



ROADMAP FOR THE GREEN BUILDING IN LEBANON

August 2022



Roadmap for the Green Building in Lebanon

Editorial

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Executive Summary

Buildings represent more than 40% of total energy use and energy-related CO₂ emissions for their operation in Lebanon. Internationally, Lebanon has signed the Paris Agreement in 2016, committing itself through the Intended Nationally Determined Contributions (INDCs) framework to an unconditional 3% (or conditional 10%) reduction in power demand through energy efficiency measures, to achieve, together with similar renewable energy commitments, an unconditional reduction of greenhouse gas (GHG) emission of 15% (or 30% conditional) compared to the business-as-usual scenario by 2030 (UNFCCC, 2015). To meet the Paris Agreement's goal of keeping global temperature increase to well below 2°C, in the heart of the quadruple economic, financial, monetary and banking crisis, the scarcity of the national electricity production and the removal of subsidies on energy, encouraging green buildings in Lebanon would contribute to energy conservation and environment protection while reducing energy costs, at the same time improving national natural sources and energy efficiency in buildings.

A roadmap for Green Buildings in Lebanon illustrates a cost-effective and economically productive pathway, resulting in a clean, dynamic and resilient energy economy dominated by renewables instead of fossil fuels. This pathway outlines a review and modernization of the various regulations and fiscal instruments relating to construction in Lebanon, including those relating to green buildings while ensuring stable and affordable measures, as well as enabling robust economic growth across different sectors.

The construction sector remains, as usual, the main lever of economic growth in this country. However, it is a burden on the energy sector. In this roadmap, short-term and medium-term strategies are suggested as essential actions to be taken by the major stakeholders for reforms, in order to develop an attractive but rational economic environment. These strategies are necessary for the Lebanese Energy Policy, regulations of application of Energy Efficiency and Renewable Energy measures that can motivate green building certifications for existing and new building stocks towards energy conservation and environment protection.

The purpose of this Roadmap is to support the application and promotion of environmental performance, renewable energy (RE) and energy efficient (EE)

technologies that are economically sustainable and innovative in Lebanon, with a focus on buildings that are one of the main priorities of the country. It will also provide recommendations for enhancing the current regulatory and fiscal framework; it will focus on the importance of the development and implementation of necessary relevant standards, education and capacity building, and will propose a marketing plan in addition to an awareness campaign that will positively contribute to the market transformation.

It is conceived as a guideline for the government and all related stakeholders in the development of Lebanon Green Building Roadmap (LGBR) based on local and international rating systems used in the country as well as the current situation, challenges and barriers, and recommendations of the stakeholders, while taking into consideration the good practices and great achievements in other countries.

The main purpose of this roadmap is to suggest the destination and the possible routes to such a destination. Mainly, the Roadmap suggests strategies for developing a green building program within Lebanese construction and retrofit market and provides resources to guide the process.

Context

Lebanon and the MENA region as a whole, are among the most vulnerable regions in the world to climate change, consequently, it's quite natural that Lebanese officials signed the Paris agreements on Climate in 2020, hence committing, inter alia, to reduce the country's CO₂ emissions. In 2011, the Ministry of Energy and Water published the National Energy Efficiency Action plan (NEEAP 2011-2015) which included objectives and policies through a set of initiatives for the next five years' period. The NEEAP was later updated for the 2015-2020 period, and with the National Renewable Energy Action Plan (NREAP 2016-2020), with an effort to increase the share of renewable energies in the national primary energy consumption mix with an ambition target in sight (12% of primary energy consumption from RE). As of 2022, the objectives have not been met and urgent action is needed.

Buildings in Lebanon are responsible for more than 40% of total energy consumption, with residential buildings accounting for 36% of total electricity consumption as per a recent study by LCEC (2018), thus causing their considerable share of CO₂. Only modest recoveries and performance control over equipment utilized in the building establishments are being carried out, unless specific performance standards become adopted at country level. Buildings in Lebanon are also a major contributor to the depletion of natural resources (e.g., soils, rocks, water, minerals, and forestry). The building construction sector in Lebanon further impacts the environment through excavation activities that induce the loss of top soil, green cover and natural habitats as well as through the increased use of construction material. Construction materials needed in buildings include cement, steel, aluminum, wood, gypsum, glass, etc. Most of these are imported from other countries, except for cement, which often suggest important carbon footprints. Buildings hold potential for consequent energy savings and GHG emissions, therefore it has become fundamental to reduce their environmental impact.

Since 2019, the country has been facing an unprecedented financial crisis that has seen private banking sector's bankruptcy, currency devaluation and high inflation, that brought about the poverty of a significant part of the population. For the first time in its history, Lebanon was in default of debt repayment and was unable to maintain its policy of subsidies on energy, thus again increasing the financial pressure on individuals. Daily

power shortages occur for as long as 23 hours in some regions. Before the crisis, the Lebanese were increasingly familiar with green building concepts following a global trend, there was a growing interest for sustainability. Following the crisis, reducing energy consumption and relying on alternative energy sources have become crucial. The end of affordable subsidized energy has made RE competitive. However, the currency devaluation makes it more difficult to import the required equipment.

Choices made in infrastructure development today will determine the competitiveness, quality of life and sustainability of countries for decades to come. In the Lebanese case, there is unfortunately no planning for the infrastructure development at national level that could be considered as a future goal to put the country on a certain level of competition in the region, as well as ensuring improved standard and quality of living without depriving the future generations of their due share of natural resources and ecological space.

In this context, particularly, it is the role of the Government and Building sector professionals, to protect, support and guide people through the elaboration of norms, standards, certifications, the implementation of incentives, and their enforcement through the elaboration of a relevant regulatory framework and incentives.

After understanding the needs and analyzing the gaps in the Lebanese regulatory framework, and after collecting the necessary instruments and/or regulations in other countries aiming to incentivize green building certification (and their respective effectiveness), the following document was developed and consists a strategic roadmap, robust but flexible enough, to allow the integration and implementation of green building regulations for both new and existing buildings in the Lebanese regulatory framework. The recommended key activities that respond to the Lebanese context will be identified. The steps to follow for the proposed roadmap will be indicated: the suitable regulation scheme and the role of each stakeholder involved in legislation, implementation, normalization and monitoring for green building certification and application. Moreover, recommendations will be provided for enhancing this regulatory and/or fiscal framework, in addition to the incentives that will be considered towards the green ratings for buildings and materials in Lebanon.

I. Introduction

After establishing the baseline scenario for the existing green buildings, the relevant current fiscal incentives and regulatory framework available in Lebanon, lack of regulations is the larger problem for construction practices in general and the green ones in particular¹.

Buildings are where people spend most of their lives. They provide shelter, places to play, create, congregate, and so much more. They are also contributing to climate change. A significant amount of greenhouse gas emissions in the region's countries come from burning fuel to heat and cool homes and buildings, produce hot water, and electrify household appliances.

Buildings with better environmental performance potentially have added economic benefits related to decreased operating costs, increased building value, increased asset value and decreased payback time for green investments.

Sustainable buildings hold some of the most profitable means of abating climate change. According to McKinsey (2009), carbon emissions in the building sector can be reduced substantially, either with net economic benefits or at low cost, using a range of proven technologies aimed at demand reduction and energy efficiency². The Global greenhouse gas abatement cost curve for the building sector shows that changes in building design and construction could offset up to 6 billion tons of carbon emissions annually through measures with a zero or negative net life-cycle cost³. In other words, green buildings have the potential to save money and carbon emissions at the same time through effective insulation, glazing, water heating, air conditioning, lighting, and other energy-efficiency measures.

Worldwide concerns for the impending resources crunch, the dangers of global warming, and the understanding of the role that buildings can play to contribute

¹ ASSESSMENT OF THE GREEN BUILDING STATUS IN LEBANON_2022

² McKinsey & Company, "Pathways to a Low-Carbon Economy, Version 2 of the Global Greenhouse Gas Abatement Cost Curve", 2009

³ International Journal of Renewable and Sustainable Energy 2013; 2(4): 180-190

positively to the economy, energy security, human health and the environment have led to a green building revolution around the globe over the last decade. Both government and private initiatives can result in an expanded stock of green buildings.

Drivers for Sustainable Buildings, as per the International Energy Agency ECBCS program (Energy Conservation in Buildings and Community Systems), are the following:

- Increasing scarcity of natural resources
- Population growth
- Extreme weather phenomena
- Growing awareness of environmental issues
- Legislation on environmental issues in building codes
- Increasing interest in human health and wellbeing aspects
- Rapid and continuous urbanization – an opportunity
- Aging population in industrialized countries
- Rise of living standards in developing countries
- Rapid development of ICT solutions

In the Lebanese context, drivers can be described as the following:

- Increasing the scarcity of electricity availability (energy crisis)
- Removal of all subsidies on fuel, unaffordability of energy for the most of the population (economic and monetary crisis)
- Population growth
- Extreme weather phenomena
- Growing awareness of environmental issues

Most buildings are designed and constructed inefficiently. Due to the inefficiency of design and construction, and the adoption of inappropriate but easily available construction materials, buildings incur higher operation and maintenance costs. Most buildings are not equipped to harvest rainwater or minimize water consumption by adopting measures such as the use of water-efficient faucets and showerheads, recycling of bathwater and washbasin water for flushing toilets and watering plants.

II. Definition and Objectives

Buildings last a long time. Decisions that are made today about design and construction will determine people's energy consumption and their greenhouse gas emission levels beyond decades. The Lebanon Green Building Roadmap (LGBR) is a short-term strategy followed by a medium-term strategy, recommending at the end an upgrade for the long-term, proposed by ALMEE, in collaboration with LGBC and CEDRO V. Green Building concept is partly covered by the national policies for Energy Efficiency and Renewable Energy. However, these efforts have not led to considerable achievements during the last years. Therefore, the new NEEAP and NREAP previewed for the next years need to be complemented with this LGBR that promotes Green Building Certifications in order to cover a broader range of impacts, taking into account the “**Minimum Criteria**” for the international or local rating systems. This concerns mainly private and public voluntary sustainable construction/retrofitting and the Green Building Certification system.

The adoption / implementation of green building certification entails:

- Relevance of the green certification for the growing building sector in Lebanon
- Modalities of implementation of the green building certification
- Stock taking of concerns of stakeholders
- Roadmap for short and medium term and integration with the existing laws and legislations in the country.

. The LGBR lays out two key compliances that will reduce their energy and water consumption and greenhouse gas emissions and increase the resiliency of new and existing buildings, while improving the indoor environment and the occupant wellness, in pursuit of a carbon neutral and resilient building stock by the next decades. The two proposed compliances are:

- **Voluntary Compliance (Recommended but not obligatory for new and existing buildings):**

A voluntary framework consisting of a set of measures to be applied for the higher certifications of new and existing buildings. The aim is to set up a scheme which introduces to the local market a competition in sustainable construction especially

for tertiary sector buildings providing them with a unique opportunity to differentiate themselves from the rest of the market.

- **Mandatory compliance (obligatory for new and existing building):**

A voluntary green building certification is much like a voluntary program, without financial incentives or recognition, will have a low chance to be implemented on a significant scale.

Mandatory green building certifications are the best solution since the efficiency and sustainability of a new building will influence its energy consumption and environmental impact for its whole lifetime. Lost opportunities in the construction phase will lead to increased costs if done at a later stage and can significantly inflate the running costs for future users. While individuals continue to be the determinate of a building's fate, energy efficiency and sustainability of a new building should not be viewed only as a matter for individual choice but as a more collective issue, thus, influencing society at large and a future generation of building users.

Mandatory green certification should reflect an assessment of the balance of costs and benefits to society, including external costs (this needs assessment or real certified pilot projects in next future). The justification for mandatory green building certification is that there should be a societal benefit that could not be gained in the absence of legislation.

From an economic perspective, the green certification levels should reflect best estimates of whole-life costs and benefits to society as a whole. Buildings have long lives and so the costs and environmental impacts inevitably depend on uncertain estimates of the future. These may be unrecognized or incompletely recognized by the market place – and hence form a justification for regulation.

Consisting of minimum requirements to be implemented in the design and construction permits (for the basic certifications of buildings), the mandatory compliance requires all new built and major renovation to include an assessment based on identified indicators. The aim is to establish a scheme that is cost-effective and simpler in terms of registration, administration, assessment, etc. (in comparison with international schemes) and that is able to effectively serve private and public sector (both residential and non-residential).

The proposed strategic roadmap to incentivize green building certification in Lebanon has the following inter-related objectives:

- Address fundamental requirements for an effective implementation of green building certification in Lebanon.
- Address fundamental requirements of integrating green building education and literacy in engineering and architectural curricula levels.
- Highlight several ideas for successfully introducing innovations in the field of green construction in terms of policy frameworks, regulations and collaborations between stakeholders and Lebanese institutions.
- Help prepare Lebanese institutions and allied stakeholders for a successful implementation of a green building certification program by identifying barriers to implementation and developing the roadmap to address these issues.
- Propose and classify measures in terms of priority, timeline and responsible stakeholder(s) towards better practices of sustainable construction in Lebanon.

