

Analysis and Recommendations for the Improvement of Energy Efficiency Building Codes in Lebanon

**IKI Project: Accelerating 0-emission building sector
ambitions in the MENA region (BUILD_ME)**

Prepared on behalf of the German Federal Ministry for the Environment, Nature
Conservation and Nuclear Safety under the International Climate Initiative.

Prepared by:

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**The Lebanese Center for
Energy Conservation (LCEC)**
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Table of Contents

Acronyms and Abbreviations	iv
1 Energy Efficiency Building Codes in Lebanon	1
1.1 The Existing Regulatory Instruments Governing EE in the Building Sector in Lebanon	1
1.2 Analysis of Energy Codes for Buildings in Lebanon.	6
1.2.1 Code Development Process.....	6
1.2.2 Technical Scope and Requirements of Thermal Code for Buildings in Lebanon. 10	
1.2.3 EEBCs Compliance procedures of Thermal Standard for Buildings in Lebanon . 14	
1.3 Implementation Mechanisms of Thermal Standard for Buildings in Lebanon	17
1.4 Summary of the Status Que of Energy Codes for Buildings in Lebanon	19
2 Summary of the Experts' Interviews	23
2.1 Challenges and Barriers of the Enforcement and Implementation of EEBCs.....	23
2.1.1 The Technical Challenges	23
2.1.2 The Institutional and Regulatory Challenges.....	23
2.1.3 Capacity Building and Awareness Challenges.....	23
2.1.4 Financial Challenges Related to the Implementation of EEBCs	23
2.2 General Recommendations for the Implementation of EEBCs	24
2.2.1 Technical Recommendations	24
2.2.2 Institutional and Regulatory Recommendations.....	25
2.2.3 Capacity Building and Awareness Recommendations.....	25
2.2.4 Recommendations to the Financial Issues.....	25
2.3 Prioritization of the Recommendations.....	26
3 Priority Recommendations to improve the EE standard in Lebanon.....	29
3.1 A checklist of the minimum energy efficiency requirements	29
3.2 Minimal Energy Performance Standards MEPS	32
3.3 A labelling scheme for existing and new buildings	35
3.4 Trainings on EE building design and construction	37
References	39
Annex 1: Technical Specifications Tables from TSBL 2005.....	40
Annex 2: Documentation of Expert Interviews and statements on EEBCs in Lebanon	42
Annex 3: Evaluation of the General recommendations	66

List of Figures

Figure 1: Work packages of BUILD_ME	iii
Figure 2 Approach of the study and working steps	vi
Figure 3 Categories of EEBC analysis parameters	vii
Figure 4: Standardization process as per LIBNOR	7
Figure 5: Three schemes for a decree in Lebanon	8

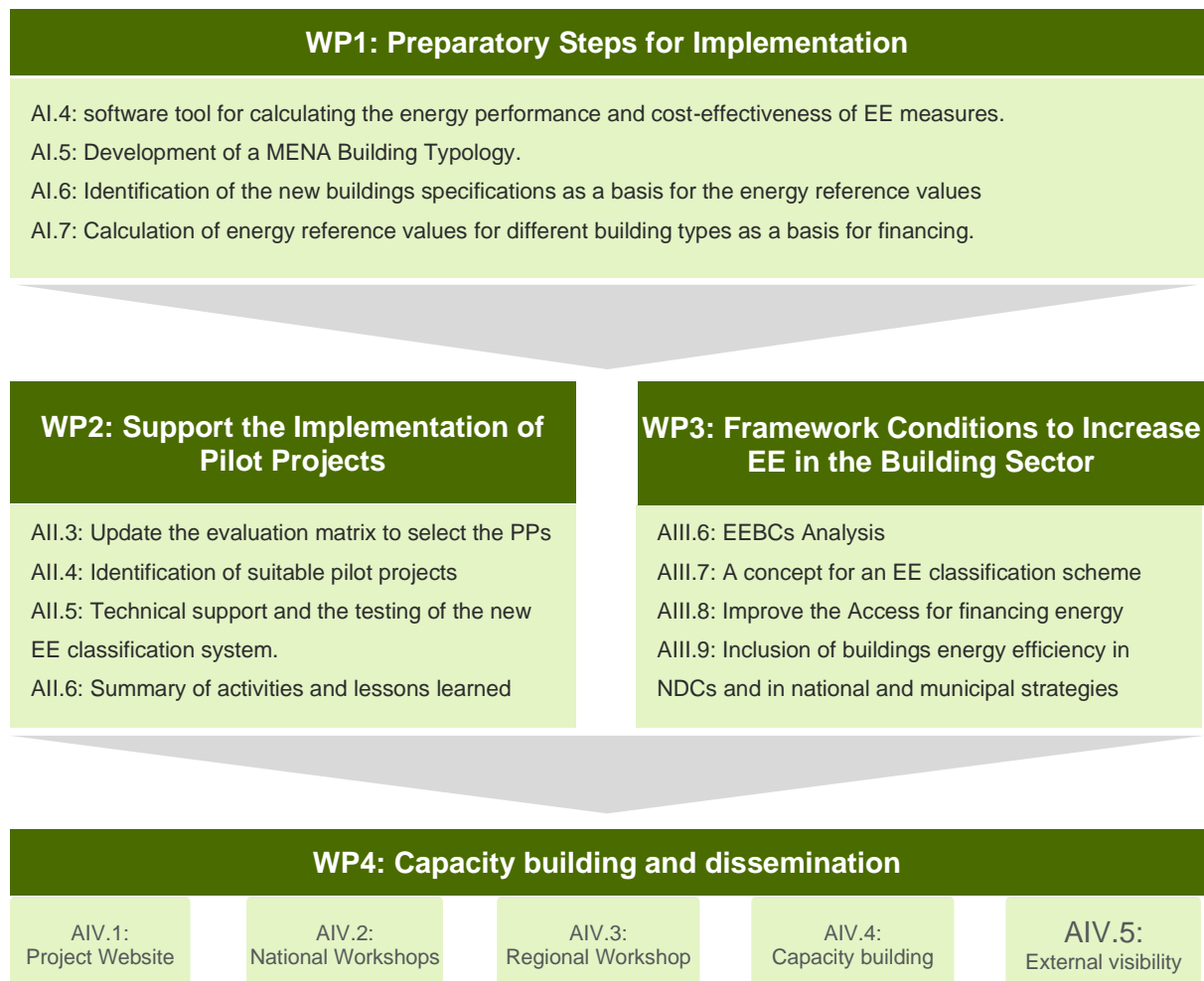
List of Tables

Table 1 A list of the categories of existing regulatory instruments for EE in the building Sector.....	vii
Table 2 Summary of Parameterization for EEBCs Analysis	viii
Table 3 List of the key laws, regulations and codes that govern EE in the Building Sector	2
Table 4 Standards for building components issued by Lebanese Standards Institution LIBNOR	4
Table 5 Development Process of Thermal Code for Buildings in Lebanon	9
Table 6 Key Technical scope and requirements of EEBCs in Lebanon	10
Table 7 Proposed Implementation Mechanisms of Thermal code for Buildings in Lebanon.....	17
Table 8 Summary of status of the Thermal Code for Buildings in Lebanon	19
Table 9 Summary of challenges of the implementation of EEBCs in Lebanon	24
Table 10 Summary of general recommendations of the implementation of EEBCs in Lebanon.....	26

BUILD_ME BACKGROUND

Continuous population growth and economic developments as well as high urbanization rates increasing the demand for housing in the countries of the MENA region. This results in a sharp increase in the energy demand for heating and cooling in the building sector. So far, this increasing demand in the BUILD_ME partner countries has been met predominantly from non-renewable energy sources. For example, the improved standard of living makes more households use air-conditioning systems, which are often inefficiently operated room by room. According to the IEA data, the building sector accounts for around 20% of total energy consumption in the MENA Region and is expected to increase if no measures are taken. The vast majority of buildings are constructed in a non-energy efficient way, which results in a poor energetic quality of the buildings. Considering the long service life of the buildings, this will jeopardize the transition to low-carbon development paths in the MENA region. Therefore BUILD_ME project (IKI Project Accelerating 0-emission building sector ambitions in the MENA region) focuses on supporting the relevant stakeholders in shaping the path for a more energy efficient building sector. In the previous phase (2016 - 2018), a comprehensive understanding of the barriers to invest in energy-efficient and/or renewable energy-based heating and cooling in the MENA region was developed. The implementation, upscaling and consistency of the recommendations for action into national strategies are the guiding principles of the BUILD_ME project (2019 – 2021). Further information and insights about BUILD_ME activities can be found on the project website: <https://www.buildings-mena.com/>. The focus of the new BUILD_ME phase is on the elaboration and implementation of the general recommendations concluded in the first phase. The project is divided into four work packages shown in the following figure:

Figure 1: Work packages of BUILD_ME



Acronyms and Abbreviations

EE	Energy Efficiency
RE	Renewable Energy
MoHUUC	Ministry of Housing, Utilities & Urban Communities
HBRC	Housing and Building National Research Center
MoERE	Ministry of Electricity & Renewable Energy
MoE	Ministry of Environment in Lebanon
MEW	Ministry of Energy and Water in Lebanon
NUCA	New Urban Communities Authority, Egypt
EEBCs	Energy Efficiency Residential Buildings Codes
EEERBC	Egyptian Energy Efficiency Residential Buildings Code
EEECBC	Egyptian Energy Efficiency Commercial Buildings Code
OEP	Organization of Energy Planning
EEIGGR	Energy Efficiency Improvement and Greenhouse Gas Reduction
EgyptERA	Egyptian Electric Utility and Consumer Protection Regulatory Agency
OTTV	Overall Thermal Transfer Value
SHGC	Solar Heat Gain Coefficient
SGR	Shading Glazing Ratio
WWR	Window-to-Wall
ACs	Air conditioners
EER	Energy-Efficiency Ratio in Btu / (h * W) (no metric equivalent);
IPLV	Integrated part-load value (unit-less)
COP	Coefficient of performance in W/W
VLT	Visual Lighting Transmittance
LIBNOR	Lebanese Standardization Institution
ISO	International Organization for Standardization
IEC	International Electrotechnical Commission
EN	European Standards
TSBL 2005	Thermal Standards for Buildings in Lebanon
MED-ENEC	Energy Efficiency in the Construction Sector in Lebanon
OEA	Order of Engineers and Architects

Introduction

Energy efficiency building codes (EEBCs) constitute the basis for buildings construction. Through their national application, they establish an important lever for increasing energy efficiency in buildings. Effective policy to implement and enforce the EEBCs can serve as a tool to eliminate several challenges, reducing energy consumption and GHG emissions in general. While ineffective policy can undermine a conducive environment for investment in energy efficiency by creating reverse incentives, EEBCs are necessary governmental instruments to overcome the market barriers towards energy efficiency gains in the residential, commercial, and public buildings. To increase the buildings energy efficiency, EEBCs need to be tailored to the market and the local situations they are intended to affect and change; different mixes of policies are needed depending on whether the focus is on new buildings or retrofitting existing construction. This is particularly important in developing countries where rapid population growth and urbanization demand generating millions of buildings and have significant effects on energy demands.

