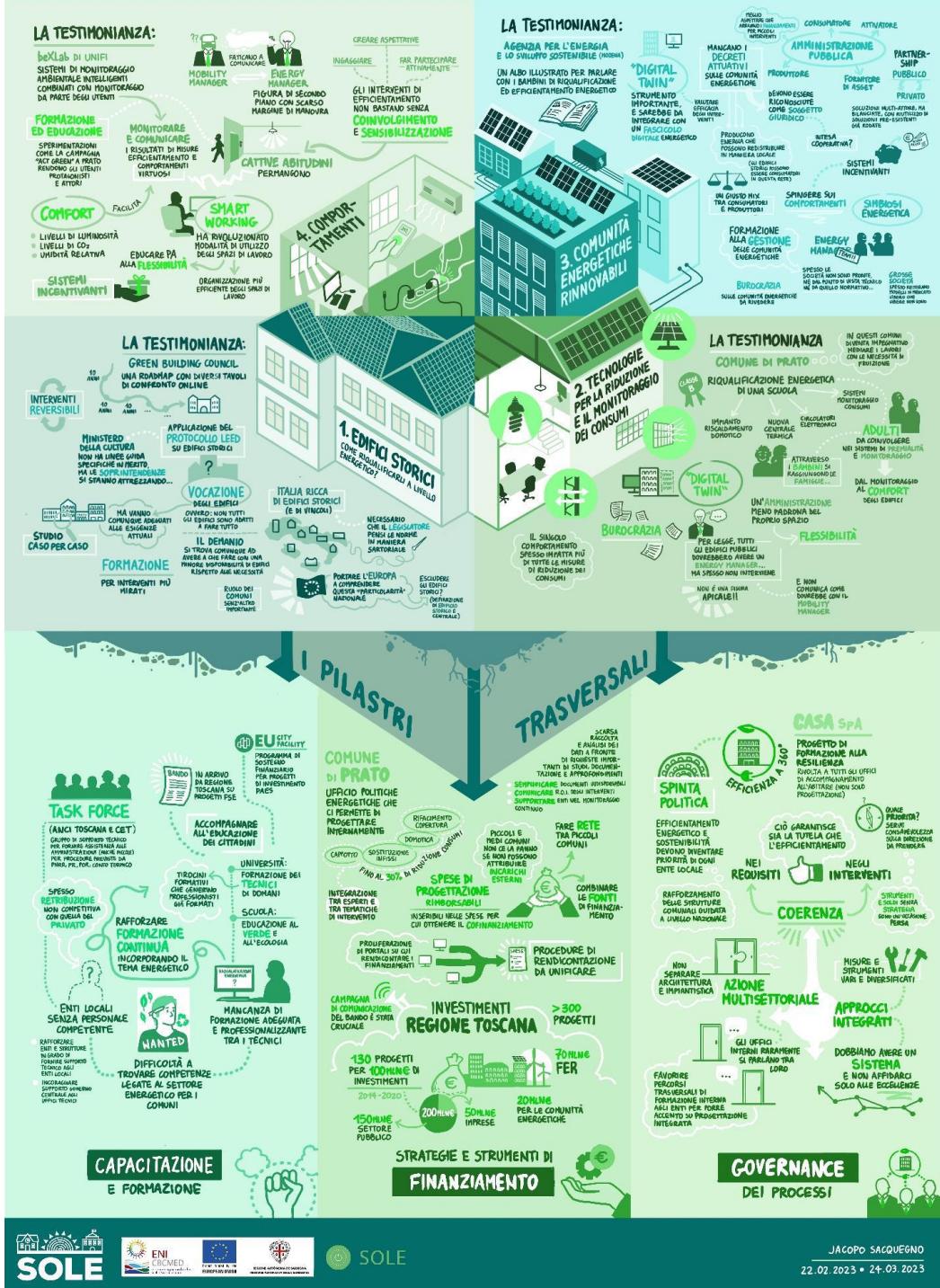
Below the sketch of the first session and then the sketch of the second session.



Finally the whole sketch, with the entire building of the future.



L'EDIFICIO PUBBLICO DI DOMANI



After each session, we have produced a **report** that we have **shared with all invited stakeholders for their critical review**. Per each thematic stakeholders we have highlighted **Weaknesses** and **Opportunities or Best practices or recommendations**.

<i>Thematic</i>	Historic buildings
<i>Question:</i>	How to refurbish historic buildings while taking into account architectural and urban planning constraints?
<i>Weaknesses</i>	<ul style="list-style-type: none"> - Huge number of listed buildings covered by architectural constraints - No national guidelines for energy requalification interventions on listed/historical buildings - Complex bureaucratic procedures - High numbers of actors that must be involved in process of energy requalification of historical buildings - No taking account of the “vocation” of the historical building – a lot of h.b. are not suited to their use
<i>Opportunities/ Best practices</i>	<ul style="list-style-type: none"> - National adoption of the GBC historic building protocol - Custom interventions with multidisciplinary teams - Specific Energy efficiency goals for historic buildings different from the ones for new buildings - Promote training initiatives for technicians and capacity building programs for Policy Makers and Public Authorities

<i>Thematic</i>	Technologies for consumption reduction and monitoring
<i>Question:</i>	What are the most promising and applicable technologies for energy monitoring and consumption reduction?
<i>Weaknesses</i>	<ul style="list-style-type: none"> - We have a lot of data about the energy use of public buildings but local entities have no resources to analyze it - Technologies are only instruments without a behavioral change (importance of the human factor) - High numbers of actors that must be involved in process of energy requalification of historical buildings

	<ul style="list-style-type: none"> - No taking account of the “vocation” of the historical building – a lot of h.b. are not suited to their use
<u>Opportunities/ Best practises</u>	<ul style="list-style-type: none"> - Availability of low impact and low cost technologies for energy systems management and control - Building Digital Twin for predictive simulations of building energy demand - Creation of an Energy Building Dossier
Thematic	Users’ Behavioral
Question:	How much energy habits of the users of the building affect the consumption? How we can intervene to promote the behavioral change?
<u>Weaknesses</u>	<ul style="list-style-type: none"> - Persistence of bad habits of building users even after renovation interventions - Poor decision-making empowerment of energy managers - No link between energy manager and mobility manager - Although Covid-19 has introduced new work habits, the work spaces are yet managed in traditional way
<u>Opportunities/ Best practices</u>	<ul style="list-style-type: none"> - The Covid-19 has introduced new work modalities (i.e. smart working). Re-thinking work spaces (i.e. flexible workstation) can contribute to consumption reduction. - Raising awareness campaign on consumption reduction must be “tailor-made” to the target and must stimulate pro-active contribute of the building’s users - Communicate the results of raising awareness initiatives - Gamification and welfare schemes with rewards for most sustainable habits