Taking into consideration the good practices and great achievements in the other countries⁴, the main purpose of this roadmap is to suggest the destination and its possible routes. Mainly, the Roadmap proposes strategies for developing a green building program within the Lebanese construction and retrofit market and provides resources to guide the process.

The LGBR puts forward three mutually reinforcing priorities:

- Sustainable Construction growth: promoting a more resource efficient, greener and more competitive in its minimum requirement without additional over costing.
- Inclusive growth: fostering a high quality of knowledge, and stakeholders' implication delivering social and territorial awareness and cohesion
- Economic and financial growth: developing a green economy between supply, employment and consumption based on a realizable strategy due to the current financial crisis.

⁴ INTERNATIONAL GOOD PRACTICES ON GREEN BUILDING_2022

III. Description of the Roadmap

Given the socio-economic situation of its population, which has been deteriorating since 2019, due to its quadruple economic, financial, monetary and banking crisis, the roadmap is set to encourage the uptake or adoption of green buildings in Lebanon in 2 phases (short and medium-terms) while long-term recommendations are provided in the second phase.

➤ Short Term Road Map

For an initial period of two to four years, a short-term roadmap is proposed with a target of implementing existing and new green building certifications. The purpose is to capture immediate opportunities of improving sustainability in building sector, while all the time focusing on the priorities that should be provided by the government to insure basic legislations, standardization in terms of electricity, renewable energy, energy efficiency and energy performance. A demonstration project must be green certified in the beginning as a model. Green building certification may be adopted for public / Government existing buildings and later may be mandated for all buildings.

➤ Medium Term Road Map

The time-frame for implementation of the medium-term roadmap is recommended as five to seven years. In medium term roadmap, it is intended that the country would work towards establishment of testing facilities, policies for performance monitoring and inspection (post implementation of buildings) through trained officials and can look forward to meeting the global best practices of green building certification.

The details of the short- and medium-term plan can be summarized as follows:

Table 1 Short- and Medium-Term Plan

	Short Term	Medium Term
Duration	2-4 years	5-7 years
Target	<ul style="list-style-type: none"> - Demonstration project with local green building rating system certification - Voluntary minimum green building certification enforcement for existing and new or rehabilitated buildings 	<ul style="list-style-type: none"> - Mandating minimum green building certification for all existing and new or rehabilitated buildings
Purpose	Quick response to market Pilot projects -	Stabilizing as per international best practices
Feature	<ul style="list-style-type: none"> -Certification of a sample of existing buildings (LGBC and other stakeholders using any local GBRs) - Display green building certificates in these buildings - Voluntary presentation in the file of permit of construction to OEA a provisional green building certificate for all new and retrofit buildings 	<ul style="list-style-type: none"> -Pilot projects of new buildings certified by any local green building rating system - Mandatory presentation in the file of permit of construction to OEA a provisional green building certificate for all new buildings. - Voluntary presentation in the file of permit of construction to OEA a provisional green building certification for all retrofit and rehabilitated buildings

IV. Charting the Journey

In order to identify and prioritize areas where an action plan could be used to increase the sustainability of buildings, the LGBR provides a general overview of a wide range of topics to support green building design, construction, management and operations in Lebanon including:

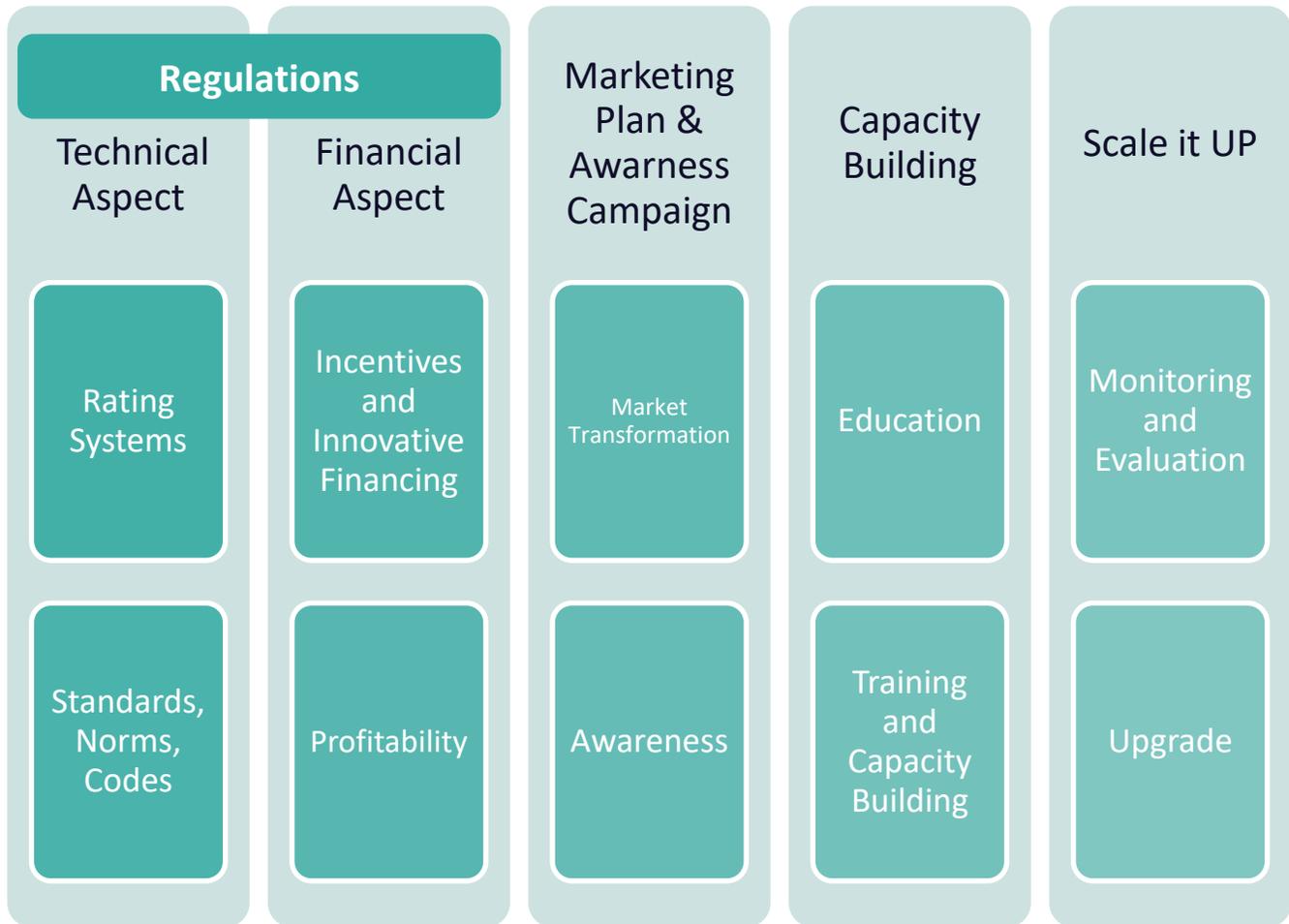


Figure 1. Chart of the Lebanon Green Building Roadmap

V. Institutional Framework

Lebanon has the following entities responsible for the institutional framework for green building certification:

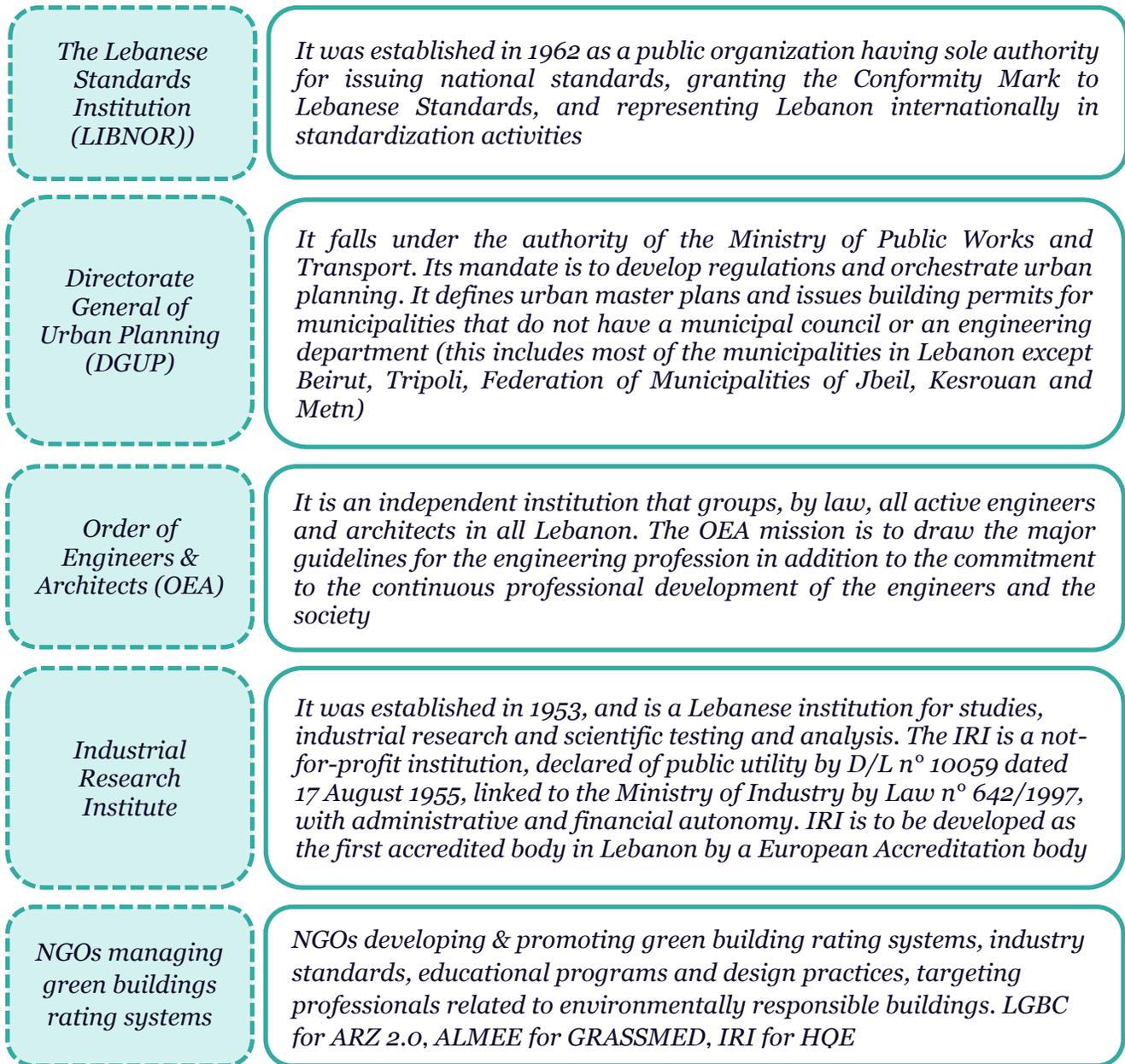


Figure 2. Entities responsible for institutional framework for green building certification

VI. Regulatory Framework: Government on Board!

It is the responsibility of the Government to set a range of policies and other measures to encourage and enable sustainable construction and green building certifications. These range from:

- Building codes and standards ,
- Incentives such as subsidy, grant and rebate programs,
- Ratification of the mandatory minimum certification level, codes and standards and their corresponding tools/platforms for new and retrofit projects,
- and promotion of the voluntary rating programs, codes and standards and their corresponding tools/platforms.

However, while taking into consideration the unavailability of national electricity, and the energy crisis in all its forms, existing policy instruments should be also reevaluated, reset and encouraged: policies for energy efficiency, renewable energy, water management, waste management, and other aspects of sustainability can be considered the main drivers for green buildings.

In this section, initially proposed is the roadmap for the technical regulations, standardization, norms, codes, rating systems, guidelines, etc..., for green buildings in Lebanon, with the aim that it provides a clear framework for the applications of Green Buildings from the concept to the certification then to the operation. Later on, a financial and non-financial incentive policy for the construction of green buildings in Lebanon, in addition to an innovative financing and a primary cost-benefit analysis, will be developed, so as to encourage green building, given the existing socio-economic situation, which has been deteriorating since 2019, due to the economic, financial, monetary and banking crises.

The regulatory framework for the implementation of policy directives and compliance for built space, is available with various statutory bodies both under the government / line ministries as well as independent entities like the OEA with appropriate powers to deliver the intended output from this sector.

A. Technical Aspect

It is envisaged that for the induction of green building certification, the strengthening of regulatory framework in its technical aspect is required in order to:

- **Integrate green building certificate in the licensing / approval framework for buildings;**
- **Understand and apply the green building certification in correct manner for both retrofit as well as new constructions as per the Lebanese market context;**
- **Monitor compliance with green building certification and impose penalties for non-compliance for all buildings.**

In addition to this, the regulatory framework should consider role of third-party independent agencies to validate and certify green buildings. Globally, it is observed, that public private partnership (PPP) approach has worked successfully in achieving desired results⁵.