The findings from BUILD_ME first phase show that there are several challenges linked to enforcement and implementation of EEBCs and their success to promote efficiency in the building sector in Egypt, Jordan and Lebanon. Based on several hundred interviews with stakeholders from different backgrounds (ranging from project developers to authorities, utilities and consumers), BUILD_ME first phase identified a need to take a closer look at the EEBCs in place in three countries, namely Jordan, Lebanon and Egypt. This study aims at defining the regulatory and implantation gaps regarding EEBCs implementation and provide concrete recommendations on how these gaps can be filled and pave the way for effective implementation of the EEBCs. This study “Analysis and improvement of building codes” is activity number six (Activity III.6) within the Working Package three “Framework conditions to increase the energy efficiency in the building sector” (WP3) of BUILD_ME project.

Approach and Working Steps

This report focuses on the analysis of the existing situation of the EEBCs and energy efficiency standards in the buildings. The analysis aims ultimately to formulate concrete recommendations to boost the implementation of the existing or proposed codes in the three BUILD_ME countries. This has been prepared through five methodological components: a) Data collection and parameterization for EEBCs gap analysis b) Expert interviews, c) definition of challenges and barriers, d) general recommendations. The general recommendations have been discussed with the relevant stakeholders in each country. This lead to define the priority actions to improve the implementation and enforcement of EEBCs. To fully consider the local conditions, the detailed content of each working step may differ from country to another depending on the local circumstances of each country.

Figure 2 Approach of the study and working steps



A) Data Collection and Understanding the Status Quo of EEBCs

The scanning of the status quo of EEBCs has been gathered via desktop research based on government documents, national building codes, standards and based on the expertise of the project national partners and the project team. For the data collection purposes, different sets of templates have been prepared. The desktop research aims at providing a general picture of the status in each country, which covers the data related to the scope of the regulations, the existing regulatory instruments in general and the technical scope of the EEBCs.

The Existing Regulatory Instruments

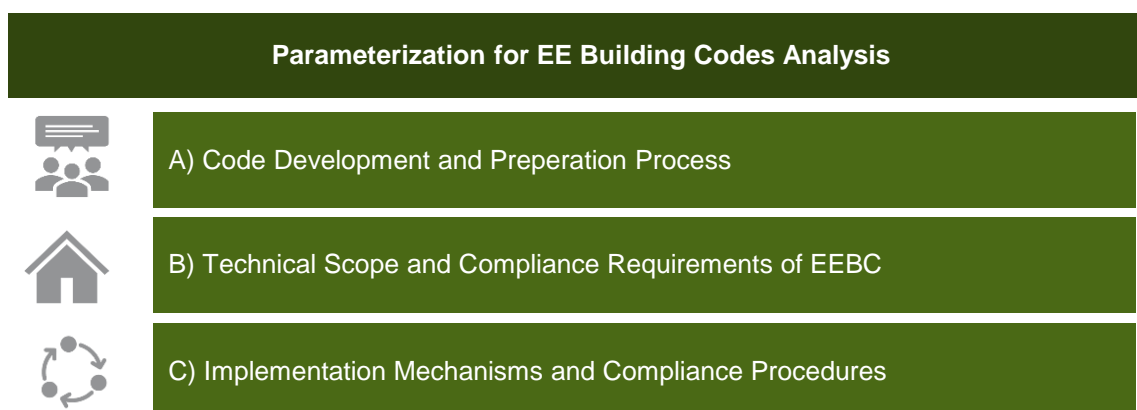
The data collection started with focusing on identifying laws, codes and regulations governing the energy efficiency in the building sector. The following table shows the key information collected, the type of regulatory instrument and the key criteria for analysis and data. This also includes the entities mandated and responsible to prepare, issue and enforce the regulations.

Table 1 A list of the categories of existing regulatory instruments for EE in the building Sector

The Existing regulatory instruments	
Building laws and bylaws	mandatory, voluntary, endorsed, or other status
The legal status of the existing instrument	mandatory, voluntary, endorsed, or other status
Special code / requirements for building types	Commercial, residential, tourism, public etc.
Energy rating certification scheme	Type, standards, labelling
voluntary performance standards	Other standards that exist and applied
Other ambitious / proposed instruments	Planned, proposed, endorsed etc.
Building energy certification schemes	Available certification or labels systems

Parameterization of EE Building Code Gap Analysis

In order to understand the status of EEBCs and regulations, data collected and analysed under three main categories of parameters. The first category focuses on the code development process. The second category focuses on the technical requirements and compliance paths described in the EEBCs. The third category of parameters looks closely at the implementation mechanisms of the EE Building codes including implementation plans and proposed procedures for the enforcement of the EEBCs.

Figure 3 Categories of EEBC analysis parameters


The three categories of the EEBCs analysis are shown in Figure 3. Additionally, the topics and parameters which had been used as a basis for the data collection are listed in table 2. After discussions with BUILD_ME partners, the list has been tailored based on the demands, status and local conditions of each target country: Jordan, Lebanon and Egypt. The study and the analysis of those parameters represent the substantial parts of this interim report.

Table 2 Summary of Parameterization for EEBCs Analysis

Category	Parameters	Description
Code development process	The government bodies responsible for the code	Define Mandates, activities and plans
	Stakeholders' involvement	The relevant stakeholders and involvement process
	Frequency of code updating	Define the review, extension and update plans
	Coordination with NEEAP, NDCs	Compatibility with national plans and targets
Analysis of technical scope and requirements of EEBC	Type of the Code	Prescriptive, performance based, trade-off, Mixed.
	Climate Zones in the code	Number of zones, representative cities or locations
	Building design, forms, orientation	Characteristics of building design
	Building envelope	U Value, G Value, window, roof, ground etc.
	Building systems or Standards	Lighting, domestic hot water systems, HVAC, other
	Renewable energy utilization	Solar water heaters, geothermal, solar cooling,
Analysis of Implementation Mechanisms	Implementation and compliance plans	phases, instruments, existing and future plans.
	The enforcing governmental bodies	Define those bodies and their procedures, if any
	Building permit process	Is the compliance with EEBCs enforced in the procedures of obtaining the occupancy permits?
	Entities responsible of issuing the building permits	For the different areas and levels
	Stakeholders' involvement	Architects, engineers, industries, construction etc.
	Readiness of the construction market	relevant to Industries, construction, tender etc.
	Capacity Building programs	Programs focusing on the EEBCs
	Documentation of compliance	structured (centralized) data collection platform
	Provision of technical support in design	Availability, types of Assistance,
Provision of technical support in construction	Availability, types of Assistance,	

Category	Parameters	Description
	Building delivered according to the EEBC	Number of the buildings, date and lessons learned
	New plans to enforce the code	The recent proposed governmental plans to enforce the EEBCs
	What are the relevant ongoing projects and plans	By national and international agencies.

b) Experts Interviews

The strength of such experts' interviews lies in their potential to provide a profound understanding of the existing conditions and the challenges that hinder the effective implementation of the EEBCs at the local level. After the first screening of the country status based on desk research and literature review, BUILD_ME team compiled a list of key experts with a strong relevance for the given topics in each country and based on networks of BUILD_ME team. The list of experts has been identified including government representative from the entity responsible of issuing the codes, as well as non-governmental experts from the construction and financial sector, business associations, energy agencies and relevant NGOs.

The expert interviews have been held in a semi-structured way providing one to one communication to understand what works best in each case. BUILD_ME team prepared questionnaires templates to be used during expert and stakeholders' interviews. The questionnaires work as a guidance document rather than a static set of questions to be followed. The conclusions derived from the interviews have been analysed and summarized to serve as basis for determining the next steps of the study and identifying the focus of the recommendations in each country.

C) Definition of challenges and barriers

Based on the data collected and the experts' interviews, the key challenges and barriers for implementation and enforcement of EEBCs have been identified. Those barriers covered a wide range of items under four categories of technical challenges, regulatory challenges, capacity building challenges, financial challenges. Finally, some other cross cutting challenges and barriers have been also identified.

D) General recommendations

Following the same categorizations of the challenges identified in the previous steps, a number of general recommendations have been elaborated. Those recommendations aim at the improvement of the implementation and enforcement of current EEBCs. Recommendations will include the changes that should be implemented to ensure codes are comprehensive, implementable, and accepted by the stakeholders and in line with national strategies. The advantages and goals of each recommendation have been qualitatively highlighted. The specific roles of governmental organizations that are necessary to implement the proposed actions has been also clarified.

E) Specification of the Recommendations and Exchange with Relevant Stakeholders

The barriers, challenges and recommendations have been discussed with decision-makers, responsible authorities, and sector practitioners. Organizations such as Codes responsible entity, Engineers' Associations or Building Councils have been invited for discussions. The aim is to update the recommendations, prioritize, add recommendations previously not included in the list and/or remove recommendations that the stakeholders deem not feasible. This step aims also to stay in close contact with the relevant ministries and authorities and ensure their ownership and adaption for the elaborated recommendations.