Thematic	Governance
Question:	How can we improve the governance of the energy requalification interventions?
<u>Weaknesses</u>	<ul style="list-style-type: none"> - Lack of multisettorial approach - Lack of integrated planning in PA

<p><u>Opportunities /Best practises</u></p>	<ul style="list-style-type: none"> - Sustainable goals must become part of the “mission” of public and private entities - Fostering cross-cutting paths of internal training in institutions and facilities to build integrated planning approaches - Energy requalification approaches must include energy systems, green spaces, water and mobility
<p><i>Thematic</i></p>	<p>Renewable Energy Communities</p>
<p><i>Question:</i></p>	<p>How the Renewable Energy Communities will change the energy habits and what are their possible development?</p>
<p><u>Weaknesses</u></p>	<ul style="list-style-type: none"> - Legislative framework under development - Complex bureaucratic procedures for renewable energy plant installation - Accessibility barriers for Public Administrations - Poor knowledge of REC in Municipalities - Risk of monopoly by large energy players
<p><u>Opportunities/ Best practises</u></p>	<ul style="list-style-type: none"> - Big opportunity for PA that can cover 4 type of role: <ul style="list-style-type: none"> ○ Promoter ○ Prosumer ○ Consumer ○ Share its assets for RES plants - Create local sustainable communities and promote the development of RES plant - Raise awareness on citizens about rational use of energy - Rethinking energy usage - Create synergies between public and private actors, sharing experiences and technical competences - High economic incentives from EU
<p><i>Thematic</i></p>	<p>Economic instruments for financing requalification initiatives</p>
<p><i>Question:</i></p>	<p>What are the most fruitful economic instruments for incentive the energy requalification of the buildings?</p>
<p><u>Weaknesses</u></p>	<ul style="list-style-type: none"> - Poor knowledge of financial instruments - Few human resources in the PA for executive design and planning - Lot of different procedures for financed project management

<p><u>Opportunities/</u></p> <p><u>Best practices</u></p>	<ul style="list-style-type: none"> - Territorial informative campaigns before the launch of the calls - Rethinking the organization of technical office of the PA with multidisciplinary teams - Creating network between small Municipalities to share resources for project preparation
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<i>Thematic</i>	Training and capacity building of PA and privates
<i>Question:</i>	What could be the strategies for the capacity building of public entities and private citizens for raising awareness among sustainable approaches?
<u>Weaknesses</u>	<ul style="list-style-type: none"> ▪ Lack of competence of professionals and recent graduates about initiatives for energy requalification of buildings
<p><u>Opportunities/</u></p> <p><u>Best practices</u></p>	<ul style="list-style-type: none"> - Reinforcement of technical offices of PA or creation of technical external qualified teams that support technical offices of PA - Sustainable education in schools (ecology, energy, climate adaptation) - Professionals' internship in technical offices of PA - Upgrade continuing education courses for technical professionals - Organisation and Implementation of awareness raising campaigns (like ACT Green) among the staff who can increase the possibility of lowering energy consumption thanks to more virtuous behaviour at working place. Example experience at Livorno Municipality offices. Less kwh consumed = less CO2 emissions = less money spent by PA (who can invest in other sustainable devices)

SPAIN

The future scenario of energy efficiency in public buildings in Andalusia is defined in the Andalusia Energy Strategy, Horizon 2030, which was approved by the Regional Government of Andalusia in July 2022. This document is the result of numerous meetings and consultations with the Andalusian stakeholders with whom the measures to be implemented in the short/medium term in Andalusian public buildings have been defined. The most important contributions of the SOLE project as the results of the meeting with Andalusian stakeholders, has been the identification of the potential for energy innovation in buildings and public facilities as a priority measure to be included in the aforementioned Strategy, as well as the need to urgently work on the training of public workers for a change in behaviour towards an improvement of energy efficiency (results of SOLE WP5).

Thus, the SOLE project and the activities developed in it are explicitly included in the Andalusian Energy Strategy as a reference of the actions to be implemented in the rest of the buildings of the Andalusian Public Administration. In particular, the references to SOLE are included in the measure G3.9, called “energy innovation in public buildings and installations” within Energy Strategic Action Line 11, which refers to “supporting energy management and decarbonisation in public entities and services”.

Other measures contained in the Energy Strategy in relation to public buildings to be implemented in the short/medium term refer to:

- Articulate financial measures and grants for the energy rehabilitation of public buildings and facilities of the Regional Government, with actions in the envelope, air conditioning facilities, sanitary hot water, lighting, water pumping, etc.
- Promote self-consumption, storage and ICT systems and make public buildings a reference building in the field of innovation in new technologies and energy services.
- Develop an Investment Plan for the Energy Network of the Administration of the Government of Andalusia (REDEJA), which manages the Andalusian Energy Agency
- Undertake a progressive change of the mobile fleet of the Regional Government towards a more sustainable one that incorporates vehicles with lower environmental impact (zero vehicles and eco-emissions) as well as the necessary recharging infrastructures.
- Centrally energy management in the buildings of the Regional Government, which allows to take advantage of the existing common infrastructure and the unification of criteria that speed up the decision making to give a technical and coordinated support for other public



- authorities in the development of their actions. This will have an impact on the reduction of primary energy consumption and associated CO2 emissions.
- Attend and advise the demand of Andalusian public entities that request it to the Agency and that cover the different phases involved in an energy rehabilitation, from the diagnosis of the building to the monitoring of results.

These and other measures were exposed and discussed in the framework of a working table organised by the Andalusian Energy Agency in Seville, on March 7, 2023, coinciding with the SOLE partner meeting held the previous day in Seville, and in which, in addition to the Andalusian stakeholders, national and international experts on energy efficiency in public buildings, representatives of European universities and research centres, as well as SOLE's partners, participated.

The working table with the title “strategies to transform buildings into net zero buildings” intended to outline a roadmap to improve the energy efficiency of public buildings, which, based on the measures already planned and mentioned above, was enriched based on the reflections and good practices that were shared by the speakers during the session.