1. How to define Green Buildings in the Lebanese context?

Green building is not only a construction but a practice of **creating structures and using processes** that are **environmentally responsible and resource-efficient** throughout a **building's life-cycle** from siting to design, construction, operation, maintenance, renovation and demolition. This practice expands and complements the classical building design concerns of **economy, utility, durability, and comfort**. Green building is also known as a **sustainable or high-performance building**. Thus, a green building is one whose construction and lifetime of operation reassure the healthiest possible environment. Green building tools are contrived from **local eco-sources** that offer a healthy environment assembled on the traditional and architectural heritage. A building is considered green when it emphasizes on the **competent use of resources** such as **energy, and water, the proper use of materials** in addition to the **reduction of the negative impact on the environment**. In brief, one of the criteria for a building to be a

⁵ International Best Practices of Public-Private Partnership - Insights from Developed and Developing Economies, Springer Singapore ISBN: 978-981-336-268-0, 2021

Green Building, is that it must be **energy efficient**, when it **consumes less energy and produces fewer greenhouse gasses**. Throughout their lifecycle, green buildings reduce the injurious impact on the ecology, decrease the use of energy and water resources and provide healthier indoor environment. Building materials and components are re-used or recycled, due to their ecologically friendly nature. The issue of sustainable construction is of high relevance to Lebanon. The local construction sector is continuously active, causing a major strain to the country's natural resources. Although this barrier exists, it is fair to say that the Lebanese construction industry has a great potential for implementing green building techniques. The country's meteorological conditions are favorable for generating renewable energy. Furthermore, the construction and demolition industries generate significant amounts of materials, which can be recycled.

In the Lebanese context, a building can be considered sustainable if the following measures are applied together depending on **a feasible conception and on affordable existing market**. Here below, but not limited to, some of feasible and affordable measures that can and should be applicable in Lebanon and would be helping in green building certification:

- The building should be in avoidance of the sun but has to be located in a way that sunlight can come into the building and be usable as a substitute for a light source during the day time (in cooling design zones) – *Energy and Wellness*
- The building can use active or passive architecture to cool or heat the premises (including shading devices) – *Energy*
- To make use of the sunlight as a light source – *Energy and Wellness*
- The building design can allow the car park at the basement – *Site*
- Using sensors, it can easily detect presence and movement – *Energy*
- Water efficiency is another aspect of green buildings, where rainwater harvesting technology is one of the best ways to use water efficiently – *Water*
- Insulated double wall (for heating design zones) – *Energy and Material*
- Eco-roof – *Energy and Materials*
- To insulate heating and cooling pipes and ducts – *Energy and Materials*
- Improving the site plantation and greening the parking – *Site*
- Installing Solar Domestic Water Heating – *Energy*

- Green back-up electricity: Generating Green Renewable Electricity (solar and wind where applicable) – *Energy*
- Efficient back-up electricity: Efficient Diesel Generator with heat recovery for exhaust – *Energy and Wellness*
- Providing natural ventilation – *Energy and Wellness*
- Install efficient lighting and efficient electrical appliances – *Energy*
- Biophilic interior design and indoor plantation – *Wellness*
- Eco-friendly indoor materials and furniture – *Material and Wellness*
- Efficient water fixture units – *Water*
- Domestic wastewater treatment plant generating greywater for irrigation – *Water*

The listed measures could help in achieving the minimum target of obtaining a green building certification without adding a high over cost on the building considering the actual necessity due to the unavailability of electricity and water and their corresponding high costs. None of these measures are mandated by the Lebanese construction law, although some of them are encouraged through incentives¹.

2. What Rating System to choose?

A wide range of green building rating and assessment systems are used around the world, including LEED and BREEAM. In order to evaluate the level of sustainability, countries all over the world have established building rating systems to evaluate and rate green buildings. Sustainability is now a top priority in MENA region. Many Countries like Qatar and UAE have come up with their own green building rating system to fit their own to incorporate socio-economic, environmental and cultural aspects.

To rate any building performance as green, several key areas are recognized such as, sustainable site development, water savings, energy efficiency of systems, materials selection, and indoor environmental quality and Envelope.

As with many countries around the world, LEED and BREEAM are the most used systems of rating in Lebanon. Certified buildings are restricted to new developments that aim to “green wash” and to promote environmentally friendly practices, particularly for achieving grants, as well as luxurious ones that have the financing to afford international certifications’ registrations fees.

However, Lebanon's unique geography, climate zoning, cultural architectural building techniques and socio economy make these systems less compatible to its needs.

Lebanon has the urge to start introducing green and sustainable technologies to use energy more efficiently and to save water and other earth's natural resources but still faces several barriers, namely, high registration prices of international certifications, and the complication of the certification process due to the fact that they need to be customized to fit the Lebanese context and are not developed for this part of the world.

Recently, two rating systems have been developed in Lebanon. The ARZ 1.0 Building Rating System (BRS) founded by LGBC (The Lebanon Green Building Council) in 2011, in partnership with IFC, to be of an international standard while accounting for the specific context of Lebanon's climate, environment, and building techniques. Its successor ARZ 2.0 is as a web based public domain which has the ability to rate both residential and commercial projects and is easily accessible by a large part of the community. GRASS is a new rating system established by ALMEE (Lebanese Association for Energy Saving and for Environment) that covers the main features of Green Buildings Standards that are suitable for Mediterranean Climate, Environment and Lifestyles.. It introduces a new approach of rating systems for New Designed and Existing Commercial & Residential Buildings in Mediterranean region.

In brief, Lebanon will benefit greatly, in the short and medium terms, **in pushing its local green building rating systems** forward by targeting technical, financial, legislation and regulatory challenges to promote them. The purpose is to make compulsory the application of t green building certifications in the construction or retrofitting of Public, commercial, and tertiary buildings under certain regulations:

1. **Educate** the various stakeholders (public and private owners, design firms, contractor, end users, etc.), **on the importance of the Lebanese Green Building Rating Systems** (detailed in the education and capacity building section).
2. Lebanese Green Building Rating Systems should be promoted by **creating a marketing plan** and a **business unit** to communicate them (detailed in the market transformation section).
3. Concerned ministries, institutions, and organizations such as MoEW and OEA, etc..., can **provide technical and regulatory** tools to integrate green building certifications as part of a larger nationwide approach, like to include green buildings standards as part of the building code, to bring into effect approval

frameworks for every permit and licensing submissions to regulatory bodies, and to enforce incentives/ penalties of non-compliance to boost the adoption of the certifications... (detailed in the next sections).

3. Steps of the enforcement of the certification of Green Buildings

The administrative procedure should be simple to apply with minimum constraints.

- It is suggested to have, at the design stage, a provisional approval of a green building certificate as the requirement for compliance.
- Since the projects first get registered with the OEA, it is proposed that the same agency should be entrusted with the responsibility of checking project stage compliance of the green building certification through engineers LGBC-OEA certified ARZ assessors or ALMEE-OEA certified GRASSMED assessors or IRI-OEA certified HQE, LEED or BREEAM certified assessors.
- A separate cell may be created at the OEA, which in association with LGBC, ALMEE and IRI should be conducting tests for certified green building assessors.
- This cell may consider conducting training programs and LGBC-ALMEE-IRI-OEA certificate test. These LGBC-ALMEE-IRI-OEA certified green building assessors would be recognized as third party inspectors.
- Random audits of some reports would be carried out by the joint committee of the OEA and LGBC, ALMEE and IRI, to ensure that the certification issued by qualified green buildings assessors is correct.
- In case the details used to generate the green building certification report are found to be non-conforming, the LGBC-OEA or ALMEE-OEA or IRI-OEA certified assessor should be losing the assessor certificate.
- The promoter/builder/building engineers should be required to declare that the building will be made as per the documents submitted at the stage of registration. In case a deviation is found, some provision of penalty may also be kept to discourage such mismatch. One way of addressing this could be provision of losing certificate for practice. In case the details used to generate the green building, certification report is found to be different from the actual details, the LGBC-OEA or ALMEE-OEA or IRI-OEA certified assessor should be losing the assessor certificate.

When the certification becomes mandatory, the DGUP is considered as a main actor and should be integrated in the procedure by law. Within the framework of this system, the certification of green buildings would be granted by the DGUP, but after amendment of decree-law 69/83 of 9 September 1983 (town planning law), to provide the DGUP of this new competence or assignment. Similarly, this presupposes the amendment of article 8 of the decree of June 21, 1997 (organization and operation of the DGUP), to add to the tasks of the "Department of urban planning studies" of the DGUP, the instruction or the study of the files of the ecological buildings which request the certification.

4. Thorough enforcement procedure

In general, mandatory green certification is viewed as a serious problem. There are many strategies for enforcement along with some essential elements. A thorough review of the design plans to check the level of green certificates can highlight problems before the construction phase, therefore can facilitate low-cost fixes. Additional site inspections during construction are essential for checking the quality of installation and the accuracy of following through on design details important to efficiency, environment and the green rating system requirements. In addition to qualified assessors to inspect for green certification, the building sector must also know how to demonstrate compliance. Clearly defined policies/tools for green building certification are essential.

5. Penalties for lack of compliance

Penalties for the nonexistence of provisional green building certificate for commercial and public buildings can include withholding permits.

Levying fines should be defined for non-compliance with the provisional green building after construction.

6. Green building certification governance

Green building certification governance is the combination of legislative frameworks and funding mechanisms, institutional arrangements, and co-ordination mechanisms, which work together to support the implementation of green building strategies, policies and programs.

Three main aspects of green building certification governance are identified: enabling frameworks, institutional arrangements and co-ordination mechanisms. Each aspect includes specific activities that contribute to an overall system of good green building certification governance.

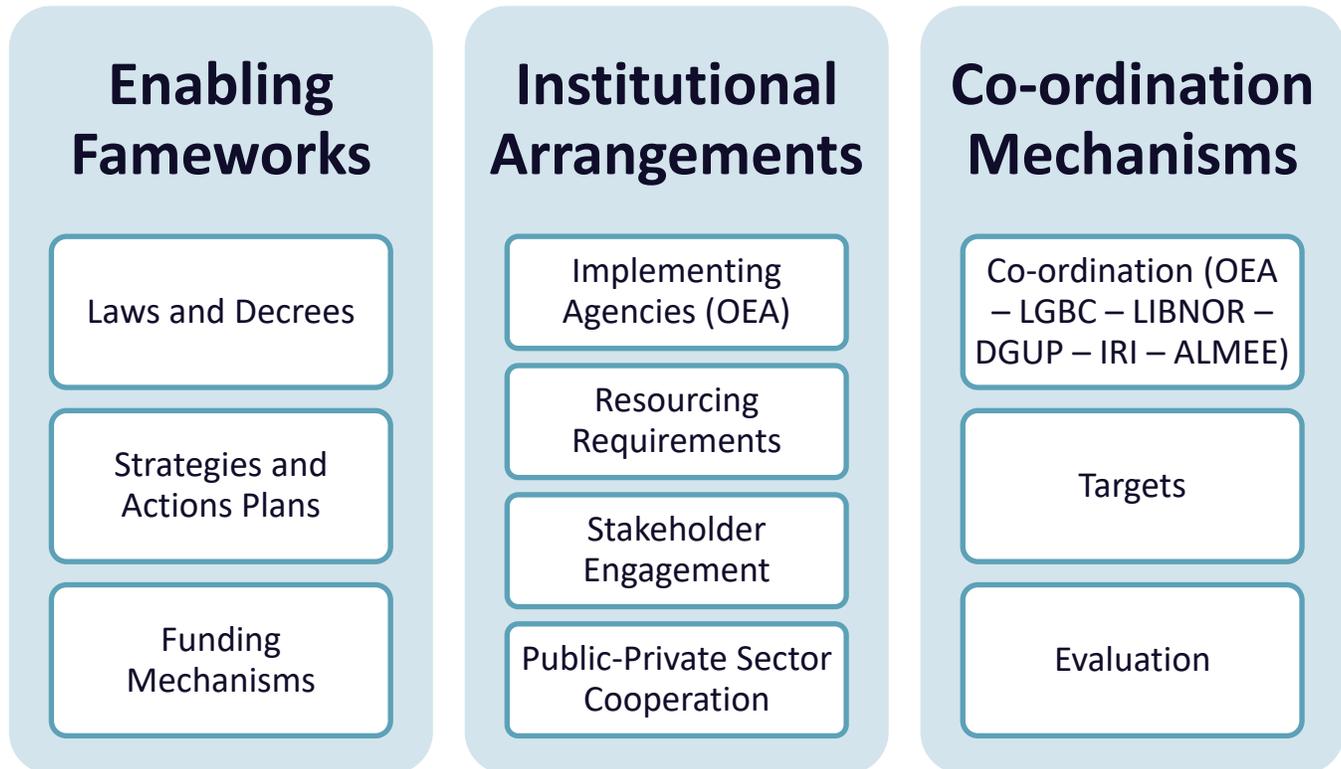


Figure 3. Main aspects of green building certification governance

a. Enabling frameworks

Enabling frameworks confer authority, build consensus, attract attention to and provide resources for green building certification policy implementation. Important enabling frameworks include laws and decrees, strategies and action plans as well as funding mechanisms. Laws and decrees (or directives and proclamations) provide for other governance mechanisms, such as implementing agencies (OEA) in addition to funding and co-ordination mechanisms. Strategies and action plans comprise the second enabling framework. They use national strategy formulation or an action planning process to engage stakeholders, build consensus and enable green building certification

to be implemented. Funding mechanisms are the last – and perhaps most important – enabling framework. Experiences from around the world show that access to adequate, stable and dedicated funding sources is critical for the development of green building organizations and for the professionals that carry out policy implementation. Funding mechanisms will be detailed in the financial aspect section.