1 Energy Efficiency Building Codes in Lebanon

1.1 The Existing Regulatory Instruments Governing EE in the Building Sector in Lebanon

Lebanon has issued a number of laws, guidelines and policy instruments that govern the building sector to improve the energy efficiency in the buildings. Table 3 shows a list of the most relevant and recent laws, regulations, codes and policies of energy efficiency in the building sector in Lebanon. The main Lebanese Building law no. 646 for the year 2004 and its implementation decree are fundamental legislation that administer the building construction in Lebanon. The Lebanese Building Law does not impose detailed energy efficiency requirements for the construction of the buildings. All codes cited in Table 4 tackle the building sector in a way or another. The Lebanese Building law (646/2004) and its enforcement decrees tackle the construction sector in general. However, they include one clause related to the installation of double wall in case the developer/end-user decided to install one. Double wall in this law and its enforcement decrees is not mandatory.

The Thermal Standard for Buildings in Lebanon (TSBL 2005) has been developed in the context of Project “Capacity Building for the adoption and application of Thermal Standards for Buildings” . The project was funded by the Global Environment Facility, managed by the United Nations Development Programme, and executed under the Lebanese General Directorate of Urban Planning, Ministry of Public Works and Transport. The project falls under the Climate Change focal area and aims at the establishment of Thermal Standards for Buildings, and at enabling their adoption and application through the provision of capacity building and information dissemination. It should be noted that the word standard in the TSBL 2005 does not reflect the conventional definition of a standard and is not linked to standards developed by LIBNOR. TSBL 2005 is a report including a set of recommendations for those willing to develop energy efficient buildings.

The National Energy Efficiency Action Plans for Lebanon (NEEAP 2011-2015) and (NEEAP 2016-2020) tackle the development of EEBC, the development of MEPS and double wall installation (in the NEEAP 2016-2020). However, none of the measures related to the building code was finalized.

Following the NEEAP 2016-2020, a technical committee was created at LIBNOR to develop a standard that tackles sustainable buildings. The standard is under preparation and it will be entitled: A Building Environmental Performance- Principles, Requirements and Guidelines. This standard will be published as a voluntary standard then can be transformed to a mandatory one if any of the Lebanese stakeholders’ request this. The process of standard development by LIBNOR is explained in detail in the next section of this report.

An energy conservation law is being under study by the Council of Ministers. This law tackles some measures relative to the building sector. The law is a framework law that should be followed by executive decrees for the technical, inspection and compliance aspects development.

The General Budget Law 2019 in article 66: Sustainable buildings push towards sustainable construction. As per this law, sustainable buildings (green buildings) are the ones that fit into specific environmental, social, organizational, and energy requirements. The law does not tackle technical specifications however it only specified the benefits/incentives for the developer/end-user. A technical guideline was developed by LCEC in 2016 to facilitate the submittal of projects tackling energy efficiency in the building sector for those willing to benefit from the financing mechanism in place (NEEERA).

In conclusion, the existing laws, regulations and codes for the energy efficiency in buildings does not tackle the technical specifications of implementing such measures except for TSBL 2005. Thus, this report will tackle in general the development of an EEBC in Lebanon with a special focus on the TSBL 2005 in some tables and figures.

Table 3 List of the key laws, regulations and codes that govern EE in the Building Sector in Lebanon

Name	Type	Legal status	Implementation	Issuance Year	Issuing body
Lebanese Building Law (646), year 2004	Law	Mandatory	Enforced	2004	Parliament
Enforcement decree of the Lebanese Building Law (2005 and 2007)	Decree	Mandatory	Enforced	2005/2007	Council of Ministers
Thermal Standard for Buildings in Lebanon	Code	Voluntary	No	2005	GEF, DGUP, Ministry of public works and transport
National Energy Efficiency Action Plan for Lebanon (2011-2015)	Plan	Plan	Adopted by the Council of Ministers	2011	LCEC/MEW
National Energy Efficiency Action Plan for Lebanon (2016-2020)	Plan	Plan	Adopted by the Minister of Energy and Water	2016	LCEC/MEW
Energy Conservation Law	Law	Mandatory	Approved by the Ministry of Energy and Water and under review by Council of Ministers	Under Study by the COM	Parliament
LCEC Guidelines on Preparing technical proposals for non-certified high energy performance buildings	Guidelines	Mandatory for NEEREA loans	Adopted by BDL	2016	LCEC

Name	Type	Legal status	Implementation	Issuance Year	Issuing body
Building Environmental Performance-Principles, Requirements and Guidelines	Standard	Voluntary	LIBNOR	Under Preparation	LIBNOR
General Budget law	Law	Mandatory	Enforced	2019	Parliament

Lebanese Standards Institution LIBNOR started the preparation of a number of codes and standards such as standards of Building Construction, Refrigeration and Air Conditioning; Machinery, Solar Energy, Building Environment Design, Thermal Insulation and Home appliances. Most of those standards are not mandatory by law, they rather offer guidance for developers, investors and engineers who are intended to construct energy efficient buildings.

Table 4 Standards for building components issued by Lebanese Standards Institution LIBNOR (LCEC, 2016)

Standard	Title	Mandatory	Year
NL 13162	Thermal insulation products for buildings – Factory made mineral wool (MW) products – Specification	No	2009
NL 13163	Thermal insulation products for buildings – Factory made products of expanded polystyrene (EPS) – Specification	No	2009
NL 13164	Thermal insulation products for buildings – Factory made products of extruded polystyrene foam (XPS) – Specification	No	2009
NL 13165	Thermal insulation products for buildings – Factory made rigid polyurethane foam (PUR) products – Specification	No	2009
NL 13166	Thermal insulation products for buildings – Factory made products of phenolic foam (PF) – Specification	No	2009
NL 13786	Thermal performance of building components – Dynamic thermal characteristics – Calculation methods	No	2006
NL 13789	Thermal performance of buildings – Transmission heat loss coefficient – Calculation method	No	2005
NL 14063	Thermal insulation products for buildings – In-situ formed expanded clay lightweight aggregate products – Part 1: Specification for the loose-fill products before installation	No	2009
NL 14316	Thermal insulating products for buildings – In-situ thermal insulation formed from expanded perlite (EP) products – Part 2: Specification for the installed products	No	2009
NL 14317	Thermal insulation products for buildings – In-situ thermal insulation formed from exfoliated vermiculite (EV) products – Part 1: Specification for bonded and loose-fill products before installation	No	2009
NL 6946	Building components and building elements- Thermal resistance thermal transmittance: Calculation method	No	2006
NL 10211	Thermal bridges in building construction – Heat flows and surface temperatures – Part 1: General calculation methods	No	2006

Standard	Title	Mandatory	Year
NL 14782	Thermal bridges in building construction – Linear thermal transmittance – Simplified methods and default values	No	2005
NL 823	Thermal insulating products for building applications – Determination of length and width	No	2003
NL 68	Guide to the thermal insulation and summer comfort of buildings in Lebanon	No	1999

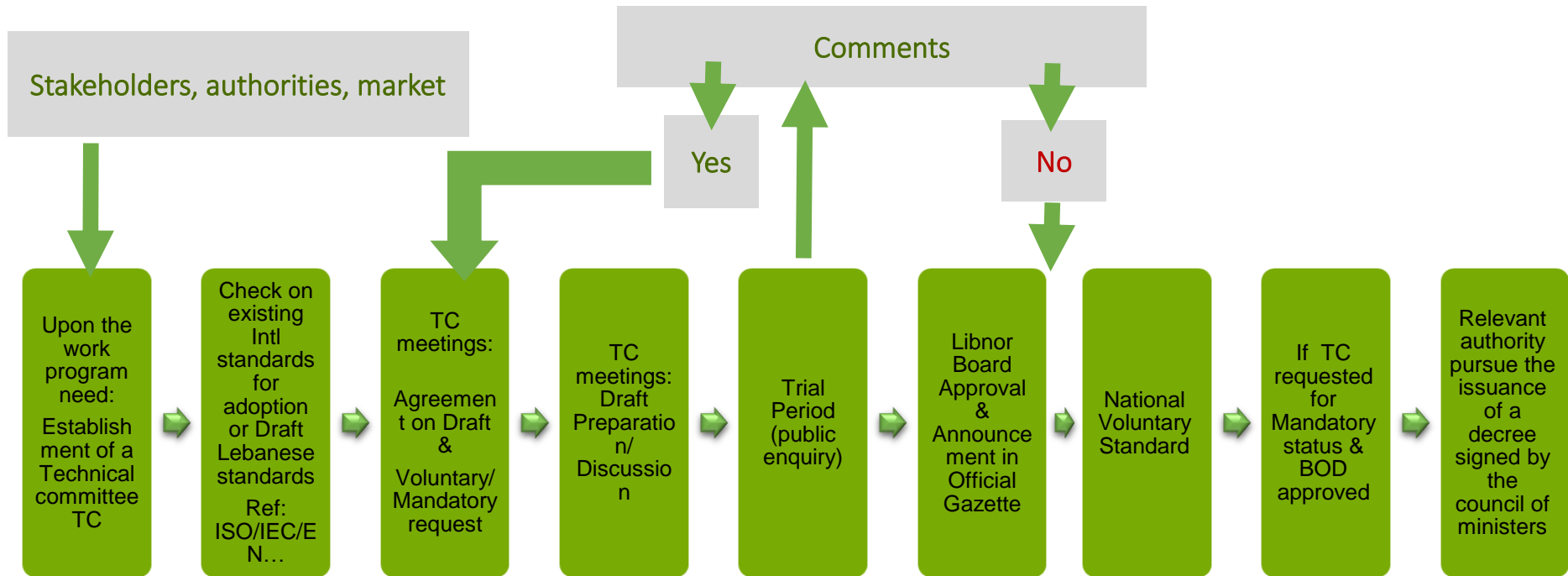
1.2 Analysis of Energy Codes for Buildings in Lebanon.

1.2.1 Code Development Process

This section tackles the process of development of a code whether it is a standard, a law or a decree. First and in general, standards are not mandatory in Lebanon, only laws and decrees are mandatory once voted at the parliament and published in the official gazette.