In particular, the working table addressed three issues that were discussed extensively by the rapporteurs:

- National and Regional strategies for improving energy efficiency in different countries.
- The role of the microgrids and the energy management systems in buildings
- The role of hydrogen in the energy mix of a building and other forms of energy storage

GREECE

During the discussion of the World Cafe event, we had the opportunity be informed and reflect on various issues related to the energy transition and public buildings in Athens. The most interesting of them were related with the policies and the measures for the reduction of the climate consumption and with the energy upgrade of a variety of public buildings in Athens.

So, when it comes to policies and initiatives for the future, as the representative of the Ministry of Environment explained to us the first measures in the coming period have to do with the regulations in order to reduce the consumption of natural gas and electricity. Greece has to meet through the NECP (National Energy & Climate Plan) 55% targets and the carbon neutrality to 2050.

The "Save 2021" program (Private sector – housing) is the current energy upgrade program for homes with a total budget of 632 million euros. The design of the Program takes into account the integrated approach of energy saving interventions in the residential building sector and aims at: reducing the energy needs of buildings and emissions, cost savings for citizens, improvement of daily living and comfort conditions as well as safety and health of citizens when using these buildings and achieving a cleaner environment.

In addition, the Electra Program is to improve the energy efficiency of the building stock owned or used, which includes, energy used for heating, cooling, ventilation, domestic hot water (DHW) production and lighting, ensuring optimal levels of hygiene, indoor air quality and comfort. The total duration of implementation of the Program is the period 2020 - 2026, with the possibility of extension. The main objective of the "ELECTRA" Program is its contribution to the achievement of the national indicative energy efficiency target which in the relevant law defines the achievement of the objective of annual energy renovation of 3% of the useful floor area of central public sector buildings administration, and to promote the exemplary role of the state in improving energy energy efficiency of its buildings.

On energy upgrade projects in the municipality of Athens, as the vice Mayor explained to us, right now there is a intensive effort to acquire expertise in order to absorb funds given to Greece by the European Union and to upgrade public properties owned by the Municipality of Athens. European development Bank is giving funds to the municipalities and to the regions for energy upgrading systems and thus Athens has a budget of 30.000.000,00 euros. Through the variety of the examples of five schools, one cultural building and two municipal building, that were presented to us it became clear that measures for the energy upgrading of buildings have to do with: restoration of building facades (thermal facades – thermal insulation), substitution of thermal openings, installing photovoltaic system with net metering, installing of heating / cooling power of new heat pump vrv/vrf.

The current conditions regarding the energy crisis globally, prove that the effort for the energy upgrade of the building envelope is complex and time-consuming. The difficulties of drastic interventions on the building shell guide us to the choice of energy production, in order to reduce the

balance of energy consumption. Energy production from renewable energy sources is the strategic choice at the national, regional, and local levels.

As the discussions showed right now in Athens there are lots of efforts must be done. Thus, one of the most important aspects is the proliferation of instruments to finance and support energy upgrading at the building shells. More specifically, this has to do with improving the expertise in securing and channelling funds on the part of the state as well as in the absorption of funds by stakeholders.

In the current period when Athens' building stock is aging, as many of the stakeholders claimed, energy upgrading can be an important opportunity for revitalization. This could be achieved through a combination of measures that on the one hand have to do with energy saving and on the other hand renovate and give modern functional characteristics to the buildings.

As also emerged from the debate the issue of energy upgrading requires the cooperation of many parties. Public bodies, institutions and authorities in combination with the private sector, the technical sector and experts in general, have to make a joint effort in order to clarify and simplify procedures and to ensure that the results start to become quickly visible. Moreover, the more people involved in this case, the more immediate the achievement of the objectives will be and the more widespread the awareness of citizens will be. Last but not least the research for optimal solutions and increasingly sophisticated technical practices is an imperative. In this context, both the research for new materials and technologies and the reduction of their costs should be an important priority.

JORDAN

This report is to illustrate the future of renewable energy and energy efficiency for public buildings in Jordan- 2050. Based on the expectations of SOLE projects' stakeholders; energy policy makers, public administrations, Local authorities, local community and end users. Under the framework of ENI CBC MED program/ SOLE project, RSS/ NERC has conducted a workshop titled "CAPITALISATION / Future of Public Buildings in Energy Efficiency & Renewable Energy in Jordan", on Feb 28th, 2023.

The commencement of the event was initiated with an introduction to the Royal Scientific Society (RSS) and the SOLE project by the Director of the National Energy Research Centre. Following this, the Energy, Environment & Climate Change Programme Manager from the European Union presented the ENI CBC MED programme, as well as the Interreg NEXT MED Transnational Cooperation Programme 2021-2027. During this session, the Manager highlighted the challenges, priorities, and opportunities associated with the programme. Subsequently, the SOLE project coordinator delivered a comprehensive presentation on the implemented energy efficiency and renewable energy interventions at Iskan Al Faiha' mixed school. Thereafter, the Director of the National Energy Research Centre discussed the outcomes of activity 6.2. The Director's discussion included a public building energy efficiency stakeholder power mapping in Jordan, funding and legislation impacting energy efficiency in public buildings in Jordan, and the energy situation in Jordan.

Keys and findings

Following the aforementioned sessions, the Manager of the Energy Efficiency & Solar Thermal Energy Division at the Royal Scientific Society/National Energy Research Centre (RSS/NERC) divided the audience into work groups, consisting of 5-6 individuals. The Manager provided an explanation of the main objectives of these groups, allowing each group 25 minutes to conceptualize the future of energy efficiency and renewable energy in public buildings in Jordan. Each group was assigned a facilitator who was responsible for providing outputs to the audience. These outputs were subsequently shared with all attendees.

Work group No.1 outputs

- District cooling and heating using natural refrigerants.
- Green roof-top
- Using automated appliances
- Battery storage system for public buildings
- Using electric vehicle EV, electrical bikes for the transportation
- ISO 50001 and Environment management systems
- Monitoring and O & M department for energy performance of buildings.
- Buildings Management System

Work group No.2 outputs

- Generating biogas from source separated organic waste for electricity production.
- Natural ventilation
- Using heat recovery for the public buildings
- Green hydrogen
- Artificial intelligence applying in the public buildings
- Using the latest update of ISO50001 related to energy management system

Work group No.3 outputs

- Polycarbonate houses connected to composting that provide fertile soil to farms and hydroponics
- generated by solar thermal system and PV systems
- Applying energy management system, control system and RE technologies in public buildings
- Integrated PV system in public buildings in addition to roof gardens
- Electrical Tram operating on a variety of renewable energies generated in the city
- Using energy labelled appliances with high energy efficiency class

Work group No.4 outputs

- Renewable energy power plant for all public buildings
- Buildings with water harvesting technologies to self-sustain and promote vertical greenery &
- Increasing green areas at a lower footprint
- EV parking with EV charging stations and shading lots for public transportation
- Public spaces with access to waste segregation bins for recycling, composting and biogas production.
- Using newest technology for lighting system integrated with PV modules and battery storage

Main Outcomes

Following the work group session on the future of energy efficiency and renewable energy in public buildings in Jordan, an external designer was invited to participate in these work groups. The designer aimed to understand each group's main concepts and ideas to develop and create a poster as shown below.