One of the main reasons possible for lack of enforcement of green buildings in Lebanon is the perception that the green building regulations are not as important as safety related regulations. Article 66 of the General Budget Law 2019 defined sustainable buildings as the ones that fit into specific environmental, social, organizational, and energy requirements push towards sustainable construction. However, it does not tackle technical specifications¹. The first step towards enforcing green buildings is to technically specify sustainable buildings.

The solutions proposed for better enforcement of green building certification are quite similar in different regions of the world, including the following:

- Impose regulations for green building certification.
- Provide sufficient resources for enforcement by OEA, with budgets supplemented by utilities, carbon finance, and other interested parties.
- Make specialist training available for green building certification and all trades involved in building issues, with budgets supplemented by utilities, carbon finance, and other interested parties.
- Establish a system of accredited third party enforcement, possibly in conjunction with OEA spot checking and significant sanctions against fraudulent approval.
- Provide information and incentives to builders and homeowners. Consider penalties for non-green certification in the longer term.

Some regulations, highly needed for a successful promotion of green buildings in Lebanon, are proposed in the current section.

a.1. Electricity and Renewable Energies

Concerning electricity sector and renewable energies in Lebanon, the legal ingredients (exploitation, privatization, fiscal and monetary incentives, electricity regulatory body, BOT, Net-metering, distributed renewable energy law etc.), that are supposed to promote the utilization of these energies, are dispersed over several types of

regulations. Instead, they should be the subject of a single coherent, integrated and strong law; especially since most of these regulations are not applied and have fallen into disuse¹.

To be realistic, the roadmap should be considered the fact that Lebanon is suffering from deprivation in its power supply, and the electricity supply is one of the major political challenges facing Lebanon over the coming decade. Depending on polluting diesel generators is a major barrier in certifying green buildings. Therefore, renewable energy generation at domestic level will be a crucial ingredient in the transition to promote green buildings.

- The most prominent renewable energy support mechanisms are feed-in tariff and net-metering. Concerned laws should be developed to become more feasible.
- Increasing renewable energy in the national energy mix is considered a fundamental requirement for a more sustainable energy regime.
- Encouraging the private sector to invest in these energies, when the country strongly needs this kind of investment, to provide electricity to citizens, at a time when the State withdrew its investments in the electricity sector due to its deep financial crisis.
- Normalizing the dimensioning and installation of renewable energies for domestic and commercial building generation especially the solar PV system.
- Mandating the implementation of domestic solar water heaters outside the cities and collective ones in the cities.

As for the existing back-up generators that are mostly one of the existing solutions to cover the electricity needs, measures should be taken into consideration as the following:

- Control the quality of the exhaust gas of the diesel generators by defining the minimum requirements.
- Conduct comprehensive management of sound insulation, absorption, noise reduction and vibration reduction for the generator installation including air inlet, air exhaust and smoke exhaust system.
- Mandate a minimum power factor and efficiency for the diesel generators.

a.2. Energy Efficiency

During the last decade, several plans, policies, standards, fiscal and monetary incentives, a draft law... have been developed or adopted by public bodies, such as the ministries of energy and finance, LCEC and the BDL...¹. However, no legal framework yet exists in Lebanon regarding energy efficiency; hence the need for a law that brings together all the norms and incentives in this area, after rectifying some, and updating others that have become obsolete, because they were part of plans to limited turnaround times. Otherwise, there will be no progress in this area.

Consequently, it has not been made aware of it to take advantage of it and contribute to the achievement of the objectives of this efficiency, as if the financial advantages provided for this purpose were reserved for the privileged.

When targeting the building sector, energy efficiency will be also an essential ingredient in the transition to promote green buildings by applying the following:

- Adopting the energy conservation law especially in the building sector.
- Developing and adopting the Energy Efficiency Building Code (EEBC) and adopting the EE law
- Developing and adopting the Building Energy Performance Standard, Certifications and its relevant tool.
- Defining and adopting the MEPS and labeling for the electrical appliances in the building sector.

a.3. Green Construction Code

In the absence of a code of this kind, it is foreign certification standards (BREEAM, LEED, etc.) that occupy the field, even though they are expensive to attain creating a barrier for accessibility, to the overwhelming majority of Lebanese whose socio-economic situation is already known. Thus, the absence of a Lebanese green building code is currently one of the main factors blocking green construction in this country; hence the need for the promulgation of a Green Construction Code. A code that contains minimum requirements for increasing the environmental and health performance of buildings. Generally, it mandatory applies to the design and construction of all types of new and existing buildings that exceeds 2000m² (Commercial, industrial, mixed use, residential). It includes measures that result in better indoor environments, lower impact on natural resources, better neighborhood connections, and improved walkability. This code will contain the following subject areas: Sustainable sites, Energy efficiency, Water

efficiency, Materials and resource use, Indoor environmental quality, Emissions, and Operations and maintenance.

The government should move now to integrate the existing “Criteria for Green Buildings”, by its minimum requirements, directly into building regulations, and no technical standards would remain at all outside of the Building Regulations system, recognizing that this will take time and may require legislative change, while taking into consideration the affordability and the feasibility of the different criteria in the Lebanese market to be analyzed and assessed in a specific study later.

Greening the construction code will surely require particularly the obligation of the Thermal Standard for Buildings in Lebanon.

The administrative procedure relating to certification, which must be easy to follow, clear, inexpensive, and including in detail the steps from the request for certification to the issuance of the green building certificate by a public or official body should be integrated in the code. The possibility of renewing the certification, each time one or more additional technical criteria are met, to benefit from more financial advantages, provided that this renewal is as easy as the administrative process of certification.

Some promulgations of existing decrees are necessary prior to the Green Construction code and are proposed here below with other new suggestions:

- The promulgation of the implementing decree for two paragraphs of article 14 of the Building Code, relating to thermal insulation: these are paragraphs 5 and 7 of article 14 of the Construction Code (Law 646 of 11/12/2004 which amends decree-law 148 of 16/9/1983) which exclude from the calculation of the coefficient of exploitation (of land occupation), respectively waterproofing and thermal insulation works, and double masonry for thermal insulation, subject to the promulgation of a decree which sets the conditions, on the proposal of the Minister of Public Works and Transport, after consultation with the Higher Council for Town Planning (paragraphs 5 and 7).
- The promulgation of a decree relating to the teaching of eco-construction: this decree makes the introduction of the “eco-construction” subject mandatory in engineering, architecture and environmental science courses.
- The promulgation of a decree establishing an eco-construction award: this decree creates an annual prize that would be awarded to the village or city that has made the most progress in the field of eco-construction and sustainability. As for the selection of the city or village benefiting from this prize, it would be carried out by

committee made up of members representing the Ministry of the Environment, the General Directorate of Urban Planning, the Order of Engineers and Architects, ALMEE, LGBC, IRI and LIBNOR and each of these members would be nominated by their organization. This award involves municipalities in green construction, given its various advantages which can be summed up by official recognition of their success in this area; by the prestige that this award bestows on their town or village; by the publicity which the latter enjoy as localities of ecological well-being, and its effects on their real estate sector.

a.4. Environmental Protection

The government must require a minimum environmental sustainability standard for new buildings and existing buildings that undergo major retrofitting through Environmental Legislation. To ensure that the building works meet the minimum environmental sustainability standard, a qualified person (who submits the building plan) and the other appropriate practitioners are jointly responsible submit their declaration and Environmental Impact Assessment along with their Building Plan submission for approval, mandated for project with built surfaces exceeding 2000m². As for the other projects, it should meet the maximum allowed carbon footprint as defined by the Decision 16-1/2022.

a.5. Water and wastewater Management

A building with a polluted potable water supply, and/or an unavailability of domestic water supply, can never be considered sustainable. From this conception, a national strategy and action plan for water and waste water should be reset to monitor and control the water pollution, to conserve the water resources through the national infrastructure and to ensure the availability of potable water in urban areas. Regulations should be set water quality standards for contaminants in surface waters, such as underground water, rivers, lakes, wetlands and the sea, making it unlawful to pollute waterways. This work can be done and controlled at municipal level.

To push as well for green building certification, and especially for the cities, regulations should be set in a way to mandate all new high-rise buildings and retrofitted ones, to collect rain water, treat their sewage and reuse them as greywater for irrigation and

other domestic use. Since today rain water collection is only required when there is no public water distribution network in the construction area, as indicated paragraph 4 of article 13 of the Construction Code (Law 646 of 11/12/2004 which amends decree-law 148 of 16/9/1983 (building law). Consequently, it becomes necessary to amend of this paragraph with a view to making the rainwater tank compulsory, even in the presence of a water distribution network, given its role in reducing the waste of Lebanese water resources, a good part of which is lost by runoff to the sea; especially since these resources are diminishing due to the global warming, and the extension of the drought season in the Middle East. Likewise, this exempts the State from incurring colossal expenses on the construction of water dams, which further reduce the green area of Lebanon.

To complement the conservation of water, the inefficient water fixture unit should be banned by law, and the efficient ones should be encouraged.

a.6. Eco-friendly Materials and Efficient Equipment

The government must encourage the use of eco-friendly and efficient Materials/Equipment through specific legislations:

- Gross material use and gross GHG impacts should be controlled to save the natural resources and reduce the emissions;
- Improve material efficiency through banning inefficient materials and equipment and encourage efficient, recycled and recyclable ones, including the prevention and management of construction and demolition waste generation.
- Defining and adopting the MEPS and labeling for the electrical appliances in the building sector as suggested in the EE.

a.7. Indoor Environmental Quality

Indoor environmental quality (IEQ) refers to the quality of a building's environment related to the health of occupants within it. It consists of the characteristics of indoor environmental pollution, the guidelines related to indoor environmental quality referred to the one developed by the World Health Organization (WHO), to reduce the health effects of combined or multiple exposures to health stressors in indoor environments.

a.8. Land use

Support more intensive use of buildings in order to reduce the need for further built environment: e.g., use empty buildings instead of building new ones, use buildings for more than one purpose ...

b. Institutional arrangements

Institutional arrangements constitute the second pillar of green building certification governance. Four main types of institutional arrangements: implementing agencies (OEA...), resourcing requirements, public-private sector co-operation and stakeholder engagement.

Collectively, these arrangements reflect the broad range of actors that play leading roles in green building policy implementation. Resourcing requirements are an important consideration in making sure that implementing agencies have the financial and human resources needed to assume their policy implementation responsibilities.

Public-private sector co-operation ensures that government policies take full advantage of the resources and commercial acumen of the private sector. Such co-operation also supports market transformation strategies, as new demand for green building products needs to be satisfied by new products, developed and manufactured by the private sector. Stakeholder engagement is important for building political consensus on policy and implementation strategy and for ensuring that policy deliberations consider a diverse range of perspectives and practical experiences.

c. Co-ordination mechanisms

Co-ordination mechanisms include co-ordination between main institutional and agencies actors in green building, targets and evaluation. Creating co-ordination mechanisms directly influences the quality and effectiveness of green building policy outcomes. Intra-agencies co-ordination helps avoid overlap and duplication, and allows informed discussions about how best to implement green building policies. Co-ordination across levels of government enables municipalities to devolve implementation responsibility to local authorities, while retaining overall programmatic control. Targets are useful co-ordination mechanisms because they help to motivate

policy implementers, track implementation progress and identify the need to make mid-term policy adjustments. Targets can provide a concrete basis for developing multi-year programs, mobilizing funding and identifying agency staffing needs. Evaluation is critical to good green building certification governance, as it serves to test planning assumptions, monitor overall results, compare program performance, fine-tune implementation processes and incorporate the lessons learned into future green building policies and programs. Evaluation also provides the foundation for oversight and accountability arrangements.

B. Financial Aspect

Economic, financial and ecological pleas in favor of eco-construction today are reflected in a considerable boom in this sector, even in developing countries. The potential for green building in cities in these countries was estimated at \$24.7 trillion by 2030⁶.

In this section, the financing options including incentive programs, rebate programs and innovative mechanisms that provide needed funds or incentivize actions to encourage investment in green building (design, construction and equipment) are proposed. It takes into consideration the actual economic situation, the unavailability of local funds. Based on the assessment for green buildings in Lebanon¹, finance has been identified among the most important barriers for the adoption of green building designs.

Proposed is a series of financial and non-financial incentives, as well as new regulations, likely to give a boost to the revival of its green building sector. On this subject, it was made sure that these regulations and incentives, particularly in the financial field, do not constitute heavy burdens on a State which is in full financial disarray, and which would be so for a few more years. Consequently, these are realistic financial and regulatory solutions, and therefore without significant repercussions on public finances which would block their adoption by the public authorities.