Standards are usually issued for compliance and quality reasons. Standards are discussed and prepared by the technical committees formed by LIBNOR. These committees include representatives from both public and private sectors, including Ministries, Public Administrations, Laboratories, Universities, Syndicates, Chambers of Commerce Industry and Agriculture, Associations, NGOs and others. Based on the context of the proposed standard, a Technical Committee (TC) is established, which includes representative from the previously mentioned sectors. The TC conducts a background check on the proposal and searches for existing international standards for adoption (such as ISO, IEC, EN), or drafts the Lebanese Standards from scratch. Within the TC meetings, the draft is agreed upon and finalized. Lebanese national standards are voluntary in principle; however, after a voluntary period and upon a suggestion from one of the involved stakeholders and approval by LIBNOR's Board of Directors, a standard may be granted the mandatory status by a decree from the Council of ministers. A standard development procedure as defined by LIBNOR is detailed in the figure below:

Figure 4: Standardization process as per LIBNOR



Second, laws development such as the building law previously mentioned should be voted at the parliament level. As per clause 18 of the Lebanese Constitution, the parliament and the council of ministers have the right to propose laws. A law shall not be published unless approved by the parliament.

The Lebanese legislator gave the deputies the right to initiate the drafting of laws by presenting law proposals that they submit directly to the presidency of the parliament.

If the law is proposed by a minister(s), it shall be approved by the council of ministers then it will be transferred to the parliament by a decree signed by both the President of the Republic, the Prime Minister, and the competent ministers.

In addition, the council of ministers' issues decrees called enforcement decrees related to laws already voted and approved at the parliament such as the enforcement decree related to the building law mentioned in table 3.

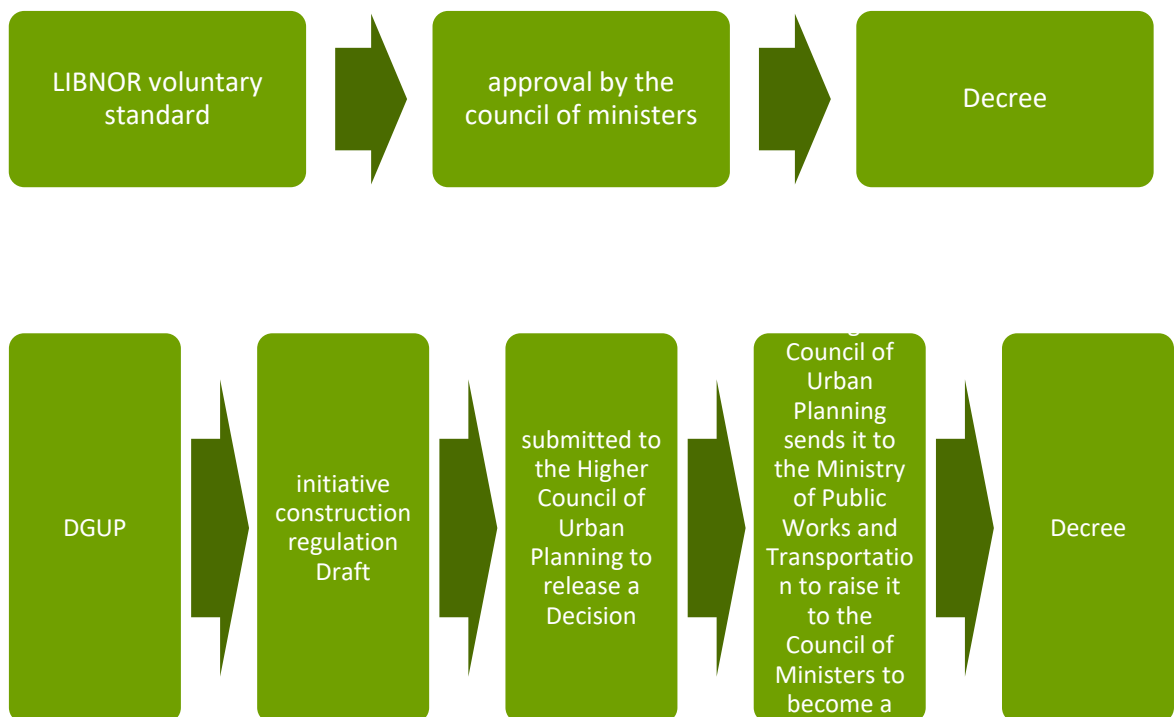
In summary, a new building code in Lebanon to be mandatory can take two paths: a decree and a law. As a law, the proposal shall follow the procedure described earlier. As a decree, through the Directorate General of Urban Planning (DGUP) in cooperation with several parties (Ministry of Industry, Ministry of Energy and Water, Order of Engineers, European Union etc...) draft an initiative construction regulation. Then it is submitted to the Higher Council of Urban Planning to release a Decision. Then, the Higher Council of Urban Planning sends it to the Ministry of Public Works and Transportation to raise it to the Council of Ministers to become a Decree.

through LIBNOR that issues it as a voluntary standard then mandatory after approval by the council of ministers as a decree.

through one ministry's request (or more than one) through the council of ministers.

Figure 5 shows the three schemes for a decree development in Lebanon.

Figure 5: Three schemes for a decree in Lebanon



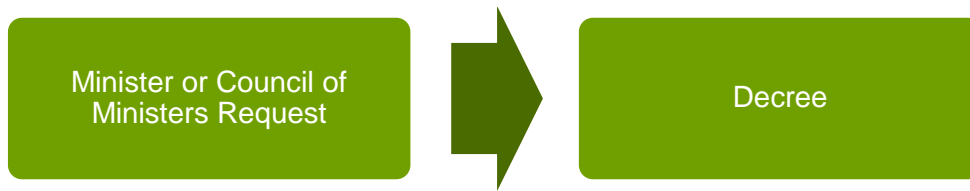


Table 5 below describes the stakeholders that might be involved in a building code in Lebanon in general whether it is a standard as per LIBNOR, a decree or a law.

Table 5 Development Process of Thermal Code for Buildings in Lebanon

Category	Parameters	Description
Code development process	The responsible governmental bodies	<ul style="list-style-type: none"> LIBNOR, General Directorate of Urban Planning or any ministry
	Stakeholders involvement	<ul style="list-style-type: none"> Public (Private Sector in case of a LIBNOR standard is involved in the technical committees) LCEC, Order of Engineers and Architects UNDP, Lebanon Green Building Council (LGBC) Universities Consultants
	Frequency of code updating	There is no law or obligation to update a code published under decree or law. In case of LIBNOR Standard, it depends on the demand of the stakeholders involved in any TC or upon the request of any entity
	Coordination with NEEAP	Lebanon NEEAP 2016-2020 Summary of activities relevant to the code: B01: Double Wall Ordinance B02: Testing Facility for Building Components B03: Building Code B04: Use of Efficient Equipment B05: Energy Performance Certificate for Buildings B06: Energy Audits for Public Buildings B07: Implementing Energy Efficiency Measures in Selected Public Buildings B08: Pilot Project: Exemplary Green Building (LCEC new premises) B09: Capacity Building for Refurbishment

Category	Parameters	Description
	Coordination with NDCs	In the procedure of Lebanon’s first NDCs, all NEEAP (2016-2020) measures including the building measures were taken into consideration. In fact, NEEAP’s results and initiative were shared with the ministry of environment (MoE) and several meetings were conducted between MoE, MEW and LCEC regarding this matter.

Several initiatives exist in order to incentivize end-users to adopt energy efficiency measures in Lebanon. One of them is the National Energy Efficiency and renewable Energy Action (NEEERA) financing mechanism. Guidelines were developed by LCEC to facilitate the submittal of files requesting loans, These Guidelines request detailed information regarding the new measures to be implemented (double wall, double glazing) and the energy savings compared to a business-as-usual case. The energy savings are computed using simulation tools such as the Hourly Analysis Program (HAP). The Final Energy Consumption is based on the MED-ENEC study entitled “Energy Efficiency in the Construction Sector in the Mediterranean- A Roadmap for Developing Energy Indicators for Buildings in Lebanon” .

1.2.2 Technical Scope and Requirements of Thermal Code for Buildings in Lebanon

As mentioned previously, TSBL 2005 is the only thermal code for buildings available that details technical specifications for EE in buildings. Table 6 describes the technical recommendations as mentioned in TSBL 2005 besides different laws, decrees and standards if available.

Table 6 Key Technical scope and requirements of EEBCs in Lebanon

Parameters	Description
Type of the Code	Both Prescriptive and performance based
Climate Zones in the code	Number and names of the climate zones Zone 1: Coastal Zone 2: Western Mid-Mountain Zone 3: Inland Plateau Zone 4: High Mountain
Building design and forms	NA
Building envelope Thermal Resistance/U value for walls and roofs	Prescriptive Requirements: Check section 1.2.3 of this report + table A in Annex 1 for Maximum allowable U-Value of a building component (W/m ² K) is required according to the climatic zone and building category: - Category 1: Residential Buildings: - Category 2: Non-Residential Buildings:

Parameters		Description
	Ground Floor	<p>NA Prescriptive Requirements:</p> <p>Definition of minimum allowable thermal resistance ($m^2.K/W$) and width of Thermal Insulation (m) for Slab on Ground is required according to the climatic zone and building category:</p> <p>- Category 1: Residential Buildings:</p>
	Fenestration, Shading and WWR	<p>Prescriptive Requirements:</p> <p>Maximum reference effective fenestration ratio (EFR) required according to the climatic zone and building category:</p> <p>- Category 1: Residential Buildings:</p> <p>Zone 1: EFR<11%</p> <p>Zone 2 : EFR<13%</p> <p>Zone 3 : EFR<11%</p> <p>Zone 1 : EFR<16%</p> <p>- Category 2: Non-Residential Buildings:</p> <p>Zone 1: EFR<10%</p> <p>Zone 2 : EFR<13%</p> <p>Zone 3 : EFR<11%</p> <p>Zone 1 : EFR<21%</p>
	Thermal Comfort	<p>Defined thermal comfort in the code</p> <p>-Temperature between 22°C and 24°C and Relative Humidity between 40% and 60%</p> <p>-Zone 1: Coastal below 200 m altitudes: Winter Design Dry-Bulb = 7°C, Summer Design Dry-Bulb = 34°C</p> <p>-Zone 1: Coastal above 200 m altitudes: Winter Design Dry-Bulb = -3°C, Summer Design Dry-Bulb = 34°C</p> <p>-Zone2: Winter Design Dry-Bulb = -4°C, Summer Design Dry-Bulb = 34°C</p> <p>-Zone3: Winter Design Dry-Bulb = -4°C, Summer Design Dry-Bulb = 34°C</p> <p>-Zone 4: Winter Design Dry-Bulb = -5°C, Summer Design Dry-Bulb = 34°C</p>
Building systems	Natural Ventilation	- ASHRAE Standards 62.1 and 62.2 are used in Lebanon