The work groups' main ideas represented their vision for a smart city in 2050, in which energy efficiency (EE) and renewable energy (RE) measures are taken. Among these ideas, the most sustainable and impactful were selected and showcased in the poster below. Firstly, all work groups agreed that this smart city should be powered entirely by renewable energy, generated by a renewable energy power plant, along with an energy battery power station for emergency cases and public transportation, including electric trams. Additionally, a station should be set up to produce biogas from source-separated organic waste for electricity production and heating applications in the city.

A central district cooling and heating plant would operate using natural refrigerants to consume minimal energy and eliminate the use of environmentally unfriendly refrigerants such as HCFCs and HFCs while providing all city facilities with heating and cooling. A separate PV system would supply public street lighting and an electric vehicle charging station (car park) for electrical cars to support e-mobility. Each building would be equipped with solar water heaters to supply the buildings with hot water. These buildings would be supplied with energy-efficient equipment such as ventilation, heating and cooling appliances, and a lighting system. All of these appliances would be connected to an advanced energy management system that uses artificial intelligence (AI) in accordance with the latest ISO standard related to energy management in buildings.

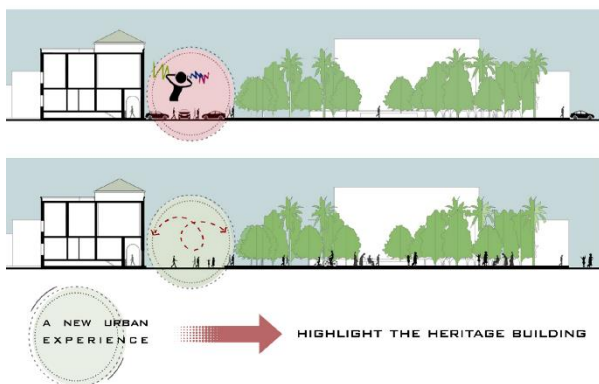
The government would assign an operation and maintenance team to each building to maintain all systems' long life. The public space would be equipped with waste segregation bins for recycling, composting, and biogas production. Additionally, polycarbonate houses would be established to produce the necessary plants for this smart city, generated by RE technologies. Water-harvesting technologies were also taken into consideration in this city.



TUNISIA

The ‘future of public building’ brainstorming workshop, in Tunisia, was executed at the National School of Architecture, through a bootcamp, where architect students, worked in teams, to design the best energy efficient public building design.

Each group was given a specific building, and they had to face the challenge, of old building adaptation, repurposing and integration of new efficiency techniques, that have never been part of building maintenance. The winning team, working on the municipal building of Bizerte, and proposed the following main transformations:

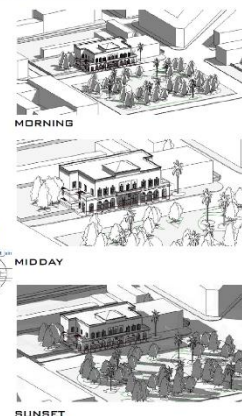
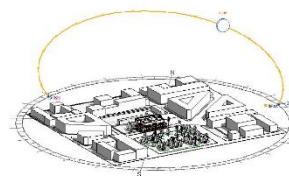


ABOVE 2 DRAWINGS BY ENAU STUDENTS TASNIM KALLEL & RAHMA OULED ABDELKADER

SUMMER/WINTER SUNLIGHT STUDY

THE SUN'S TRAJECTORY: SUMMER

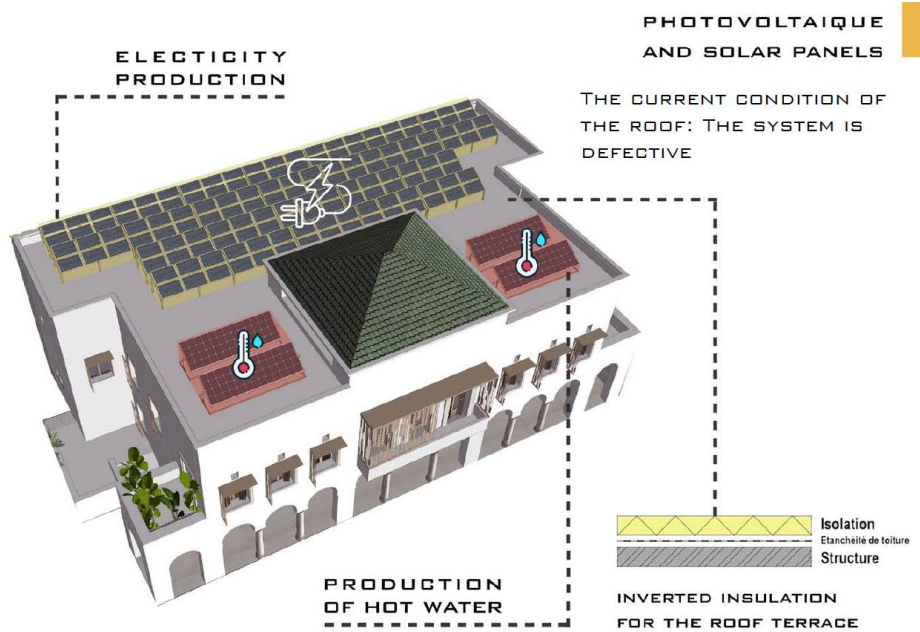
SOUTH EAST ELEVATION



Student outcomes, focused also on improving the urban experience and not only building transformation. The sun trajectory was also mapped onto the building, to study optimal use, and most efficient solar energy integration in energy consumption.

The use of photovoltaic systems, for historical buildings, is a controversial topic in Tunisia, especially in UNESCO heritage cities, where most restoration architects, believe that it, it negatively impacts the urban rooftop landscape. Hence, the students, needed to rethink of the most appropriate method, that respects the built heritage and provide renewable energy at the same time.