⁶ International Finance Corporation (IFC) (2019), "Green Buildings: A Financial and Policy Blueprint for Emerging Markets"

At the same time, the extension of the sustainable would give rise to several advantages for Lebanese public finances and the national economy, of which we quote:

- Less consumption of electricity from EDL and generators, produced through fossil fuels, reduces both the Lebanese import of these energies (therefore less outflow of foreign currency), and state subsidies electricity from the EDL, two monetary and financial benefits that Lebanon desperately needs today.
- The use of photovoltaic electricity by green buildings reduces the electricity bill of the average Lebanese household. This should improve the purchasing power of households, and ipso facto the volume of their consumption, which increases VAT revenue in Lebanon.
- The premium of green buildings can be up to 31% when sold, compared to conventional buildings in developing countries, according to IFC (2019)⁷. This would increase revenue from registration fees, as well as from the capital gains tax of the Lebanese state.
- When the green building sector enjoys financial and non-financial benefits, as well as incentive regulation, it attracts new investors, which increases the income tax base.

Consequently, these financial, economic and socio-economic advantages, apart from the ecological advantages, make it judicious to revive green construction for the Lebanese State, through financial and regulatory incentives, of the kind that below are propose.

1. Incentive Programs

These incentives are in the form of financial advantages granted to natural or legal persons whose building (house, company, educational establishment, hospital, etc.) meets the green building minimum criteria. These advantages vary according to the level of certification obtained by the concerned building. Incentives are proposed below:

⁷ to IFC (2019), “Green Buildings: A Financial and Policy Blueprint for Emerging Markets”

- Reimbursement of a percentage of the VAT of the efficient equipment/eco-friendly materials
- Reimbursement of a percentage of the net amount of the building permit
- Tax allowance for the amount of acquisition of efficient equipment, when calculating income tax, or check from the Public Treasury for 10% of this same amount.
- Right to an additional floor

These advantages are of seven kinds:

- Exemption from rental value tax: this is a housing or property tax, collected by the municipalities on behalf of the Public Treasury. It is 5% of the actual or estimated amount of the rent for the residential building, and 7% of that for the non-residential building (Law 490, amended by Law 671). This exemption is granted to green certified buildings, and its duration increases with the level of certification.
- Reimbursement of a percentage of VAT: it is made on presentation to the Ministry of Public Finance of the purchase invoices for the efficient equipment and eco-friendly materials, duly stamped and signed by the seller, and on which the VAT paid appears.
- Reimbursement of a percentage of the net amount of the building permit, i.e. after deduction of levies due to the municipality and the Order of Engineers. This reimbursement, which is made on presentation to the Ministry of Public Finance, of the permit payment receipt, benefits buildings with minimum certification, and its percentage increases with the level of certification.
- The tax deduction of the amount of acquisition of the efficient equipment and eco-friendly materials: it is a question of deducting from the taxable income of the actor of the green building, the amount allocated to the acquisition of the equipment in question, before calculating the income tax. In the event that this acquisition amount is greater than the taxable income, the taxpayer does not pay income tax for the current year, and the tax allowance is carried over to the following fiscal year, for the residual amount.
- The check from the Public Treasury for 10% of the amount of acquisition of the efficient equipment and eco-friendly materials: this check is only granted by the Public Treasury to players in certified green buildings, which are not taxable on their income (farmers, hospitals, educational establishments, cooperatives, trade

unions...), under article 5 of Legislative Decree 144 of 12.6.1959 (Income Tax Law). However, this check can only be used by these non-income tax payers for the payment of their other taxes.

- The right to an additional floor: this is a density bonus in the form of a height bonus, achievable by extending the overall exploitation coefficient which authorizes the increase in the built-up area on the same surface of the ground. This right reduces the share of the price of the land in the overall construction cost. However, this right to an additional floor presupposes the amendment of paragraph 2 of article 14 of the Building Code (Law 646 of 11/12/2004 which amends decree-law 148 of 16/9/1983), to include the additional floor concerned, among the parts of the buildings whose surfaces are not included in the calculation of the overall exploitation coefficient (floor occupation coefficient).

2. Proposition of Financial Regulation and Additional Actions

- The amendment of decree 167 of 17.02.2017, relating to "the fixing of the details of application of article 20 of the Environmental Code No 444 of 29.0.7.2002".

This amendment aims at:

- Paragraph 2 of article 7 of this decree, which benefits from the reduction in customs taxes for several "technologies and equipment that protect the environment", but excludes all other equipment and materials required by green building, such as such as solar panels for water heaters, thermal insulation materials (double glazing, waterproofing, etc.), energy-saving household appliances, wastewater treatment plants, LED lamps, detectors presence to turn on the light, the temperature sensors to switch on the heating or air conditioning, etc.
- Paragraph 3 of article 8 of this decree, which conditions the reduction of customs duties on the import of "environmental protection technologies and equipment", by the approval of the Minister of the Environment of the request for reduction presented by the importer. Furthermore, this paragraph gives the minister concerned a period of 150 days to decide on this matter.

As these two conditions (approval and delay) are likely to discourage these types of imports essential to meeting the criteria of green buildings, it is necessary to remove them.

- The amendment of the Income Tax Law (Decree-Law 144 of 12.06.1959)

This amendment targets Article 31 of this decree-law, which relates to the tax reduction, to allow those involved in certified green buildings to benefit from the amount of acquisition of the efficient equipment and eco-friendly materials.

- Reduced registration fees for certified green buildings

Provide in the general budget following the promulgation of the Green Building Code, a tax reduction of 50% of the amount of acquisition of the efficient equipment and ecofriendly materials, when calculating the registration fees for certified green buildings, at their purchase. This reduction is likely to encourage the purchase of green buildings, and real estate developers to green construction.

- The removal of the electricity subsidy

This abolition reduces the amortization period for the expenses incurred by the players in green buildings, on the purchase of equipment for the production of solar and wind electricity, etc., and increases their profitability, which further encourages spending or investment in this type of equipment; except that the Lebanese state subsidy to EDL electricity has so far contributed almost half of the public debt.

- The Water consumption gauging

This gauging enhances the construction of a rainwater reservoir - which we have previously considered as a condition for obtaining a building permit - by reducing the amortization period of the expenses incurred on this reservoir, thanks to the savings made at the water bill; apart from the fact that the current system of fixed water subscription is now a significant source of wastage of water resources in homes.

- The limitation of subsidized loans to the financing of the additional cost of green buildings

The subsidized loans granted until now and refinanced thanks to foreign and international aid, or by the Banque du Liban, were so high that they were capped for some, such as those of NEEREA at \$20 million for a period could vary between 14 and 18 years. However, this means that these loans were not intended to cover only the additional cost of green buildings, but rather the overall cost of the latter; which was

unnecessary, as the bulk of the loan financed the conventional or ordinary parts of the building. Thus, as the sums devoted to the refinancing of these subsidized loans were limited, those of NEEREA only benefited a little more than a thousand projects, for a total sum of 600 million dollars, i.e. 600,000 \$ per beneficiary, which is considerable. If this sum of \$600 million had been advanced - in the form of small loans of \$6,000 on average, with a repayment period of 6 years, and at the same NEEREA rate (0.6%) - for the purchase of production and storage of photovoltaic electricity, it would have provided solar electricity in a first stage, to at least 100,000 Lebanese households, and so on with each rotation of this capital (\$600 million).

Consequently, in the event that this financing mechanism is resumed, it would be essential to considerably reduce the ceiling of these subsidized loans, as well as the duration of their repayment, so that they benefit the greatest number of households. Thus, green buildings would be accessible to large sections of the population (For example using the new facilitation through UN-Habitat program for solar), and the country is entering the stage of what we call “the democratization of the sustainable good”.

3. Innovative Financing

The challenge in financing green buildings in Lebanon can, however, be overcome with the right partners by side and access to good financial support. It could be direct finance, including debt, equity or quasi-equity financing with a focus on green investments and use of advanced resource-efficiency techniques. It could as well be intermediated finance through local financial institutions or through nonfinancial intermediators, such as organizations dedicated for energy and energy service companies, in order to finance public buildings through large-scale public-private partnership (PPP) framework programs, green-labelled property bonds (the proceeds of Green Bonds are earmarked to support projects in energy efficiency, renewable energy, water management, waste management and environmental services and sustainable public transport), structured financing such as ESCOs, and other international loans.

A long term international financing mechanisms can be considered for green buildings in Lebanon such as the EU financing programs for EE, RE and Green cities, the European Bank for Reconstruction and Development (EBRD) Green Cities programs, the embassy funds for sustainability including but not limited to the USAID funds, the Netherlands

funds, the UN-habitat programs, the German funds.... Once the roadmap is developed and the short-term results are published, it can be disseminated to international funders in order to attract funding programs.

Subsidized loans are also an option. The subsidized loan of the amount of acquisition of efficient equipment and eco-friendly materials would be granted by commercial banks at an interest rate of 20% lower than the average rate on current deposits on the Lebanese market, and for a period of 5 years. As for the refinancing of this loan, it is carried out through loans or foreign or international aid to environmental protection projects in Lebanon. In the event that these loans or aid fail or prove to be insufficient, the Banque du Liban authorizes commercial banks to use up to 5% of their required reserves for this refinancing, after normalization of the banking situation in Lebanon.

4. Profitability

Sustainable buildings provide plenty of environmental, economic, and social benefits. Building sustainably frequently involves higher costs due to advanced design work, new technologies, certification cost, innovative materials, and other (costly) efforts to minimize the ecological impact of the building. However, many Lebanese people are considering energy efficiency and renewable energy measures at their own level and auto-financing to reduce their consumption and to face the scarcity of electricity.

There is a common misconception that they are too expensive and people are still hesitant to take action. Initial investment should not only be considered, but the lifecycle of the building. Often it has been found that the added costs are balanced by long-term savings⁸. Like a good investment, the original costs will return over time. Designing ecologically ultimately means building economically. Factoring in sustainability from early on can help make buildings more efficient in the long run. And more than that: sustainable buildings present a real investment case. This perception is globally proved, but differs from a country to another depending on many criteria.

To encourage investing in green building construction, and **after implementing one or more demonstration projects in the short-term, a detailed study of profitability within the Lebanese context should be done in the medium term in order to prove that green buildings are profitable.** This study must include (but not limited to) the estimation of

⁸ United State Green Building Council, 2003

the additional budget, the evaluation of the savings in the operation cost (energy life-cycle cost) as well as the return on investment. This study should be published and disseminated and it will help estimating the needed financing and predicting the investments in the green building industry at the long term.

With a good setting and implementation of sustainable construction legislation in the long term, non-compliant buildings will surely lose economic value and might end up as stranded assets or even face legal action.

VII. Marketing Plan and Awareness Campaign: Green Building ... Green Business

Green buildings represent a tremendous opportunity to help mitigate global climate change, but mainstream consumers have not yet adopted the most sustainable designs and construction strategies for new constructions as well as for existing buildings. This is mainly because many Lebanese citizens are not aware of all the benefits of green buildings that are available to them at little-to-no additional cost over typical building practices. In addition to this, the majority of the Lebanese citizens are simply not concerned with climate change, pollution, natural resource depletion, or social justice issues that are commonly cited when promoting green buildings. Therefore, the average citizen's' perceptions of green building need to change, therefore get them to consider sustainable building options. The regular citizens need to be educated so they can make a more informed buying decision. In addition to changing mainstream perceptions, the connection between the regular citizen and professionals needs to be reinforced in order to make high demand and implementation of green building practices a reality. Among the key factors driving the growth of the green building market, pinpointed are:

- Green buildings are identified as higher living quality standards,
- Green buildings save on the long term the consumers' money by reducing for instance their monthly energy bills.

A. Target groups

In the marketing plan and awareness campaign, two main target groups are considered:

- **Decision makers** interested in or willing to support the certification process by bringing their knowledge to the market. This group includes, among others, consultants, developers, builders, architects, government representatives, real estate companies, and international companies interested in developing the market.

- **End users** of buildings interested in buying or renting energy-efficient/green buildings. The end users should ensure that the primary target groups (decision makers and developers) certify the buildings and apply Green Building Certification standards.

B. Marketing Campaign Topics

The marketing campaign aims in spreading the necessary information regarding:

- Increased market value
- Verified building performance
- Healthy environment
- Reduced running costs
- Saving energy
- Reduced carbon consumption
- Saving water
- Waste management
- Increased productivity
- Environmental responsibility
- Improved risk management

C. Key Benefits

Key benefits of implementing a marketing plan and awareness campaigns include:

- An increase in construction, architecture, engineering, and energy retrofiting jobs
- New and expanded building material manufacturing jobs
- Economic multiplier effect due to more mainstream citizens realizing major energy cost savings
- Less pollution
- Greater biodiversity
- A sustainable supply of natural resources and raw building materials
- Improved public health
- Improved worker productivity
- Improved energy productivity

- Greater quality of life

The campaign can also demonstrate added value for particular types of buildings:

- Increased sales per square meter (in commercial buildings)
- Increased productivity (in offices)
- Increased production (in factories and workshops)
- Better academic performance (in education buildings)
- Earlier patient discharges (in hospitals)

D. Key Marketing Actions

Key Marketing actions to adopt green building concept include:

- Disseminate green building information through advertising using conventional media such as digital newsletter, television, radio, and print outlets. A multi-faceted strategy taking advantage of paid media, public service announcements, and earned media (public relations) is recommended to reach the largest number of consumers.
- Promote green purchase behavior through encouraging and persuading people to buy eco-friendly products.
- Promote green building aspects through content assets at all construction phases – customer contact (blog post, e-mail, social media, mobile marketing, word-of-mouth, etc.).
- Social media such as Facebook, Instagram ... have also become a prominent avenue for information delivery.
- Initiate market research and visualize the results to educate consumers and recommend green improvements.
- Partner different like-minded businesses to cross-promotion.
- Support eco-friendly programs and corresponding community initiatives.
- Organize events focusing on green building and EE. Additionally, direct outreach to consumers via trade shows, festivals and other public events are a powerful way to raise public awareness.
- Prepare promotional materials (leaflets, banners, etc.) for all events.
- Initiate Green Building Award (GBA) to honor companies and professionals who demonstrate clear implementation of sustainable design, construction and

operation of buildings and structures. Promote the GBA through the aforementioned tools to whom it may be interested by participating, these include a call for applications on websites.