Parameters	Description	
Heating, ventilation & air conditioning (HVAC)	<ul style="list-style-type: none"> - ASHRAE Standard 90.1 and 90.2 are used in Lebanon 	
Domestic hot water system	<ul style="list-style-type: none"> - ASHRAE Standard 90.1 and 90.2 are used in Lebanon - Solar ordinance under preparation. The solar ordinance consists of the obligation of Solar Water heaters to be installed in new buildings. If there isn't enough space, buildings developers have to install heat pumps for domestic hot water use. The solar ordinance is in its final stages where it is approved by the Higher Council of Urban Planning and will be proposed to the council of ministers by both Ministry of Industry and Ministry of Energy and Water 	
Lighting	<ul style="list-style-type: none"> - Initiative 1 in NEEAP: banning the import of incandescent lamps to Lebanon - Compact Fluorescent Lamps (CFL) program in the Residential Sector 	
Daylighting	<ul style="list-style-type: none"> - NA 	
Renewable Energy Applications	Solar Hot Water	<ul style="list-style-type: none"> - As per the solar ordinance, the sizing of the active surface of the SWH is 1.5 m²/100 L -Decree 5305 dated October 28, 2010 assigned IRI to test and certify all SWH before introduction to the Lebanese market. This decree states that the following standards are mandatory for all type of SWH: NL EN 12975 (Parts 1 & 2)-Thermal solar systems and components (solar collectors) NL EN 12976 (Parts 1 & 2)-Thermal solar systems and components (factory made systems) NL EN 12977 (Parts 1, 2 & 3)-Thermal solar systems and components (custom build systems)
	Geothermal	<ul style="list-style-type: none"> No requirements
	Solar Cooling	<ul style="list-style-type: none"> NA
	PV- installation	<ul style="list-style-type: none"> Only standards are applied for applications under NEEREA. - All PV modules used in projects submitting to NEEREA loans, should have a certificate of compliance to either of the following standards:

Parameters	Description
	a- IEC 61215:2005: crystalline silicon terrestrial photovoltaic (PV) modules – design qualification and type approval b- IEC 61646:2008: thin-film terrestrial photovoltaic (PV) modules – design qualification and type approval All PV modules should have a certificate of compliance with the followings standards: a IEC 61730-1: photovoltaic (PV) module safety qualification – part 1: requirements for construction b- IEC 61730-2: photovoltaic (PV) module safety qualification – part 2: requirements for testing
Minimal Energy Performance Standards	No (under development)

Besides TSBL2005, here below a description of some codes that tackle the energy efficiency in the Lebanese Buildings:

a) Lebanese Building code

The Lebanese building code under law 646/2004 mentions double wall as voluntary measure. In case of double wall, outer walls areas are not accounted within the investment factor and the general investment factor. The definition of the Investment factor as per Article 14 of the Lebanese building code as follows:

The surface investment rate is the ratio between the area of the horizontal projection of the building and the area of the plot/land. As for the general investment factor, it is the ratio between the building area and its floors area counted in the investment and the area of the plot/land.

The non-counted outer walls include insulation thickness, if any, and parts of the columns within the exterior walls and ranging in thickness between twenty-two centimeters / 22 cm / and thirty-five centimeters / 35 cm /. It is required that the separation between the two walls should not be less than 3 cm (three centimeters) and the outer wall thickness not less than ten centimeters (10 cm).

b) Building Environmental Performance- Principles, Requirements and Guidelines (under preparation)

However, the technical committee TC205: Building Environment design at LIBNOR has been preparing a new building code to be entitled Building Environmental Performance- Principles, Requirements and Guidelines. This code will include 5 sections: Energy, Indoor Environmental Quality (IEQ), Water, Waste and Site. TC205 includes stakeholders from both public and private sectors that were divided into 5 working groups relative to the proposed sections. This committee has already prepared the Energy and IEQ sections and the final draft shall be shared soon with the committee for commenting.

The Energy section of this new building code includes two parts: envelop and equipment. The Energy Working Group has adopted a prescriptive approach for both parts. The Energy section will be shared with Navigant team as soon as possible.

c) General Budget law 2019

The General Budget Law 2019 in article 66: Sustainable buildings push towards sustainable construction. As per this law, sustainable buildings (green buildings) are the ones that fit into specific environmental, social, organizational, and energy requirements.

- 1- Subject to the laws and regulations pertaining to building sector, the landlord of a non-built property, who wishes to establish a sustainable building in accordance with the first clause above, can benefit from incentives related to an increase in the investment factors, and the number of floors and the height, as follows:
 - In the regions where the number of permitted floors does not exceed four floors: an increase in the general investment factor up to 25 percent, provided that this increase is distributed evenly over the number of floors
 - In regions where the number of permitted floors exceeds four: only one floor can be added to the building by which it's space/area does not exceed the space/area of the last floor.
- 2- The owner of the property/plot/land pays fees equal to 80% of the value of the presumed land of the additional spaces, such fees are collected for the benefit of the state's treasury.
- 3- Licensed buildings that are under construction can benefit from the provisions of this law, provided that the building permits are modified according to this law.
- 4- This article's application shall be determined by a decree taken by the council of ministers based on the proposal of the Minister of Public Works, Minister of Transport, Minister of the Environment, Minister of Social Affairs, Minister of Energy and Water, after the approval of the Higher Council of Urban Planning.

On the other hand, LIBNOR adopted voluntary energy efficiency standards for five household appliances: solar water heaters (SWH), compact fluorescent lamps (CFL), refrigerators, A/C split units and electric and gas water heaters. In decree 5305, passed on October 28, 2010, Lebanon's Council of Ministers (CoM) made the standards mandatory for solar water heaters (SWH) and compact fluorescent lamps (CFL).

1.2.3 EEBCs Compliance procedures of Thermal Standard for Buildings in Lebanon

This section of the report summarizes the requirements mentioned in TSBL 2005 since it is the only available code with technical specifications for EEBC in Lebanon. Other compliance schemes would be developed once a law, or a decree are in place.

TSBL 2005 requirements apply for new buildings and new additions to existing buildings including two categories: category 1: residential buildings and category 2: non-residential buildings. Residential buildings include residential complexes, individual residences, secondary seasonal residences and chalets, dormitories whereas non-residential buildings include commercial and retail (offices, stores, shopping malls, restaurants, cinemas, etc.), hospitality facilities (hotels, motels, etc.), educational facilities (schools, universities, etc.), health care facilities (hospitals, nursing homes, etc.), institutional facilities (government services, etc.) and indoor Sports facilities.

TSBL 2005 does not tackle existing building, buildings used for industrial processing, manufacturing and storage purposes, religious buildings and buildings that require particular indoor environmental conditions such as greenhouses and warehouses.

In addition, it provides a choice of two compliance paths: Prescriptive Path and Performance Path. As the names imply, the prescriptive path requires the user to satisfy a certain standard such as the requirement to install a pre-specified R-value in an exterior wall while the performance path requires the entire building to perform up to a pre-specified standard. Having more than one compliance path offers more flexibility and allows the user to choose the path that best suits his proposed building design.

a) Prescriptive Path:

It is based on the use of equations and tabulated reference values and requires the compliance with the thermal transmittance value and the effective fenestration ratio. Note that compliance with the thermal transmittance value can be applied using individual component approach or overall building envelope approach.

a.1. Compliance with the Thermal Transmittance using the Individual Component Approach:

For Roofs, Walls, Glazing and Exposed and Semi-Exposed Floors, the requirement is demonstrated in maximum U-value. The two equations used are:

$$(a) \text{ For the calculation of the building component U-Value: } U_i = \sum (1/R_1 + 1/R_2 \dots)$$

Where:

U_i = thermal transmittance of the proposed building component ($W/m^2.K$)

$1/R_1, 1/R_2, \text{ etc.}$ = thermal resistance of each layer of material ($m^2.K /W$)

$$(b) \text{ For the compliance with the Reference Value: } U_i \leq U_{ref}$$

Where:

U_{ref} = maximum allowable thermal transmittance of a building component ($W/m^2.K$)

Note the above calculations should exclude the effects of interior and exterior films.

The Reference Thermal Transmittance Values per component can be found in table A in Annex 1.

For Slabs on Ground, the requirement is limited to slabs on grounds constituting the floors of conditioned spaces and is demonstrated as a minimum thermal resistance and a minimum width for an insulation layer placed on the perimeter of the slab on ground.

The Reference Thermal Resistance Values and Width of Thermal Insulation for slab on ground can be found in table B in Annex 1

a.2. Compliance with the Thermal Transmittance using the Overall Envelope Approach:

In this approach, the overall envelope U-value of the proposed building is less than or equal to the overall envelope U-value of the reference building where the U-values of each individual building component of the reference building must comply with the prescriptive requirements of the individual component approach (table A and table B in Annex 1).

The calculation of the overall envelope U-value of the proposed building is done as per the below equation:

$$(c) U_{env} = \sum (U_i \times A_i) / \sum A$$

The calculation of the overall envelope U-value of the reference building is done as per the below equation:

$$(d) U_{ref} = \sum (U_{i-ref} \times A_i) / \sum A$$

Compliance with the overall building envelope U-value equation:

$$(e) U_{env} \leq U_{ref}$$

Where:

U_i = Thermal transmittance of the individual component assemblies (roofs, exposed walls, exposed ground floors, semi-exposed ground floors, windows and skylights) ($W/m^2.K$)

U_{i-ref} = Reference Thermal transmittance of the individual component assemblies ($W/m^2.K$) as per the component approach of the prescriptive path.

A_i = Area of individual component assemblies (m^2).