With global warming, having water at all times of the day, is becoming and more and more a challenge, and hence the students, designed a system by which water use could be optimised in the building.



- ROOF WATERPROOFING WILL BE REDONE.
- AN INVERTED ROOF SYSTEM WILL BE IMPLEMENTED: A MORE ENVIRONMENTALLY FRIENDLY SOLUTION.



ABOVE 2 DRAWINGS BY ENAU STUDENTS TASNIM KALLEL & RAHMA OULED ABDELKADER

The ENAU bootcamp, was a very rich exchange, which made future architects, aware of the importance of building efficiency in building design, management and conversion.

The work of the top three winning student groups, was presented to stakeholders, and project partners.

Finally the main recommendations for better management of energy efficiency in public buildings in Tunisia:

- Simplify energy audit procedures for municipalities by adopting specifications for generic energy management measures (example: LED lighting in buildings, LED street lighting, double glazing, etc.) with a view to accelerating the energy audit process.
- Strengthen the human capacities of municipalities in the various aspects (technical, regulatory and financial) in relationship to the municipal energy transition.
- Improve energy governance and position energy as a national priority.
- Unit stakeholder objectives of all energy efficiency stakeholders (Communities, MIME, ANME, STEG, CPSC, etc.).
- Set up a joint commission, composed of representatives of the Ministry of Industry, Mines and Energy, the Ministry of the Interior, the National Agency for Energy Management, the Tunisian Electricity and Gas Company, the Loans and Support Fund for Local Authorities, the National Federation of Tunisian Municipalities, the Photovoltaic Trade Union Chamber and all other interested parties, to define and implement the necessary reforms the regulatory and technical frameworks of renewable energies in order to enable municipalities to take full advantage of them, in particular for public lighting.
- Start immediately by upgrading the existing public lighting networks.
- Develop “Network electricity/PV” adaptation kits for public lighting.

LEBANON

In the future, Lebanon is poised to make significant strides in energy efficiency in public buildings, driven by growing awareness, policy support, and technological advancements. Here's a possible scenario of what energy efficiency in public buildings in Lebanon could look like:

Enhanced Policy Framework: The Lebanese government strengthens its policy framework by implementing stricter energy efficiency regulations and standards for public buildings. This includes mandatory energy audits, building performance certifications, and incentives for energy-efficient retrofits and new constructions. Clear guidelines and enforcement mechanisms ensure compliance and accountability.

Deep Retrofits: Public buildings undergo comprehensive energy efficiency retrofits to address their high energy consumption. The retrofits include measures such as upgrading insulation, replacing inefficient HVAC systems with energy-efficient alternatives, installing smart lighting and controls, and optimizing building management systems. Deep retrofits significantly reduce energy demand and result in substantial cost savings.

Technological Integration: Advanced technologies play a crucial role in achieving energy efficiency goals. Public buildings adopt smart technologies like sensors, meters, and automated systems for real-time monitoring, data analytics, and energy management. Artificial Intelligence (AI) algorithms optimize energy usage, occupancy patterns, and equipment operation, leading to further energy savings and improved building performance.

Renewable Energy Integration: Public buildings increasingly integrate renewable energy systems into their infrastructure. Solar panels, wind turbines, and geothermal systems are installed to generate clean and sustainable energy on-site. This reduces reliance on the grid, minimizes energy costs, and lowers carbon emissions, aligning with Lebanon's renewable energy targets.

Net-Zero Energy Buildings: Several public buildings achieve net-zero energy status, meaning they produce as much energy as they consume over a given period. These showcase projects demonstrate the feasibility and benefits of highly efficient buildings powered by renewable energy sources. They serve as inspirations for future developments and motivate stakeholders to adopt similar energy-efficient practices.

Energy Performance Monitoring: Continuous monitoring and evaluation of energy performance become standard practice for public buildings. Real-time energy monitoring platforms provide insights into energy consumption patterns, identify areas for improvement, and facilitate informed decision-making. Building occupants and administrators have access to user-friendly interfaces that display energy usage and provide tips for energy conservation.

Public-Private Partnerships: Collaboration between public institutions, private sector entities, and international organizations strengthens the implementation of energy efficiency projects. Partnerships facilitate knowledge exchange, funding opportunities, and technical expertise. Public



buildings serve as demonstration sites for innovative energy efficiency solutions developed through these collaborations.

Behavioural Change and Public Awareness: Energy efficiency awareness campaigns and educational programs create a culture of energy-consciousness among building occupants, administrators, and the wider public. Workshops, training sessions, and community engagement initiatives promote sustainable behaviours, encouraging energy-saving practices, and fostering a sense of responsibility towards environmental stewardship.

This future scenario envisions a transformed landscape of energy efficiency in public buildings in Lebanon, with reduced energy consumption, improved building performance, and a significant contribution to the country's sustainable development goals. Through concerted efforts and collaboration, Lebanon can establish itself as a regional leader in energy efficiency and inspire positive change in the broader built environment sector.

EGYPT

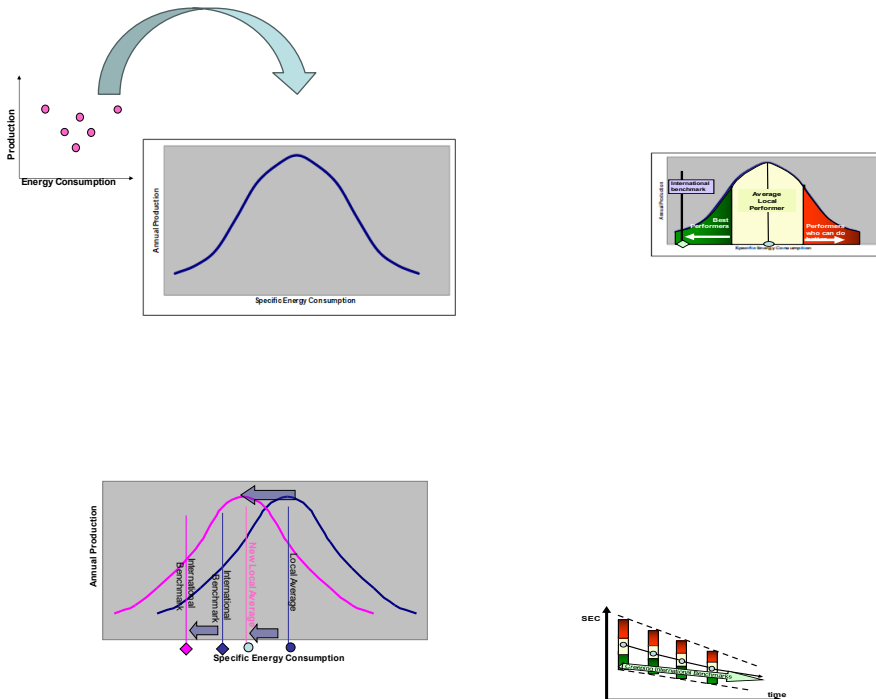
A number of individual and group interviews and discussions were conducted to discuss issues related to EE & RE in public. Based on these discussions the following proposed scheme is introduced.