E. Key Actors

Key actors to apply and diffuse the marketing plan are the Lebanon Green Building Council, chamber of commerce and associations. Their roles can be summarized as follows:

- List the available sources of reference materials as well as all the good practices and the lessons learnt
- Implement planned activities
- Communicate with stakeholders through marketing plan
- Prepare marketing materials
- Provide workshops, seminars, meetings, discussions forums, other – Manage and update web content
- Ensure information exchange between different actors through established networks

F. Market Survey

Main problems identified in surveys addressed to targeted groups on green building issues and its development possibilities:

- For the most part, real estate professionals think that their clients cannot appraise property when buying or renting. When one talks about green there is a perception that the property has to have a good green yard or a green roof. The first criteria for them are first “Place” and then “Price”. They would rather invest less initially and improve the homes afterwards, than pay more for buildings that are already energy-efficient.
- The developers were interested in green building practices. Unfortunately, they are not fully aware of what a green building is, though they know about some of the features such as energy efficiency and nice landscaping. All of them agree that a green building is a high-profile building, and would like to build green. They have

already started with energy efficiency, applying some building envelope materials, but have not done an overall building simulation to get verified results, nor have they tested the buildings. Some developers are using improved doors and windows, etc.

- Environmental concerns of end users affect their purchase decisions of green building construction and eco-friendly products. However, decisions to build with green building criteria are not considered, because green building concept is unfamiliar to majority of Lebanese population and are not communicated effectively.

G. Monitoring Results: Database and Assessment

To increase the number of certified green buildings and as such improve the performance of buildings in Lebanon, assessment has to become more attractive and the benefits more obvious to the public. This would be supported by having a wide assessment framework with core indicators, which would allow for generation of reliable and comparable data. The perfect institution to conserve this database is the Order of Engineers and Architects (OEA) in all its branches. Based on the fact that it is the reference body for all the construction permits, it will be the one and only actor in this roadmap that has the potential of collecting such database.

The development, monitoring and assessment of this scheme incur some administrative costs, but are expected to be modest, to be added to the permit cost. Together, the OEA and LGBC will be responsible for the annual assessment relying on the available database. Database should be accessible for everyone and the assessment published.

Outreach and measuring results:

- Showcase Lebanon green buildings
- Provide testimonials of green building owners
- Provide case studies of high efficiency and green buildings
- Provide green maintenance and operation practices for building owners
- Develop database of local and state green ordinances
- Diffuse database of financial incentives, including rebates and energy-efficient loans

The success of the campaign can be measured by:

- a post campaign survey of the public's awareness
- the increased number of green building projects
- the increased number of certified green building
- the increased number of green building award applicant
- the number of media impressions generated by the campaign

H. Demonstration projects proposition

CEDRO 5 should propose programs aiming to demonstrate the feasibility of different of ARZ 2.0 certification. This is required to build industry confidence by ensuring that the technical feasibility and cost of higher level of certification have been properly and practically explored before making them mandatory.

It is preferable to demonstrate feasibility through pilot projects and provide time to allow the construction industry to become familiar with new demands before they become mandatory. This will reduce the risks associated with new techniques.

VIII. Capacity Building

A. Training and Certification

The extent to which green building techniques and technologies are deployed on a large scale is largely shaped by public policy, and by how householders, professionals in the design field and businesses in the building sector respond to this policy. The great challenge in green building is to raise awareness and implement knowledge of sustainability. It is important to focus on the skills required to green the output of the building sector as a whole, not just the relatively small part that produces buildings meeting exceptional standards of sustainability. Public information campaigns, financing schemes, subsidies, advice services, obligations on energy companies, in addition to training and certification schemes for service providers are among the strategies to be

adopted. Skills to green the output of the building sector, therefore, be a very good investment.

Estimating the demand for skills in green building, and converting this into an estimate of training requirements is difficult. At one level, it is possible to say that everyone engaged in building requires skills in green building. The more difficult question is how many people will need training to enable specific green building initiatives to proceed. In many countries, initiatives that have developed green building skills at manual and professional levels have created pools of skilled people. Deficiencies in the supply of skills and training for green building can function as an important barrier to the development of green building. This is where standards and certification programs come into play.

Green building standards and certification programs play a vital role in maturing product markets for green building technologies, materials and design and construction techniques, developing an important base of skills and raising expectations as to the environmental performance of buildings.

Training may be helpful at several levels involved in the implementation of green building certification. Core occupational groups associated with green buildings are namely the following:

- Conceiving, planning, designing and advising occupations;
- Construction, installation, maintenance occupations;
- Controlling occupations;
- Enabling occupations;
- Manufacturing and distribution occupations;
- Green building clients.

While all these occupational groups would benefit from special skill trainings each on the domain that they contribute to in new or retrofitting construction, occupations in the first (individuals and professionals in the engineering and construction domain), third and fourth (auditors, consultants and policy makers) groups are the ones that need to be targeted initially in Lebanon for a mandatory skill training and testing frequently

to accommodate the changes. Officials at the OEA are considered to be in the latter groups so special training programs involved with evaluation and permission related processes are required for better implementation.

1. Who are the consultants? How to be trained?

Sustainability is not just “going green”. It goes beyond “going green” as in - it is a true balance of supporting the triple bottom line or the 3 P's - People (Society), Planet (Environment) and Profit (Economy). So, who is an energy consultant? How does one become an energy consultant? The objectives and needs of a project that is inclined towards developing a sustainable green habitat, makes the task become more intricate thus a dedicated focus on sustainability essentially demands an Energy Consultant to address the unique need of a project by integrating the sustainable performance with other project objectives of all stakeholders. Becoming an energy consultant would mean one should have the expertise in offering the best for their client. Expertise comes with experience, practice and continuous learning. If one has a background in fields pertaining to buildings, planning, designing, renewable energy technologies such as a bachelor's degree in building science, Architecture, Landscape Design, Urban Planning, Interior Design, Civil, Mechanical or Electrical Engineering... etc - anything related to buildings), complementing ones technical knowledge with knowledge in sustainable design, green building design, construction and operations, and green technologies can help integrate sustainable design practices into their current profession.

Building energy auditors/consultants, assessors and inspectors, certifiers and systems inspectors tend to be independently certified experts, certified by national authorities or under voluntary certification schemes to conduct controlling work. Training for this occupation occurs in different formats, depending on the degree of specialization required. The types of trainings approach that could be implemented in Lebanon as well as the time frame are listed in Table 2:

Table 2: The types of trainings approach

Occupational Groups	Target Group	Training and Education	Period
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Conceiving, planning, designing and advising occupations	Construction company managers and business functions	University degrees	Short term-voluntary Medium term-mandatory
	Architects and civil/structural/environmental engineers	Specialized masters and other forms of continuing training in energy efficiency, building codes and energy certification	Medium term-Mandatory
	Hvac, electrical, mechanical, sanitary, renewable energy and building services engineers/designers	Training offered by professional associations	Short term-Mandatory
	Energy, water efficiency and waste management analysts, consultants and advisers	In company training	Short term-Voluntary
	Surveyors	Certification institutions	Short term-Mandatory
Construction, installation, maintenance occupations	Construction technicians	Technical training in retrofit construction	Short term-Voluntary
Controlling occupations	Energy auditors	Technical education complemented by certified working experience	Short term-Mandatory

	Inspectors, certifiers and quality controllers	Training and examination related to certification	Short term- Voluntary Medium term- Mandatory
Enabling occupations	Policy makers	Training for teachers	
	Urban planners	Higher education for urban planners	Short term- voluntary Medium term- Mandatory
	Financing educators	Training for policy makers and finance professionals	Short Term- Voluntary
	Information providers		Medium term- Voluntary
	Researchers		Voluntary

2. Who are the assessors? How to be trained?

Assessors bring their comprehensive knowledge to steer the built environment toward sustainability. Assessors are usually technical experts in the areas of sustainable design, construction, energy, and facility management who remain current on trends in sustainability best practices and innovations. But due to the diversity of sustainable penetration into the world of construction, training and accreditation program can target the abilities of professionals from a variety of relevant disciplines including Business, Finance, Law, as well as Materials & Technology providers. Working with a project team in real-time, assessors do much more than examine features for points, they also serve as a resource for questions and offer guidance for improvements. Assessors for green buildings issue Energy Performance Certificates for buildings. Individuals in this position must already have a credential of qualification for either domestic or non-domestic buildings. This can happen through an accredited entity.

Some countries consider that introducing standardized certifications can help tackle the problem of lack of skill in the green building industry. The process is most commonly coordinated by government bodies like the MoEW and OEA, or in the case of voluntary

certification schemes by private or nongovernmental entities. In Lebanon, such entities who have developed and are in the process of developing Lebanese green building rating systems are LGBC (ARZ), Grass (ALMEE) and those who are adopting international green building rating systems are Amideast (LEED), IRI (HQE) and Eco-Consulting (BREEAM). These are official entities that are responsible to provide assessor accreditation by training and testing, in addition to approving certifications for green buildings. With the collaboration of the OEA such certifications can be enforced.

Minimum short-term and mandatory requirements are recommended to be eligible for assessor status in Lebanon:

- To become an assessor in Lebanon certification processes should be accompanied by compulsory training.
- Applicants, besides being eligible in terms of required qualifications, must also complete a training course on building auditing and certification before receiving a professional certificate by the national or international responsible body.
- Knowledge of the standards, assessment methods and evidence requirements of the qualification being assessed is also necessary. This can be gained during or after completing the Assessor qualification.

Details of how to become an assessor for LEED, BREEAM, HQE, ARZ or GRASS, are in Table 3.

Table 3: Procedure of how to become an assessor

Training Entity	Assessor Certification Process	Procedure
LEED	LEED Green Associate LEED AP with specialty	candidates must first pass the LEED Green Associate exam) Test taken Pro-metric Testing Center

BREEAM	BREEAM International New Construction New Assessor	Online class of 30hrs. Successfully passing this course and examination enables the candidate to apply for an assessor’s license under the BREEAM International New Construction scheme.
HQE	Référent CERTIVEA for HQE: Référent HQE Bâtiment et HQE Bâtiment Durable Référent HQE Aménagement Durable Référent HQE Infrastructures Durable	Certivea, has designed certifying training courses on environmental labels. Passing the exam at the end of the training will give you access to the status of “Referent” or assessor, in Lebanon IRI has certified assessors under Certivea
ARZ	LGBC accredited assessor	ARZ assessors who have passed a rigorous training program and have been accredited by LGBC
GRASS	“ALMEE” assessor accreditation	GRASS assessors will pass an examination set up by ALMEE after a series of training sessions and will be listed on the “GRASS” building rating system website

3. Green Building Certification Enforcement

Enforcement is the process that the building inspection staff at OEA would undertake to ensure that site plans and constructions follow the provisions of the green building certification rating system. Without a significant emphasis on enforcement, compliance diminishes, and the outcome is always the same: new building or renovation projects that fail to realize their full potential for energy savings, sustainability and the myriad benefits that go along with them.

Enforcement Options:

Imposing green building certification should be integrated into the regular enforcement system for the general building code with plan review and inspections as part of the routine construction process. This will, however, be effective only when there is a sufficient number of well-trained green building certification enforcement staff in addition to compliance manuals, forms, and software. Separate enforcement would require the build-up of a separate enforcement infrastructure that would be even costlier and could easily double the number of inspections that need to be done before a building is allowed occupancy.

Table 4 presents various key features, requirements and implications related to enforcement of green building certification through three institutional options.

Table 4: Institutional Options for Enforcing Green Building Certification

	OEA	Private Third Party	Self-certification to OEA
Key features	Order of Engineers and architects wholly responsible	Private third party is certified by competent structure (LGBC for ARZ, ALMEE for GRASS, USGBC for LEED...)	Builder provides compliance statement to green building rating system to owner or OEA
Support Infrastructure needed	OEA inspectors	Trained and certified third-party staff come training of OEA staff if spot checking	Policing of compliance statements
Cost to OEA	High but may be recovered from builder	Moderate	Low. Moderate if builders are certified
Cost of owner/ developer	Low unless OEA charges	High	Low
Information and infrastructure needs	Trained OEA assessors	Trained private assessors; Certified processes	Knowledgeable builders and owners. Certification of assessors
Non-compliance risk	Low, provide adequate funding	Low, third party depends on certification for income (but also on certified builders)	High, unless owner places high value on green building. Lower if builders are green

			building certified	assessor
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The main reasons possible for lack of enforcement are high enforcement costs and under resourcing of OEA, including for staffing and staff training, inspectors’ lack of qualifications and specialist knowledge, and finally, the perception that the green building regulations are not as important as safety related regulations.