A = Area of all envelope components enclosing conditioned spaces or exterior components for unconditioned building (roofs, exposed walls, exposed ground floors, semi-exposed ground floors, windows and skylights) (m²).

a.3. Compliance with the Effective Fenestration Ratio (EFR):

The effective fenestration ratio (EFR) is used to evaluate the impact of solar load on heating and cooling energy usage of a building.

The compliance is achieved when the effective fenestration ratio of the proposed building is less than or equal to maximum reference effective fenestration ratio. The reference effective fenestration ratio values are presented in table C in Annex 1.

Note that the maximum reference effective fenestration ratio is defined according to the climatic zone and category of buildings. It is mandatory that the window size and orientation used for the calculation of EFR of the proposed building and EFR of the reference building be the same.

The calculation of the EFR of the proposed building is done as per the below equation:

$$(a) FR = \frac{\sum (A_{wi} \times Sc_{wi} \times ASF_{wi})}{\sum A_v} + 2 \frac{\sum (A_{si} \times Sc_{si})}{\sum A_h}$$

$$(b) EFR \leq EFR_{ref}$$

Where:

A_{wi} = Area of the individual window (m²)

Sc_{wi} = Shading coefficient of the individual window. The glass shading coefficients can normally be obtained from the manufacturer's documentation

ASF_{wi} = Architectural shading factor of the individual window. Tables D, E and F in Annex1 summarize respectively the results for unprotected windows, windows with overhangs, windows with fins, and windows with both overhangs and fins.

A_v = Area of all vertical surfaces (opaque walls + windows) (m²)

A_{si} = Area of the individual skylight (m²)

Sc_{si} = Shading coefficient of the individual skylight

A_h = Area of all horizontal surfaces (roofs + skylights) (m²)

b) Compliance Path

It is based on the calculation of the total annual heating and cooling requirements for a proposed building, which in turn should be less or equal the total heating and cooling requirements of a similar reference building. The compliance is demonstrated via usage of an hourly-energy simulation software tool approved by the competent Lebanese authority.

Compliance with the Annual Heating and Cooling Energy Requirements equation:

$$E_{building} \leq E_{reference}$$

Where:

E_{building}: computed annual thermal energy needs of the proposed building (kWh/year) via the approved software tool and using inputs of the proposed building including the weather files and the fixed simulation parameters which have been approved by the competent Lebanese authority.

E_{reference}: computed annual thermal energy needs of the reference building (kWh/year). The building envelop components should comply with the requirements of the individual component approach of the prescriptive path.

Note that the following listed simulation parameters must be identical in both the proposed building and the reference building:

- Weather file for simulation
- Exterior design temperatures
- Interior temperature set-point in cooling mode
- Typical occupancy schedule

- Occupant density
- Occupant internal heat gain
- Equipment internal heat gain
- Equipment schedule
- Lighting internal heat gain
- Lighting schedule
- Process heat gain
- Process schedule
- Temperature set-points in heating
- Temperature set-points in cooling
- Temperature schedule
- Infiltration level
- Infiltration schedule
- External energy usage (e.g. Lighting)
- Domestic hot water input details (all zeros)
- System type and performance (fans, coil, compressors, boilers)
- System capacity
- System efficiency
- System operation schedule

1.3 Implementation Mechanisms of Thermal Standard for Buildings in Lebanon

The implementation depends on the type of the Building code to be adopted. If the code is a voluntary standard, incentives are needed to enforce the implementation. However, if it is a form or law then implementation decrees are published to ensure its application.

The role of Urban planning and Order of Engineers and Architects (OEA) are definitive since these two entities are responsible of issuing new permits for construction. Thus, in all cases these two entities shall be involved in the enforcement of any form of code.

For TSBL 2005, as it is a recommended voluntary standard, the implementation and compliance paths are described in the standard (and previously in this report). The compliance scheme depends on the type of the scheme prescriptive or performance approaches. For the prescriptive approach, it is a simple comparison between the recommended U- values and the implemented ones as explained previously in section 1.2.3.a. For the performance scheme, it is based on a yearly consumption as explained previously in section 1.2.3.b.

Table 7 Proposed Implementation Mechanisms of Thermal code for Buildings in Lebanon

Category	Parameters	Description
Analysis of Implementation Mechanisms	Implementation and compliance plans	Both Prescriptive and performance based (for TSBL 2005)
	The enforcing governmental bodies	Depending on its form (law, decree of standard)

Category	Parameters	Description
	Is the compliance with EEBCs enforced in the procedures of obtaining the occupancy permits	No
	Entities responsible of issuing the building permits	Urban Planning ,OEA and municipalities
	Stakeholders involvement in the implementation (e.g. Architects, engineers, industries, construction etc)	Architects and engineers: Design and Commissioning OEA (as a body): checking of drawings Municipalities: Monitoring and issuance of permits in some cases Urban planning: Verification and issuance of permits
	Readiness of the construction market relevant to Industries, construction, tender etc.	The Lebanese real estate market is very developed (availability of technology and know-how). Thus, it can adapt to any update in regulations and codes
	Capacity Building programs relevant to the EEBCs	Not directly. Several entities organize seminars and trainings related to EE in Buildings. These entities are OEA, LCEC, AEE.... Engineering programmes at Lebanese Universities also tackle EE in buildings such as the Renewable Energies Matser's programme at the Lebanese University in collaboration with École Supérieure d'Ingénieurs de Beyrouth (ESIB)
	Documentation of compliance	None currently
	Provision of technical support in design	No
	Provision of technical support in construction	No
	Building delivered according to the EEBC	No (according to the actual building code)
	New governmental plans to enforce the code	Yes
	What are the relevant ongoing projects and plans	NEEAP , EE law and Green building code (LIBNOR) under preparation

1.4 Summary of the Status Que of Energy Codes for Buildings in Lebanon

Building construction is regulated through the building code. It is ratified by the government regulate construction. The primary application of a building code is to new or proposed construction. It typically does not apply to existing buildings. Codes and standards typically serve as minimum requirements for many of the high-performance building attributes. The development process includes the involvement of all relevant stakeholders and synergy with existing policies and action plans. The building code takes into account the climatic characteristics of the different regions in Lebanon. It ensures compliances with many international standards. It also sets thresholds and performance targets.

As explained earlier, building codes in Lebanon can refer to standards (voluntary or mandatory), laws or decrees. The only existing standards for now is the TSBL 2005 which is a document including recommendations for EE in buildings in Lebanon. The Lebanese building code include one article related to double walls which is not mandatory. However, this article recommends how to install the double wall.

The General budget law 2019 tackles also the concept of sustainable buildings without going into the details of implementation or the technical requirements. In conclusion, no mandatory scheme for EE in buildings is in place. LIBNOR in its committee TC205 has started the development of a standard that tackles the EE aspect in the envelope and the equipment.

Table 8 Summary of status of the Thermal Code for Buildings in Lebanon

Category	Parameters	Description
Code development process	The responsible governmental bodies	LIBNOR, General Directorate of Urban Planning or any ministry
	Stakeholders involvement	<ul style="list-style-type: none"> ▪ Public (Private Sector in case of a LIBNOR standard is involved in the technical committees) ▪ LCEC, ▪ Order of Engineers and Architects ▪ UNDP, ▪ LGBC ▪ Universities ▪ Consultants
	Frequency of code updating	There is no law or obligation to update a code published under decree or law. In case of LIBNOR Standard, it depends on the demand of the stakeholders involved in any TC or upon the request of any entity

Category	Parameters	Description
	Coordination with NEEAP	Lebanon NEEAP 2016-2020 Summary of activities relevant to the code B01: Double Wall Ordinance B02: Testing Facility for Building Components B03: Building Code B04: Use of Efficient Equipment B05: Energy Performance Certificate for Buildings B06: Energy Audits for Public Buildings B07: Implementing Energy Efficiency Measures in Selected Public Buildings B08: Pilot Project: Exemplary Green Building (LCEC new premises) B09: Capacity Building for Refurbishment
	Coordination with NDCs	Yes. In the procedure of Lebanon's first NDCs, all NEEAP (2016-2020) measures including the building measures were taken into consideration. In fact, NEEAP's results and initiative were shared with the ministry of environment (MoE) and several meetings were conducted between MoE, MEW and LCEC regarding this matter.
Technical scope and requirements of EEBCs in Lebanon	Type of the Code	Both Prescriptive and performance based
	Climate Zones in the code	Zone 1: Coastal Zone 2: Western Mid-Mountain Zone 3: Inland Plateau Zone 4: High Mountain
	Building design and forms	
	Building envelop	Thermal Resistance/U value for walls and roofs
Ground Floor		Prescriptive Requirements: Check paragraph 1.2.3 + Table B in Annex 1

Category	Parameters	Description
	Fenestration, Shading and WWR	Prescriptive Requirements: Check paragraph 1.2.3 + Tables C, D, E and F in Annex 1
	Thermal Comfort	
	Natural Ventilation	- ASHRAE Standards 62.1 and 62.2 are used in Lebanon
	Heating, ventilation & air conditioning (HVAC)	ASHRAE Standard 90.1 and 90.2 are used in Lebanon
Building systems	Domestic hot water system	- ASHRAE Standard 90.1 and 90.2 are used in Lebanon - Solar ordinance under preparation.
	Lighting	- Initiative 1 in NEEAP: banning the import of incandescent lamps to Lebanon - CFL program in the Residential Sector
	Daylighting	NA
	Solar Hot Water	- As per the solar ordinance, the sizing of the active surface of the SWH is 1.5 m ² /100 L
Renewable Energy Applications	Geothermal	-Mandatory standards as per Decree 5305
	Solar Cooling	Mentioned in NEEAP (2011-2015) and NREAP (2016-2020)
	PV- installation	NA Only standards are applied for applications under NEEREA
	Minimal Energy Performance Standards	No (under development)
	Number of buildings delivered according to the code	No (according to the actual building code)
Analysis of Implementation Mechanisms	Implementation and compliance plans	Both Prescriptive and performance based
	The enforcing governmental bodies	<ul style="list-style-type: none"> Depending on its form (law, decree of standard)
	Is the compliance with EEBCs enforced in the procedures of obtaining the occupancy permits	No
	Entities responsible of issuing the building permits	<ul style="list-style-type: none"> Urban Planning and OEA

Category	Parameters	Description
	Stakeholders involvement in the implementation (e.g. Architects, engineers, industries, construction etc.)	Architects, engineers, municipalities and Urban planning
	Readiness of the construction market relevant to Industries, construction, tender etc.	The Lebanese real estate market is very developed; thus, it can adapt to any update in regulations and codes
	Capacity Building programs relevant to the EEBCs	Not directly
	Documentation of compliance	None currently
	Provision of technical support in design	No
	Provision of technical support in construction	No
	Building delivered according to the EEBC	No (according to the actual building code)
	New governmental plans to enforce the code	Yes
	What are the relevant ongoing projects and plans	NEEAP, EE law and Green building code (LIBNOR) under preparation

2 Summary of the Experts' Interviews

The semi-structured interviews were conducted with six experts in the field of energy efficiency in the building sector in Lebanon from various disciplines and sectors to define the main barriers for a successful enforcement of energy codes and the key recommendations for overcoming them. The full documentation of the interviews and the questionnaires used for this purpose are available in the [Annex 2](#) of this report. The questionnaires covered several aspects around the topic including the technical aspects, the institutional and regulatory barriers, financial issues, the capacity building and awareness challenges. The questionnaires also included questions to define the key and general recommendations for the improvement of the EEBCs and better enforcement informant and implementation of the codes.