For similar activities the specific energy consumption is compute and the associated distribution is developed.

- The distribution is divided to the three parts
- The one who are good performers
- The average performers
- The performers who can do better.
- Then working on performing energy conservations applications to move the distribution towards the better performers

The above can be performed through some of the schemes which referred to the pervious sections

The following graphical presentations indicate the above steps.



Policies related to building energy efficiency

These actions (hardly named policies), but rather recommendation and government circulars, primarily issued by the housing authorities. Furthermore, the building authorities issued an energy efficiency code for building, but not mandatory, it mainly include the:

- Direction of the building.
- Material used, helping thermal insulation.
- Use of natural lighting.
- Use of natural air drafts as well.

Local best practices

The local best practices are related to technologies, these are:

- Efficient lighting systems in public lighting, commercial activities as well as domestic lighting
- Use of efficient equipment on the residential level, would be class A+ washing machines and refrigerators followed by air-conditioning equipment.
- On the industrial level would be efficient motors followed efficient thermal insulation, as well as combustion control.

CROSS-BORDER LESSONS & POLICY RECOMMENDATIONS

ITALY

From all partners' presentations in the last SOLE steering committee, arises that a key element for promoting energy requalification of the buildings is knowledge sharing and interregional cooperation, as well as we are doing in SOLE project. Another important leverage that stimulates the promotion of energy requalification interventions is the upskilling of technicians and the capacity building of public administration.

I agree with Joaquin of AEE that it is crucial for the building sector to think in a holistic way, promoting the upskilling of workers and technicians, in order to an industrial transition of the sector. I find interesting to know that in Greece there is the Electra program that set a minimum energy efficiency category target for renovated public buildings. I'm curious to know if class B is a target both for historic listed buildings and for new building. I find also interesting in the Lebanese presentation the proposal of Tax and VAT exemptions for materials related to energy savings project. All these experiences could be collected to create a database of best practises easily transferrable from one territory to another.

The climate is changing. You may have seen reports of the exceptional flooding that has affected much of central Italy in recent days (May - June 2023). So many small towns are isolated because roads are cut off by landslides. These exceptional phenomena are becoming more and more frequent. And our territory, like that of many other countries facing the Mediterranean, is very fragile. We are obliged to change our approach. On the one hand we all have to try to reduce our energy expenditure and pay attention to the use of resources, and on the other hand we have to think about climate adaptation strategies.

Fortunately, nowadays we have low-cost technologies that can help us in the energy transition (plant control and management tools, renewable energy production facilities).

Private and public entities are obliged to keep sustainable goals as part of its own mission, rethinking and redesigning their processes.

It is a big opportunity for all the actors of our economic system. We can only tackle this transition with an integrated and multidisciplinary approach, sharing experiences between private and public actors and between countries, as we are doing from the beginning of the SOLE project. We have seen



with SOLE energy talks: the debate between different actors is the only way to overcome obstacles. Often, the communication is the first step for promoting the change.

SPAIN

There are many lessons learned and the positive inputs we have received from the project. Among them, highlight the capacity to join and well organize the regional stakeholder's network in the case of Anci Tosacan. During the event in Tunez it was very inspiring the methodology used in the meetings held with the stakeholders, as well as the results obtained and the way to present them so that it was easily understood by all the attendees.

We also learned from the Tunisian event about the importance of professional training and awareness-raising campaigns. Thus, in addition to the results of the campaigns launched in SOLE, we were able to know the results of a sister project, Green Building Project, financed by ENI CBC Med. It was very interesting to know the results of the project developed at the university hospital in Manouba, where we were also able to visit the 8 solar water heaters which were installed in February 2023 and the energy sub-meters that have been also placed to monitor the energy flows.

What we learned from this visit is the importance of interregional cooperation and the programs that promote it, as is the case with ENI CBC Med, without which none of the results shown in Tunisia would have been possible. We also learned about the importance and the benefits of the cooperation between sister projects.

Another very positive impact of the event in Tunez was the session held with young architecture students who, in a concurrence organized by the Tunisian University of Architecture, defended their proposals to improve the efficiency of several buildings. It is noteworthy, the high level of the students and the projects presented during this session. Professional training is a necessity to boost energy efficiency in buildings and is what is being achieved with this example. These young people are undoubtedly a promising future for further progress in improving energy efficiency in building.

And finally, do not forget the social aspect of the energy efficiency, with some good examples in SOLE project, such as the pilot projects carried out by the PP5 partner at the Iskan Faiha' primary mixed School. It is important to note that, in this case, energy efficiency has been aimed primarily at improving the comfort of students and surely, of their performance. It is important to involve school students in energy efficiency to improve their education and awareness. The same could be said about the projects being developed in Athens and Alexandria regarding the involvement of the student community of the universities.

In line with the amended proposal of the European directive on the energy performance of buildings, with the measures of the Andalusian Energy Strategy, with the conclusions of the working table of SOLE meeting in Seville mentioned in the previous point and with the inputs from the Tunisian event, the main measures to be promoted by all Med countries are:

- Progressively introduction of increasingly demanding minimum energy performance standards to boost the renovation of existing lower-performing public buildings.
- Create new standards for new public buildings with a more ambitious vision for public buildings to move from near-zero emissions to positive energy buildings (new buildings by 2030 and all public by 2027)
- compel the development at national level of improved long-term renovation strategies for public buildings, to be renamed national plans for the renovation of public buildings, and which will have to be moved to regional and local levels
- Improve the reliability, quality and digitization of Energy Efficiency Certificates so that they become a useful information tool for public workers with energy efficiency classes that will be based on common criteria, and not as is currently the case that they are not comparative.
- Promote comprehensive renovations of public buildings, starting with a definition of “deep renovation” and the introduction of building renovation passports that identify the measures taken.
- Modernization of public buildings and their systems, and better integration of the energy system (for heating, cooling, ventilation, electric vehicle charging, renewable energy)
- Boost innovation in new materials and building systems
- Develop the appropriate framework that allows to undertake building renovation programs, including the training of professionals or the development of a legal framework that streamlines the processes of project processing.
- Develop new innovative financial mechanisms such as energy performance contracts, including private participation, to facilitate the energy rehabilitation of public buildings.
- Promote new certificates that promote energy efficiency, such as white certificates, where the efficiency measures implemented have a value in the market.
- Promote from the regional administration the development of energy communities that facilitate access to renewable energies for the most disadvantaged groups. There is great potential for the use of roofs in public buildings to install renewable systems, the generation of which can be used to meet the energy needs of public buildings, as well as those of neighboring citizens in poverty.
- Launch savings campaigns among public workers to raise awareness about the importance of energy efficiency and the contributions they can make to reduce the environmental impact on their workplaces.