B. Sustainability Education: On The Way!!

The study of Lebanon showed that the level of assimilation of the concepts of sustainable development and green building technology in higher education are very minimal. They can range from mere formulations to basic courses as electives of engineering and architectural curricula, as well as other selected activities of the educational system. The initiatives to promote concepts of sustainability in higher education have so far, actually, had little impact on education.

With this road map, the purpose is to contribute to the understanding of incorporating sustainability into education and research. This is done by examining the methods for integration and, in particular, the procedures for the classification and review of university courses and research projects. The purpose of integrating sustainability in university courses will increase how faculties will incorporate a sustainability assessment of research topics when applying for research funding. Recommendations for approaches to set into motion on the short term and medium term, are the following:

Table 5: Recommendations for approaches to set into motion on the short term and medium term for Sustainable Education

Integration Methodologies	Approach	Term
Suitable pedagogy	1-Course Classification can be done in the faculty, preferably including someone with knowledge and competence concerning environmental issues.	1-Short term - Mandatory 2-Short term- Mandatory

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	<p>2-Each school chair or head can participate and lead such discussions so that efforts are coordinated throughout the curriculum, which provides better opportunities for feedback to the instructors.</p>	
Integration into curricula	<p>1-Suggestions for improvement of course curricula can include a detailed manual with checklists for the course classification, preferably with examples from every department. 2- The national authorities such as the ministry of education could support this sustainable concept further by imposing similar requirements in the regular evaluations of all universities as well as penalties that can reach revoking of teaching licenses of faculties that don't comply.</p>	<p>1- Short term-Voluntary 2- Medium term-Mandatory</p>
Awareness level	<p>1-More feedback and opportunities to increase one's holistic awareness are recommended. This request could easily be met by discussions in departmental meetings or through information provided to faculty in print. 2-The faculties at the University need to appoint a staff member to act as environmental coordinator. The coordinator is responsible for collecting information about the performance of the institution's sustainable course integration, reporting to faculty head. The environmental coordinator in each department, with knowledge of the subject area, may be quite capable of assisting in course classification from the very beginning.</p>	<p>1- Short term-Voluntary 2-Medium term-Mandatory</p>
Community outreach	<p>The need to change the culture of the whole organization and to allocate financial and educational resources to implement real change, like hands-on workshops and laboratories.</p>	<p>Medium term-Mandatory</p>

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<p>Opportunities provision</p>	<p>1-Integrating sustainability into” Normal” courses and research projects at a university is the best way of reaching the students and equipping them with effective tools and knowledge for their future careers.</p> <p>2- Hire new instructors in the sustainability domain.</p> <p>3-incorporation of sustainable education in curricula can help classification of research projects due to their familiarity with the classified courses. This can highly increase the chances of receiving funding for such research projects.</p>	<p>1-Short term-Voluntary</p> <p>2-Medium term-Mandatory</p> <p>3-Medium term-Voluntary</p>
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IX. Scale It Up

A. Monitoring Results: Database and Assessment

To increase the number of certified green buildings and as such improve the performance of buildings in Lebanon, assessment has to become more attractive and the benefits more obvious to the public. This would be supported by having a wide assessment framework with core indicators, which would allow the generation of reliable and comparable data. The perfect institution to conserve this database is the Order of Engineers and Architects (OEA) in all its branches. Based on the fact that it is the reference body for all the construction permits, it will be the one and only actor in this roadmap that has the potential of collecting such database.

The development, monitoring and assessment of this scheme incur some administrative costs, but are expected to be modest, to be added to the permit cost. Together, the OEA and LGBC will be responsible for the annual assessment relying on the available database. Database should be accessible for everyone and the assessment published.

Outreach and measuring results:

- Showcase Lebanon green buildings
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- Develop database of local and state green ordinances
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The success of the awareness campaign can be measured by:

- a post campaign survey of the public's awareness
- the increased number of green building projects
- the increased number of certified green building
- the increased number of green building award applicant
- the number of media impressions generated by the campaign

Once a certified green building is occupied, ongoing evaluation, tracking and monitoring is necessary to evaluate building systems and educate building occupants. This ensures sustainable operations and maintenance. An effective tracking system is critical to the overall success of a green building. Tracking systems need to be implemented early in the design and development phase of the project. Post-occupancy evaluations should be conducted following the building completion and may be repeated on a periodic basis thereafter.

B. Upgrade the Roadmap for Long-Term

In the end of the plan timeline, the Green Building Plan will be evaluated, program successes will be shared; results and impacts will be publicized. After evaluating the implemented plan and the achieved goals, it will be necessary to revise new sustainability goals; set new targets for a new long-term plan that reach higher expectations to scale up the green buildings in Lebanon.

There are many criteria that might affect upgrading this roadmap for the long term, listed here below, but not limited to:

- The electricity sector situation in the country
- The economic situation in the country
- The global, regional and national targets and commitments for climate change
- The global and local markets
- The upgraded technology
- The innovations in the international rating systems

X. Impacts and Benefits

Green buildings offer solutions by conserving resources, regenerating sites, and providing economic and societal benefits. The benefits of green building design, construction, and operation should be enjoyed by residents, workers, and visitors of all cities; in order to provide for the health, life and safety of the built environment; to increase economic and resource efficiency of buildings; to reduce effects of climate change through more resilient buildings, communities, and cities; and to provide for the best buildings of today without compromising the needs of future generations. Impacts are detailed in the following:

- **Impact on Energy**

Green Buildings Certifications affect the reduction in the consumption of electricity from fossil fuels, which would reduce on one hand the State subsidies to electricity-EDL, and on the other, Lebanese imports of hydrocarbons. These could also give rise respectively to a reduction of the budget deficit, in addition to the reduction of the balance of payments, which to mention are the two advantages which Lebanon needs the most today, apart from those of an ecological nature.

- **Economic Impact**

Evidence is growing that sustainable buildings provide financial rewards for building owners, operators, and occupants. Sustainable buildings typically have lower annual costs for energy, water, maintenance/repair, churn (reconfiguring space because of changing needs), and other operating expenses. Through integrated design and innovative use

of sustainable materials and equipment, the first cost of a sustainable building can be the same as, or lower than, that of a traditional building. Some sustainable design features have higher first costs, but the payback period for the incremental investment often is short and the lifecycle cost typically lower than the cost of more traditional buildings.

In addition to direct cost savings, sustainable buildings can provide indirect economic benefits to both the building owner and society. For instance, sustainable building

features can promote better health, comfort, well-being, and productivity of building occupants, which can reduce levels of absenteeism and increase productivity. Sustainable building features can offer owners economic benefits from lower risks, longer building lifetimes, improved ability to attract new employees, reduced expenses for dealing with complaints, less time and lower costs for project permitting resulting from community acceptance and support for sustainable projects, and increased asset value. Sustainable buildings also offer society a whole economic benefits such as reduced costs from air pollution damage and lower infrastructure costs, e.g., for avoided landfills, wastewater treatment plants, power plants, etc.

- **Impact on Jobs**

At first glance, green buildings might not appear very different from the traditional ones, but they feature specialized designs and materials to limit their environmental impact. Creating these new buildings requires skilled workers—such as architects, construction managers, and carpenters—with knowledge of new design and construction techniques. The jobs created across the design, engineering, manufacturing, construction and operations industries will bolster the “green economy.” These jobs will provide practical experience in high-performance technologies, green construction and building operations.

- **Impact on Health**

The potentially negative health effects of poor indoor environment in buildings are of major concern as people spend 85-95 % of their time indoors. People are exposed to problems such as high radon gas concentrations and suffer from allergies due to poor indoor air quality associated with inefficient and defective heating or cooling systems. In low-income countries, traditional fuels used for heating and cooking contribute to chronic obstructive pulmonary disease in adults and acute respiratory infections in young children. Paints, varnishes, solvents and preservatives commonly used in buildings generate volatile organic compounds (VOCs) that have been proven to be public health hazards. Furthermore, when structure of a building begins to deteriorate, there are possibilities of exposure to asbestos which may be an important risk factor for the chronic respiratory disease mesothelioma. These poor indoor qualities attributed to the buildings lead to the notion of Sick Building Syndrome (SBS); occupants of affected

buildings often describe a complex range of vague and often subjective health complaints.

- **Impact on environment**

Buildings are large entities and have huge impacts on the environment in various ways. With the present day methods of design, construction, use and maintenance, large quantities of resources such as materials, energy and money, are consumed. In the phases of construction, occupancy and demolition, large quantities of waste and potentially harmful atmospheric emissions are generated, resulting in adverse effects such as loss of amenity and biodiversity.

- **Impact on Urban Warming**

There is also the problem of urban warming, or the so-called “heat island effect”. Roofing and walls used for construction of buildings capture and retain the solar heat and radiate to the surrounding. Air conditioners used to cool the building by evacuating heat from within the building reject it outside. Heat islands can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality. Relevant studies have demonstrated that greening approaches are the most inexpensive solutions to alleviate the urban heat island effect and to provide tangible benefits in terms of optimizing the energy use in buildings.

- **Impact on Innovation and Research**

Green building literacy has been an ill-defined term and green building themes have not been rigorously connected to science and environmental education. The road map here provides a foundation for advancing green building literacy, highlighting innovations that are born from their application and promoting further research in green buildings. The overarching goals of building “green” are to reduce the social and environmental impacts of the built environment while improving the quality of life for occupants within buildings. However, the problem remains that few people outside the building industry understand the myriad benefits of building green. So, to really appreciate the adoption of green building technology, it is necessary to look at how it can affect education and research as well as how it will drive the green technology innovations further.

Impact on Education and Research: In Lebanon, Green building education can be introduced into the basic (primary and intermediate) and secondary education schooling

years to enhance science education amid increasing calls to teach students about human impacts on nature. If advances are to be made for green building education of the public (both professionals, people in the engineering field and the general public) a framework for outlining the diverse educational content and outcomes could provide a useful starting point for curricula that are formal, informal, or even non-formal in nature, with the collaboration of Ministries, municipalities, NGOs and the large educational institutions. Research in the field of green building technology is a bit lacking in Lebanon, thus with future implementation of further awareness and inclusion of green building educational plans in engineering and architectural institutions in Lebanon and with a clear framework, this can be mitigated.

Furthermore, since the end-user, contractor or building user is the person to interact the most with the construction at a later phase, a masterplan to engage and educate end-users needs to be implemented, knowledge exchange platforms need to be set up, regulations on the use of efficient equipment in buildings needs to be issued, and standards and a certification system need to be adopted.

Impact on Innovation: The delivery of green buildings, as a good approach for reducing energy consumption, has yielded some innovative outcomes in Lebanon. The need to spark further effective innovations has become crucial. Yet, there has been no systematic examination of the green buildings field. Innovation is considered a key condition for fostering structural change. The concept of an innovation system needs to be developed to represent and understand the interactions between producers, users, institutions, and governments. An integrated approach is recommended where the national government needs to set things in motion with policy schemes that will spur green building innovation.

Platforms need to be established to stimulate the exchange of best practices, expertise, and state-of-the-art knowledge. The local certification scheme needs to be developed and finalized. In the end, these policy schemes will be implemented and monitored, and evaluated regularly. In response, the government in collaboration with the OEA will make sure policies remain flexible and could be adjusted in time.

In the short-term period, to make green building technology more accessible in the future, early awareness in schools and educational institutions, municipal campaigns, and hands on workshops need to be implemented so that the future generations can be encouraged to look at things with new eyes and more responsibility, to fully understand

sustainability and green construction as well as to engross themselves in those domains during higher education.

In the medium term and at the end of that period, Lebanese universities, vocational institutes and schools will have made mandatory state of the art courses related to green buildings that have before been selective. Policy schemes to promote proper innovation and best practices with the help of national and non-governmental entities can be finalized at this phase becoming a mandatory standard of good practice.

- **General Benefits**

“Green design and construction enable us to look beyond the usual paradigms of time, money and quality by using the green-built environment as a way to work toward improving our planet” (Michael Fegin, Marsh Global Construction Practice Leader). Nowadays, everyone is looking for a solution to reduce the environment pollution, the dependency on polluting conventional energy resources, and to reduce the carbon footprint. The green building practice is a big step to save the world.

The general benefits of the implementation of this roadmap can be considered as the following:

- an increase in the number green building projects for both private and public sector;
- an increase in the opinion that green buildings are more economical to operate;
- an increase in awareness for both environmental and social reasons of the benefits of being “eco-friendly”;
- green building technology will be viewed as a way to get more rent, increased occupancy and higher resale value;
- Technical and techno-economic expertise of green buildings will develop rapidly;
- More integration of green building technology in the educational sector;
- The set of actors involved in the green building niche will increase, and so will the interactions between them (e.g., facilitated by knowledge platforms), also stimulating internal and external learning processes;
- Furthermore, economic feasibility of green building technology improved as payback periods decreased and potential investors started to take more interest in looking for equipment with long term value;

- The Green Buildings niche will mature with time and application, and green building technology will gain in a serious foothold in the conventional building market.