2.1 Challenges and Barriers of the Enforcement and Implementation of EEBCs

2.1.1 *The Technical Challenges*

Codes and Standards in Lebanon are mainly addressed to designers with no implementation section or guideline. Design engineers can comply with the standards on paper with no real implementation on field. In addition, there is an absence of implementation and verification scheme that ensures proper installation. Inspection is a challenge to the responsible entities, namely OEA and Urban planning, and must be done at different stages of the construction. Thus, the entity must create an implementation scheme that is highly transparent. Other technical challenges are the lack of specialist in the technical execution of the EE measures. In addition, some still prefer the conventional designs and are still redundant about the environmental, economic and social benefits of EE measures. Finally, there is a lack of data about the EE products available in the local market.

2.1.2 *The Institutional and Regulatory Challenges*

Building codes do not tackle existing buildings because of their various ownership status (owned, rented, old rent. The ownership will define the responsibilities of each party and who is responsible to comply with the new code or standard if mandatory. Another point is the lobby of interest. Some people with opposite interest, real estate companies for example, have the connections to decisions makers and hinder making the codes mandatory.

Moreover, any building or house 250 m² or less does not need an engineer signature, which means that the drawings and the design are not verified by a competent engineer registered at the Order of Engineers and Architects. To be noted that in Lebanon, only engineers registered at the OEA can verify the drawings and the plans. Finally, in the elaboration process of new codes and standards, some inactive stakeholders such as public entities are not collaborating, the organization between the different stakeholders is inefficient.

2.1.3 *Capacity Building and Awareness Challenges*

There is a misconception related to the cost of EE measures. Another challenge is the absence of awareness for fresh engineers, and technicians working in the sector.

2.1.4 *Financial Challenges Related to the Implementation of EEBCs*

The existing financing mechanism mainly target medium and large projects with little interest in small projects. However, the procedure is very suitable for PV and SWH projects, it faces

some difficulties in case of large projects. Besides the financing mechanism, there is a lack of knowledge about the payback period and long-term savings of EE measures, which limit the comparison to the investment cost. Thus, developers avoid the EE measures in order to minimize the initial cost and in some cases taking into consideration that they will not benefit from the savings on the short term.

Table 9 Summary of challenges of the implementation of EEBCs in Lebanon

Aspects	Barriers/challenges
Technical	<ul style="list-style-type: none"> ▪ Codes are addressed for designers; compliance is done on paper with no mechanism for implementation check; ▪ Absence of implementation and verification scheme; ▪ Inspection at different stages of the construction is a main challenge to the Order of Engineers and Architects (OEA) and the Urban Planning; ▪ Transparency of the inspection procedure; ▪ Lack of Data about energy efficiency construction material in the local market; ▪ Work on scheme that targets overall U-value and not only double wall; ▪ Architects who still abide to conventional designs and are still redundant about energy conservation measures and their benefits; ▪ Lack of specialists in the technical execution of measures related to energy efficiency.
Institutional and regulatory	<ul style="list-style-type: none"> ▪ Political Barrier: some people with opposite interest have the power to hinder making standards mandatory; ▪ Difficulties to cover the existing building in a mandatory standard because of its complex status (owned, rented, old rent...), and defining responsibilities; ▪ Some stakeholders are inactive in the development of codes; ▪ Weak cooperation between the different stakeholders specifically between the private and public entities; ▪ Lack of organization between the stakeholders; ▪ Permit for buildings/apartments less than 250 m² does not need mechanical engineers' signature.
Capacity Building and awareness	<ul style="list-style-type: none"> ▪ Energy efficiency measures are always linked with higher investment costs which is not always the case; ▪ A lack of knowledge on when and where to choose envelope measures; ▪ Lack of energy efficiency awareness within fresh engineers; ▪ Lack of trainings for technicians on the new energy efficiency technologies; ▪ Challenge to reach elder engineers.
Financial	<ul style="list-style-type: none"> ▪ Lack of financing mechanism for small projects; ▪ Lack of awareness about the payback period and operational cost of the energy efficiency systems compared to the initial investment; ▪ Objection from the developer about the increase of initial investment as they will not benefit from the savings on the short term.

2.2 General Recommendations for the Implementation of EEBCs

2.2.1 Technical Recommendations

While elaborating the codes and standards, a checklist with the minimum requirements for permits must be included. In addition, to a checklist for the implementation and verification process. The inspection must be done by well-trained individuals, this is why a qualification

scheme to choose these inspectors has to be done. Capacity building and training program for the inspectors shall be prepared for inspection in the construction different phases.

It will be beneficial to create a database for the EE materials and appliances in the local market, and to support the local EE industry. While elaborating the codes, existing building and renovations must be included, because they form a wide share of the buildings in Lebanon. In addition, some experts recommend the development of automation codes that might lead to reducing energy consumption in buildings.

2.2.2 Institutional and Regulatory Recommendations

The main point is to clearly organize the codes elaborating process and the role of each stakeholder under one umbrella, to boost the process and be more effective. Municipalities must be included, for their important role to verify the installation. Within the OEA, the engineers need to be divided into groups for design check, implementation, inspection, etc.

Codes must be prepared based on the different climatic zones, and regularly updated and simplified. For existing building, a labelling mechanism must be done and include incentives for implementation. And finally, these codes have to go mandatory gradually.

2.2.3 Capacity Building and Awareness Recommendations

Capacity building must start from technicians and up to the engineer's level. The different stakeholders in the building sector (engineers, architects, developers, owners, etc.) must be tackled with trainings about the benefits of EE measures. Sessions about how to choose the EE measures based on the climatic zones must be organized for engineers and architects. EE courses can be integrated in the university programs specifically in the mechanical engineering programs. EE trainings must also be included in curriculum of technical schools. Also, the municipalities' inspectors must be well trained in order to verify the implementation on site.

2.2.4 Recommendations to the Financial Issues

The first step is to clarify the importance and benefits of EE measures in terms of payback period and savings, with proven examples to the users. Several financial incentives can be introduced: reduction of custom fees for the imported EE appliances, introduction of taxes on the energy class of the houses and buildings, subsidies to the suppliers of EE materials and increasing electricity tariffs which present a barrier to the EE development. Incentives must also tackle existing buildings to encourage the owners to optimize their energy consumption.

2.3 Prioritization of the Recommendations

The general recommendations concluded from the analysis and experts' interviews cover a wide range of technical, financial, Institutional and regulatory, capacity building and awareness recommendations. Some of those recommendations fall beyond the scope of BUILD_ME and/or beyond BUILD_ME timeline. Nevertheless, most of those recommendations are relevant to accelerate the implementation and enforcement of EEBCs. In order to define the focus of the next steps of this study, two methodological steps have been prepared. The first step is the evaluation of the general recommendation summarized in Table 10 (evaluation is available in [Annex 3](#)) against the following criteria:

- Highest potential to achieve BUILD_ME objectives and biggest impact
- Governmental and political support to the recommendations.
- Relevant stakeholders' interest and support (e.g. financial institution, professional association)
- Timeframe of implementing the recommendations (short term or long term)

Table 10 Summary of general recommendations of the implementation of EEBCs in Lebanon

Aspects	Recommendations
Technical	<ul style="list-style-type: none"> ▪ Capacity building: Train inspectors to verify the different measures installation at different construction phases; ▪ Create a checklist with minimum requirement for permits; ▪ Create a checklist for the implementation and verification procedure; ▪ Develop a qualification scheme for inspectors who will handle the implementation and verification; ▪ Do random inspection by a third party, to make sure that the inspection is done properly; ▪ Create an energy label for material and equipment, create a database for energy efficient material; ▪ Start to work on automation code because it is important and needs time; ▪ Support the local energy efficiency industry; ▪ Include existing buildings and renovations in relevant codes;

Aspects	Recommendations
Institutional and regulatory	<ul style="list-style-type: none"> ▪ Create a labelling scheme for existing building and provide incentives for implementation;(it is NEEAP initiative as well); ▪ Develop proper implementation monitoring and inspection scheme of energy efficiency measures; ▪ Create an umbrella that holds all the entities working on the codes and standards; ▪ Collaborate with municipalities in the verification scheme to cover all Lebanon; ▪ Simplify and regularly update the standards documents; ▪ Create code based on the climatic zones; ▪ Start to go mandatory with the standards gradually; ▪ Engineers within the OEA should be distributed into teams for design, practical, inspection, etc.
Capacity building and awareness	<ul style="list-style-type: none"> ▪ Organize trainings for architects and engineers to help in the design and the choice of the energy efficiency measure based on the climatic zone, building type...); ▪ Train the municipalities team to handle the inspection; ▪ Include standards and energy efficiency courses in the universities program; ▪ Tackle all the persons involved in the building sector: architects, engineers, owners, technicians, etc.; ▪ Train professional in technical schools; ▪ Start from technician and up to the engineers and project developer;
Financial	<ul style="list-style-type: none"> ▪ Introduce financing incentives for existing buildings; ▪ Reduction of custom fees on energy efficiency appliances and material; ▪ Provide incentives or subsidise energy efficiency material rather than give money directly to the end user. (Incentives to the supplier directly); ▪ Present running cost and payback period examples for the end user; ▪ Introduce taxes on the energy class of the buildings; ▪ Increase electricity tariff. This is impossible to tackle.