GREECE

In general, all practices and the lessons learned at Steering Committee in Tunis were of great interest to the NTUA research team, as they have deepened the team's existing knowledge on technologies such as: energy saving/generation applications/simulation and management tools, policy making and monitoring, use of renewable energies. However, among all the lessons learned, we highlight those that can be applied in more efficiently in the Greek territory:

- Firstly, the policy instruments of Andalusian energy model for 2021- 2030 period, was the most integrated presentation focusing on the whole plan of the territory. From what was presented we can mainly distinguish, the energy rehabilitation of business and household buildings and its urban environment, focusing on most vulnerable collectives and the role of the regional administration as facilitator on the Andalusian energy transition plan.
- From Lebanon partners, we highlight on the one hand the impressive development of the installation of photovoltaic panels in the context of SOLE project and on the other hand the issues raised in relation to financial measures such as the tax and VAT (included exemption in the next Government budget) and the importance of micro-credits absence.
- The partners from Tunisia highlighted issues related to the lack of expertise at the level of municipal authorities as well as the need to simplify procedures. The need to broaden expertise on energy transition issues, simplification of procedures and regulations are parameters that are also make difficult the Greek condition.

In Greece right now the energy production by the “energy communities” is an ongoing process that has managed to involve many people in both rural and urban areas. “Energy communities” was recently institutionalized by the Greek government with law 4513/2018 "Energy Communities and other provisions", which clarifies issues such as the purpose of these partnerships, their potential members, the object of their activity, the relevant for their constitution, etc.

The Energy Community is an exclusive-purpose urban cooperative with the aim of promoting the social and solidarity economy and innovation in the energy sector, tackling energy poverty, and promoting energy sustainability. Individual objectives concern the production, storage, self-consumption, distribution, and supply of energy, the strengthening of energy self-sufficiency and security in island municipalities, as well as the improvement of energy efficiency in the final use at the local and regional level through the activity in the fields of Renewable Energy Sources, High-Efficiency Cogeneration, energy efficiency, sustainable transport, demand management, and energy production, distribution, and supply.

At the same time one of the most important trends in the field of energy saving are the processes of building reuse and material reuse. As it is increasingly proven that new construction is much more costly in terms of energy than reuse, the sector of conservation of old buildings, recycling and upcycling is also developing more and more dynamically in Greece.

JORDAN

Participating in SOLE project provided us with a valuable opportunity to collaborate with a diverse group of skilled professionals from various backgrounds. The knowledge sharing between the partners was particularly insightful, as we were able to learn about different energy regulatory frameworks and also the best practices for implementing energy projects in different parts of the world which will give us an opportunity to enhance the energy sector in Jordan by considering the positive practises shared throughout the project.

Through our participation in SOLE project, we have gained valuable insight into positive practices from our partners. One example is the KENAK methodology developed in Greece, which establishes minimum requirements for energy efficiency in buildings. This methodology can provide guidance to end-users on enhancing the efficiency of their buildings. And also, we believe that it's important to encourage the local communities in Jordan to consider energy efficiency measures in their buildings by providing an incentive programme similar to The "Save 2021" programme in Greece which includes 5 categories of incentives for Beneficiaries.

Another positive practice we have learned from our Andalusian partner is the establishment of a target in their ENERGY STRATEGY FOR ANDALUSIA 2030 to carry out energy action for 30% of the building stock of the Andalusian regional government. This achievement will promote energy efficiency and renewable energy measures for all buildings across the country.

Our Lebanese partner has also provided valuable insights, such as the idea of providing land as an incentive for renewable energy projects. We believe that this practice should be also considered in Jordan to encourage major energy consumers to shift towards renewable sources. This is particularly important since the cost of land is a significant challenge for photovoltaics projects in our country.

Finally, we would like to highlight a positive practice from our Tunisian partner, which emphasizes the importance of increasing end-user awareness on dealing with energy efficient equipment and renewable energy systems, and also share the technical knowledge with them in order to ensure the sustainability of energy efficiency and renewable energy projects.

Regional cooperation is important for the harmonization of building standards and certification schemes in Jordan and all Med countries. This cooperation will help to ensure that buildings in the

region meet the same energy efficiency standards, making it easier to share knowledge and best practices across borders. This harmonization can be achieved through the establishment of a regional committee responsible for developing and implementing energy efficiency standards, codes, and certifications. This committee can work with national governments to develop common standards that are suitable for the region's climate, resources, and building techniques.

Regional knowledge exchange is another critical trend for improving energy efficiency in the public buildings sector in Jordan and all Med countries. This exchange can take the form of workshops, conferences, and seminars, where experts from different countries share their experiences and best practices. This exchange will help to promote innovation and creativity, leading to the development of new technologies and energy efficiency measures. Regional knowledge exchange can also help to create a network of experts who can provide technical assistance and support to public institutions in the region.

Establishing a regional platform for efficient buildings is another trend that can significantly improve energy efficiency in the public buildings sector in Jordan and all Med countries. This platform can serve as a hub for sharing information, best practices, and technical assistance related to energy efficiency in public buildings. It can also facilitate the exchange of ideas and knowledge among stakeholders, including governments, private sector entities, and civil society organizations. The platform can also serve as a repository for data related to energy consumption and greenhouse gas emissions in public buildings, helping to monitor progress and identify areas for improvement.

Developing a manual for energy retrofits for existing buildings is another trend for improving energy efficiency in the public buildings sector in Jordan and all Med countries. This manual can provide guidance on how to retrofit existing buildings to improve energy efficiency, reduce energy consumption, and lower greenhouse gas emissions. It can also provide information on financing options, technical assistance, and best practices for building owners and managers. The manual can be developed in collaboration with national governments, private sector entities, and civil society organizations, ensuring that it is comprehensive and practical.