XI. Barriers in Implementing the Roadmap

The operational green building rating systems require continuous updating along with continuous monitoring of enforcement to transform a country to achieve sustainably target in construction sector.

Implementing bodies / statutory agencies in various developing countries with recent history of implementation of green building certification have identified following key operational shortcomings

These barriers have been essentially qualified on the grounds of:

- Political barriers
- Complexity of procedures
- Market barriers

A. Political Barriers

Lebanon is facing political and economic challenges. Sound politics are needed to bring about the above said goals.

B. Complexity of procedures

The key of compliance, of a green building certification, remains with statutory bodies like the OEA beyond the construction where technical expertise is largely present with the architects and engineers.

It will be possible to achieve near expected results in a shorter span with minimal complexity of verification of compliance (Green certificate exists or not – Produced by a certified assessor ARZ or HQE or GRASSMED or LEED...), whereas once the systems and policies are in place, the country can graduate to a more detailed compliance verification procedure.

C. Organizational Barriers

Finally, information barriers, lack of awareness and qualified capacity among developers, suppliers, promoters, financiers, and end-users can impede decisions to invest in green building, EE and small-scale RE technologies.

- Information about green building, energy cost by end-use, market available EE and small-scale RE technologies and financing options is scarce and sometimes difficult to get. As end-users would not be aware of the available opportunities, they would not have the motivation to identify, request and implement green building rating criteria, potential EE and small-scale RE technologies, etc. Similarly, the professionals would not have the motivation to offer energy efficiency solutions as they were not requested.
- Sometimes despite the dissemination of information, green messages often fail to reach its aim, because of an inappropriate selection of communication channels and the low perceived credibility of environmental claims; in that environmental advertisement companies are showing vague arguments to justify environmental claims, while these companies do not have an eco-friendly image, which make customers mistrust them based on customers' previous consumption experience. It is recommended to use various promotion means to implement the concept of green building and Energy saving.
- Lack of adequate training and sufficient awareness campaigns for all the stakeholders involved in the green building, EE and small-scale RE value chain (e.g. developers, suppliers, promoters, financiers, consumers) contribute to widening the informational gap and affect the consumers' investment decisions.
- Lack of local skilled labor e.g. the installation and maintenance of building insulation, roof-top PV, lighting, etc., is a general barrier. In general, there is a limited technical know-how and lack of experience to adopt most sustainable design and construction strategies for green building and to install appropriate EE and small-scale RE.

Adoption of green building certification would require availability of tools and testing procedures at the disposal for statutory entities, through third party service providers as well as in-house facilities within the government framework. This would be required

to establish checks and balances in the form of financial gains to the investors complying to green building certification as well as penalties for non-compliance.

To sum up, it can be represented as:

- There is a good potential for implementation of green building certification in Lebanon as political will, technical skills as well as growing market would help sustain such initiatives.
- Support from developmental setup of Europe and the World Bank is available for taking up both advocacy initiatives as well as implementation plans.
- LGBC as well as other organizations such as IRI and ALMEE are already active in the field of green building certification. LCEC was active in the financial mechanism NEEREA supporting Green buildings and other projects.

D. To Overcome Barriers

Following action can further help overcome the barriers:

- Trainings and courses on ARZ building rating system to be supported by different donors.
- Need infrastructure for training installers, engineers and for accrediting assessors and inspectors.
- Give market time to anticipate to a green building certification and prepare itself for future
- Make sure all stakeholders are skilled to ensure proper implementation and this should apply to even the investor / owner of the building to have basic understanding of green building certification and its benefits.
- Government with support of BDL can promote green building certification program through different incentive for all stakeholders (owners, consultants, producers, etc.) in forms such as tax reduction and recognition certification in a first phase and in the future (After emerging from the economic crisis) in forms of loans and grants.
- Raising awareness and improving technical assistance and capacity building.

- Improving legal and macroeconomic framework conditions for green buildings and renewable energy technologies specifically for the technologies with possibility of integration with building envelope.
- Expanding development partnerships with the private sector (especially Banks).
- Establishing certified accredited laboratories for green materials and components.
- High profile demonstration pilot projects are necessary to propel the community.
- Establishing data base on locally available natural and ecological building materials and equipment.

While proposing the roadmap, care has been taken to suggest activities and initiatives that help overcome the above mentioned barriers.

XII. Risks

In this section the main risk categories associated with green building roadmap are identified:

Despite the benefits mentioned, the revealed key barriers risk the large-scale uptake of green building technology: (1) inflexible habits and mindsets of end-users; (2) the main push for green buildings coming predominantly from the government; and (3) ineffective inter-actor and stake holder collaboration. Measures need to be set in place by the government and other stakeholders to overcome the listed above and mitigate the risks.

XIII. Outline of Green Building Regulations in Lebanon

Enforcement of green building certification in the medium-term needs the adoption of appropriate regulations. In this section, are the proposed outlines of green buildings regulations in Lebanon.

Table 6: Outlines of Green Building Regulations in Lebanon

1.	General
101	<p>Title</p> <p>a) These regulations shall be known and cited as Green Building Regulations and Specifications in Lebanon.</p> <p>b) Within this document, they are also referred to as “the regulations.”</p>
102	<p>Purpose</p> <p>a) The purpose of the regulations is to improve the performance of buildings in Lebanon by reducing the consumption of energy, water and materials, improving public health, safety and general welfare and by enhancing the planning, design, construction and operation of buildings to create excellent cities that provides the essence of success and comfort of living.</p> <p>b) The regulations intend to create a more sustainable urban environment and extend the ability of the Lebanon’s infrastructure to meet the needs of future development.</p> <p>c) Green building is the practice of creating structures and using processes that increase the efficiency of resource use -energy, water, and materials- while reducing building impacts on human health and the environment during the building’s lifecycle, through better siting, design, construction, operation, maintenance, and removal.</p>
103	<p>Building Typologies to which Green Building Regulations are applied</p> <p>a) Villa:</p> <p>b) Residential/Commercial: This building typology includes:</p>

Building Typologies	
Residential	Commercial
<ul style="list-style-type: none"> • Apartments 	<ul style="list-style-type: none"> • Hotels, Motels and furnished Apartments
	<ul style="list-style-type: none"> • Laboratories
<ul style="list-style-type: none"> • Student Accommodation 	<ul style="list-style-type: none"> • Offices
	<ul style="list-style-type: none"> • Resorts
	<ul style="list-style-type: none"> • Restaurants / Food Outlets

c) Public Building: This building typology includes

Building Typologies	
Public Buildings	
<ul style="list-style-type: none"> • Banks 	<ul style="list-style-type: none"> • Museums
<ul style="list-style-type: none"> • Cinema/ Theatres 	<ul style="list-style-type: none"> • Petrol Stations
<ul style="list-style-type: none"> • Educational Facilities 	<ul style="list-style-type: none"> • Post Offices
<ul style="list-style-type: none"> • Government buildings 	<ul style="list-style-type: none"> • Retail Outlets
<ul style="list-style-type: none"> • Health Care Facilities 	<ul style="list-style-type: none"> • Shopping Malls
<ul style="list-style-type: none"> • Historical/Heritage Buildings 	<ul style="list-style-type: none"> • Worship Houses

d) Industrial Building: This building typology includes:

Building Typologies		
Industrial		
Factories	Warehouses	Workshops

104	<p>Applicability</p> <p>a) The regulations apply to:</p> <ol style="list-style-type: none"> 1. All new buildings; 2. Additions, extensions, and refurbishment of existing buildings which require a building permit; and 3. Existing buildings, when specified. <p>b) Mixed Use Buildings - When a building combines more than one use, each portion of the building must comply with the relevant regulations for that particular typology.</p> <p>c) Refer to the regulations on the applicability of specific regulations to specific building typologies.</p> <p>Change of Use – When there is a change of use for a building (for example, the change in use from a residential villa to a school); these regulations apply for the new use.</p>
105	<p>Additions, Extensions, or Refurbishment Details</p> <p>a) Relative to 104, new additions, extensions or refurbishments which require a building permit must meet the requirements of the regulations. Existing portions of the building which are not part of the new work will not be required to be upgraded to meet the regulations. Existing parts of a building will require upgrading if after the addition, extension or refurbishment, the existing building performs in a less energy efficient manner than previously because of the addition or extension. Any upgrading required must bring the building back to at least its minimum level of previous energy performance before the addition or extension</p>
106	<p>Effective Dates</p> <p>These Regulations will be issued by an Administrative Resolution which will determine the effective date for implementation.</p>
107	<p>Alternative Materials, Designs and Methods of Construction and Equipment</p> <p>The provisions of these regulations actively encourage innovation and are not intended to prevent the use of any suitable alternate material, appliance, installation, device, arrangement, design, or method of construction that is not specifically prescribed by the regulations.</p>
108	<p>Voluntary Green Building Rating Systems</p>

	<p>a) The Lebanon Building Regulations are not designed as a rating system. The regulations may have similar topics and/or focus as some of the worldwide voluntary rating systems, as they all address the need for more sustainable buildings.</p> <p>Compliance with the regulations is not intended as a substitute for any measure or credit with any of the rating systems.</p>
109	<p>Competent Authority</p> <p>a) The Competent Authority for the Green Building Regulations is the Order of Engineers and Architects of Beirut and the Order of Engineers and Architects of Tripoli.</p>
110	<p>Green building certification enforcement</p> <p>Enforcement is the process that building inspection staff at OEA undertakes to ensure that site plans and construction follow the provisions of the green building certification rating system.</p>
111	<p>Green building rating systems</p> <p>Green building rating system is a green building rating system recognized by the OEA such as: ARZ.2.0 – GRASSMED – LEED – HQE – BREEAM.</p> <p>The OEA shall publish and update a list of recognized green building rating systems.</p>
112	<p>Certification of green buildings assessors</p> <p>A separate cell should be created at the OEA, which in association with LGBC, ALMEE and IRI should be conducting tests for certified green building assessors (ARZ 2.0 – GRASSMED – HQE). LEED certified assessors and BREEAM certified assessors are recognized by the OEA upon presentation of their LEED or BREEAM certificates. A green building assessor should be an engineer or an architect registered at the OEA.</p>
113	<p>Public and commercial Buildings</p> <p>The file of demand of permit of a public or commercial building should include a provisional study of green building certification signed by a recognized green building assessor.</p> <p>Penalties for not existing of provisional green building certificate for commercial and public buildings can include withholding permits.</p>
114	<p>Residential Buildings</p>

	<p>The file of demand of permit of a public or commercial building can include a provisional study of green building certification signed by a recognized green building assessor.</p> <p>No penalties provided for non-existing of provisional green building certificate for residential building</p>
115	<p>Audit for green building certificate report</p> <p>Random audit of some reports would be carried out by the joint committee of the OEA and LGBC, ALMEE and IRI, to ensure that the certification issued by qualified green buildings assessors are correct.</p>
116	<p>Final green building certificate</p> <p>The promoter/builder/building engineers should be required to declare that the building will be made as per the documents submitted at the stage of registration. The declaration should be signed by a recognized green building assessor. In case a deviation is found, some provision of penalty may also be kept to discourage such mismatch. One way of addressing this could be provision of losing certificate for practice. In case the details used to generate the green building certification report is found to be different from the actual details, the LGBC-OEA or ALMEE-OEA or IRI-OEA certified assessor should be losing the assessor certificate.</p>
117	<p>Referenced Standards</p> <p>The standards referenced in the green building rating systems shall be considered part of the requirements of these regulations to the prescribed extent of each such reference.</p>

Conclusion

The environmental impact of buildings and the construction sector is indisputable. To shape the journey of green building in Lebanon, implementing this roadmap in Lebanon is an effective way of reducing energy consumption, improving water management, reducing waste and attaining financial gains. The Roadmap addresses five cross-cutting and complementary policy routes: Energy Efficiency, Renewable Energy, Construction Code, Environmental Code and Sustainable Finance. A successful implementation of policies can never be done without raising awareness, building capacities and educating in this field.

The bare minimum that should be aimed for is to see sustainable building adopted as minimum good practice and business as usual; most of buildings are efficient; some of the buildings are energy positive; and thus a transformed construction industry with the knowledge, skills and willingness to pursue alternatives and make a positive contribution.

Annex: Building Permit System in Lebanon

1. The Technical Department can be one of the following depending on the city/village:
 - a. The Technical Department in the Municipality of Beirut or Tripoli
 - b. The Union of Municipalities if one exists
 - c. The local Urban Planning department
2. The Design Drawings should be signed by an architect, a civil engineer, an electrical engineer and a mechanical engineer. Either the architect or the civil engineer can be assigned as project engineer.
3. Order of Engineers and Architects (OEA) of either Beirut or Tripoli
4. Concerned administration can be EDL, Civil Defense, Civil Aviation Authority depending on the height of the building, the Ministry of Tourism, Education or Health depending on the end-use of the building)
5. Roof casting shall only be done with signed authorization from the project engineer

When the building includes basements, the Technical Department shall check compliance of basements with permit drawings before giving approval to start execution of upper levels.