TUNISIA

Scaling up energy efficiency and renewable energy in municipalities in general is an absolute necessity at the local level in the context of the energy transition and climate change mitigation in Tunisia. For the building sector (residential and service buildings), all the necessary foundations are in place today, including institutional, regulatory and incentive frameworks, as well as human capacity and expertise, although they are insufficient in terms of quality and/or quantity. These frameworks need to be reviewed and adapted to the context of Tunisian municipalities in order to ensure the provision of an integrated, effective and efficient system for improving energy efficiency and promoting the use of renewable energy, particularly in municipal buildings. It is therefore important to implement the institutional, regulatory and incentive framework reforms outlined in this document and to strengthen the human capacity of municipalities and the local expertise.

The use of renewable energy for street lighting also needs to be disseminated, as it has significant potential to reduce the energy bill for municipalities, especially when PV systems are combined with highly energy-efficient LED luminaires. It is therefore important today to revise Government Decree No. 1123 of 24 August 2016, which establishes the conditions and procedures for the implementation of projects for the generation and sale of electricity from renewable energy sources, in order to adapt it to the municipal context. It is also important to speed up the development of the power purchase agreement by the STEG for excess electricity produced by municipalities from renewable energy sources and distributed on the low-voltage grid.

All this needs to be done within the framework of an overarching and integrated national strategy to support Tunisian municipalities in the energy transition at local level

LEBANON

The Main cross border lessons learnt are:

- Effective communication: Partners who communicate clearly and regularly tend to work better together and achieve their goals more efficiently.
- Collaborative problem-solving: Partners who work together to solve problems tend to find more effective solutions.
- Flexibility: Partners who are flexible and adaptable tend to be better equipped to handle unexpected changes and challenges.
- Focus on shared goals: Partners who focus on shared goals tend to work more effectively together and achieve better results.
- Transparency: Partners who are transparent in their communication and actions tend to build trust and stronger relationships.
- Continuous improvement: Partners who are committed to continuous improvement tend to be more innovative and effective in achieving their goals.
- Positive attitude: Partners who maintain a positive attitude tend to be more motivated and productive, even in challenging situations.

The future energy trends that we recommend for Lebanon are:

- Sustainable development: Encouraging sustainable economic growth and development that is respectful of the environment and natural resources.
- Digitalization: Embracing digital technologies to improve economic competitiveness, increase efficiency, and provide better services.
- Renewable energy: Investing in renewable energy sources to reduce dependence on fossil fuels, promote energy independence, and reduce carbon emissions.
- Innovation and entrepreneurship: Encouraging innovation and entrepreneurship to create new businesses and technologies that can drive economic growth and job creation.
- Education and skills development: Investing in education and skills development to create a highly skilled workforce that can compete in the global economy.
- Cultural exchange and tourism: Promoting cultural exchange and tourism to increase understanding and cooperation among Mediterranean countries and boost economic growth in the region.
- Regional cooperation: Fostering regional cooperation and collaboration to address common challenges and promote peace, stability and prosperity in the Mediterranean region.

EGYPT

Joint venture activities would present excellent opportunities on the level of manufacturing as well as implementations

CONCLUSION

Sustainable goals must become part of the “mission” of public and private entities.

Private and public entities are obliged to keep sustainable goals as part of its own mission, rethinking and redesigning their processes. It is a big opportunity for all the actors of our economic system. We can only tackle this transition with an integrated and multidisciplinary approach, sharing experiences between private and public actors and between countries. Energy requalification approaches must include energy systems, green spaces, water and mobility.

Establishment energy efficiency standards for public buildings.

European, national and regional regulations must be updated in line with the current world situation, promoting the reform and transformation of public buildings from net zero buildings into zero or positive-consumption buildings. These standards should set clear targets for energy savings and establish a framework for implementing energy efficiency measures across the public buildings sector. The standards should be regularly reviewed and updated to reflect advances in technology and building practices. Create new standards for new public buildings with a more ambitious vision for public buildings to move from near-zero emissions to positive energy buildings (new buildings by 2030 and all public by 2027)

Take into account the vocation of the historical buildings.

Specific Energy efficiency goals must be established for listed historic buildings different from the ones for the new buildings. A lot of historic building are not suited to their use. Consider the vocation of an historic building helps in funding the most functional use.

Simplify bureaucratic procedures.

Complex bureaucracy could be an obstacle to stimulate requalification interventions. European standards and guidelines could help local entity. Simplify energy audit procedures for municipalities by adopting specifications for generic energy management measures (example: LED lighting in buildings, LED street lighting, double glazing, etc.) with a view to accelerating the energy audit process.

Provide financial incentives for energy efficiency investments in public buildings.

These incentives will help to overcome the high initial costs of energy efficiency measures and encourage public institutions to invest in these technologies. The incentives should be designed to

target specific sectors, such as schools or hospitals, and should be regularly reviewed to ensure they are effective.

Facilitate the construction of interdisciplinary task forces to help public entities to access to economic incentives.

The EU is committed to innovation in order to improve the stock of buildings and housing, through the development of innovative solutions under Horizon Europe programme, budgeted with 95,5 billion euros.

Upskilling of building sector' operators.

Significant gaps in R & D & I to promote innovative projects in public buildings: scarcity of economic, human and material resources, a small number of innovative companies that can undertake It.

Revision of training courses to increase the skills of technician on energy upgrading.

Energy efficiency initiatives can create new job opportunities in fields such as construction, retrofitting, and energy auditing.

Promote behavioural changes of citizens through raising awareness campaigns.

New generations are more attentive than previous generations to the problem of climate change and are adopting a more sustainable attitudes to living. They are a key resource to stimulate the energy transition. The Covid-19 has introduced new work modalities (i.e. smart working). Re-thinking work spaces (i.e. flexible workstation) can contribute to consumption reduction. -Gamification and welfare schemes with rewards stimulate most sustainable habits.

Introduce the Building Digital Identity Card.

Improve the reliability, quality and digitization of Energy Efficiency Certificates so that they become a useful information tool for public workers with energy efficiency classes that will be based on common criteria, and not as is currently the case that they are not comparative. Promote comprehensive renovations of public buildings, starting with a definition of “deep renovation” and the introduction of building renovation passports that identify the measures taken.