The second step was to look on the experts' statements on the prepared set of recommendations. Therefore, a workshop has been held with representatives from different stakeholders such as Lebanon Green Building Council (LGBC), The Lebanese Standards Institution (LIBNOR) and Order of Engineers and Architects – Beirut, in addition to LCEC and Guidehouse teams. The workshop aimed at periodizing the top recommendations using criteria that include:

- Governmental and political support to the recommendations (the competent authority/agency).
- Relevant stakeholders' interest and support (e.g., financial institution, professional association).
- Applicability

Based on the above, the following general recommendations have been identified to be the focus of the next steps of this study (for details please check Annex 3):

- a) A checklist of the minimum energy efficiency requirements: To create a checklist with minimum energy requirement for building permits. The requirements will be based on the TSBL2005 (or the available updated code). The checklist will be adopted for the implementation and verification procedure. This will also include:
 - Present running cost and payback period examples
 - Awareness Campaign
- b) Minimal Energy Performance Standards MEPS: To include the Minimal Energy Performance Standards (MEPS) in the code.
- c) A labelling scheme for existing and new buildings: To prepare a labelling scheme for existing building and provide incentives for implementation and compliance with the labelling scheme (it is NEEAP initiative as well).
- d) Trainings on EE building design: to organize trainings for architects and engineers to help in the design and the choice of the energy efficiency measure based on the climatic zone, building type).

In the next phases of this study, the details of the selected recommendations will be elaborated and discussed with relevant stakeholders in Lebanon.

3 Priority Recommendations to improve the EE standard in Lebanon

The priority recommendations have been further elaborated with a structure considering the following aspects:

- a) Short summary
- b) Goal(s) of action/recommendation
- c) Extended description of action/recommendation
- d) Estimation of workload/time to achieve the action/recommendation
- e) Timeline and Milestones
- f) Stakeholders and Roles
- g) Risks
- h) MRV
- i) Good practice example

3.1 A checklist of the minimum energy efficiency requirements

A) Short summary

To create a checklist with minimum energy requirement for building permits. The requirements will be based on the TSBL2005 (or the available updated code). The checklist will be adopted for the implementation and verification procedure. This will also include:

- Present running cost and payback period examples
- Awareness Campaign

B) Goal(s) of action/recommendation

Enhance energy performance of buildings (new and existing) which will lead to decreasing the country's overall energy consumption.

C) Extended description of action/recommendation

Based on Lebanese best practices in Energy Efficiency in the building sector, this recommendation tackles the definition of EE measures that could be applied in the building sector. The proposal of a checklist would include two levels of EE based on their complexities, costs and payback periods. In Fact, some measures such as replacing lighting systems with more efficient ones and/or increasing the tightness of the building are considered low hanging fruits whereas other measures such as adding insulation to the envelope (double wall concept) would be more expensive which could be defined in the checklist as a more complicated measure.

In order to move forward with this recommendation, the main steps to be adopted:

- Propose a list of EE measures in the building sector
- Check the availability of the proposed EE measures in the Lebanese market and if not available check the cost of import
- Check if the technical expertise is available in the Lebanese market
- Define a set of criteria to classify the proposed measures (cost, payback period, savings (kWh and LBP))

- Propose a list of EE measures in order of complexity
- Set stakeholders meeting with the relevant entities (OEA, LGBC, Urban Planning, LCEC, Libnor)
- Finalize the list that includes the minimum requirements based on the above criteria
- Perform trainings and awareness raising campaigns for technicians, engineers and architects
- Propose the list to the relevant stakeholders, in order to make it mandatory when getting the construction/renovation permits.
- OEA shall inspect, monitor and keep a record of the permits that abide by the minimum requirement checklist

D) Estimation of workload/time to achieve the action/recommendation

6 man-months for market survey; 6 man-months for proposing the final list; 2 man-months per year for awareness raising campaigns; 2 man-months per year for trainings.

E) Timeline and Milestones

Step	Time required (months)
Propose a list of EE measures in the building sector including meetings with local developers, installers and suppliers	6
Define a set of criteria to classify the proposed measures (cost, payback period, savings (kWh and LBP...))	2
Propose a list of EE measures in order of complexity	1
Set stakeholders meeting with the relevant entities (OEA, LGBC, Urban Planning, LCEC, Libnor)	1
Finalize the list that includes the minimum requirements based on the above criteria	1
Perform trainings and awareness raising campaigns for technicians, engineers and architects...	4
Propose the list to the relevant stakeholders, in order to make it mandatory when getting the construction/renovation permits	1

F) Stakeholders and Roles

Leading Stakeholders:

- Governmental and political support to MEW/LCEC
- Synergies with ongoing project/plan of IMLES Energy Efficient Home Appliances and COOL_UP

Supporting Stakeholders:

- Governmental and political support to Libnor, IRI, OEA, Ministry of Industry, Ministry of Trade, Ministry of Environment
- Synergies with ongoing project/plan of National Cooling Plan, GCF Readiness Project Lebanon MEPS

Relevant actors (e.g. will be affected or considered as audience)

Local manufacturers, Association of Lebanese Industrials, Association of Importers.

G) Risks

The main risk is related to the economic crisis in Lebanon. In fact, with the LBP devaluation any EE measure specifically when the material is imported would be very hard to implement even if this mandated in a law. The Lebanese people are now more concerned to ensure the basics to live.

H) MRV

This recommendation is directly related to the construction permits thus the easiest way to monitor and verify the implementation of EE measures is to integrate this list in the process of getting a construction permit where the main roles are for OEA, Urban Planning and sometimes municipalities.

I) Good practice example

The NEEREA financing mechanism allowed to widen the notion of EE in buildings through individual EE measures such as double wall, double glazing, EE equipment and though rating schemes that were eligible to subsidized loans such as LEED, BREAM and HQE.

3.2 Minimal Energy Performance Standards MEPS

A) Short summary

To include the Minimal Energy Performance Standards (MEPS) in the code. MEPS are included as a main initiative to be implemented in the first National Energy Efficiency Action Plan (NEEAP 2011-2015) and the second one NEEAP (2016-2020). This measure tackles the proposal of a list of MEPS for equipment and tools that consume energy.

B) Goal(s) of action/recommendation

- Increase awareness regarding the use of Energy Efficient Equipment
- Control the level of performance in the equipment market
- Reduce the overall energy bill on the end-user level and government levels

C) Extended description of action/recommendation

Minimum Energy Performance Standards or MEPS determine the minimum energy efficiency that products shall meet, in order to be sold in the market. MEPS tend to protect the consumers from products that have low energy performance. MEPS can be applied to most technologies. However, it should only be applied when there is certainty that alternatives are available, and these alternatives are affordable to the consumers. MEPS should be introduced for refrigerators, cooling, heating and water heating equipment, televisions, lights and electrical motors. The first step would be to start with an Energy Consumption Labeling Ordinance that would open the way to implement MEPS in Lebanon. It requires manufacturers to decrease the energy consumption of their products by establishing MEPS, therefore “pushing” the market away from the worst performing product.

The MEPS implementation procedure should include the following steps:

- Establish the legal and regulatory frameworks
- Analyze and set standards:
 - Assess the energy performance of products currently sold in the market
 - Establish the technical feasibility and cost of each technology option that might improve a product’s energy efficiency
 - Assess a national impact analysis. Determine the economic impact on consumers (purchasing+ operating cost)
 - Predict the impact on the manufacturers (if there are local ones)
- Select products and set priorities
- Develop a testing capability: define testing facilities needed and test procedures in order to have low-cost high-quality tests
- Design and implement a labeling program
- Design and implement a communication campaign
- Establish a monitoring and verification scheme
- Ensure program integrity
 - Establish fair, consistent, and practical criteria for certifying the energy efficiency of products
 - Establish sufficient penalties and adequate administrative processes for enforcement.
- Combine standards and labels with other policies (incentives, taxes)

D) Estimation of workload/time to achieve the action/recommendation

12 man-months for the legal framework; 6 man-months for establishing the monitoring and verification scheme; 6 man-months for the communication campaign; 6 man-months for developing incentives.

E) Timeline and Milestones

Step	Time required (months)
Establish the legal and regulatory frameworks	14
Analyze and set standards	3
Select products and set priorities	2
Develop a testing capability	2 (per selected product)
Design and implement a labeling program	2 (per selected product)
Design and implement a communication campaign	6
Establish a monitoring and verification scheme	6
Ensure program integrity	1 (checked yearly)
Combine standards and labels with other policies (incentives, taxes...)	6

F) Stakeholders and Roles

Leading Stakeholders:

- Governmental and political support to MEW/LCEC
- Synergies with ongoing project/plan of IMLES Energy Efficient Home Appliances and COOL_UP

Supporting Stakeholders:

- Governmental and political support to Libnor, IRI, OEA, Ministry of Industry, Ministry of Trade, Ministry of Environment
- Synergies with ongoing project/plan of National Cooling Plan, GCF Readiness Project Lebanon MEPS

Relevant actors (e.g. will be affected or considered as audience)

Local manufacturers, Association of Lebanese Industrials, Association of Importers.

G) Risks

The risk is two-fold:

- The development of a legal framework in Lebanon is complicated and takes a long time
- The economic crisis is a barrier to any end-sue to invest in EE equipment and proposing incentives (taxes reduction/exemption) is probably not possible given the huge deficit in the budget.

H) MRV

This shall be defined in the legal framework however the main role is for the Consumer Protection Service.

I) Good practice example

EU energy labeling advises the consumer on the energy efficiency and other functional performance qualities of models. Its aim is to rank all models of certain type of products with energy class range, from A to G (A being the most efficient and G the least efficient) or A+++ to D (class ranges change as equipment become more efficient). It thus “pulls” the market towards more efficient products by better informing consumers. Eco design directive is also set by the EU, it regulates the energy consumption through the setting of minimum requirements for products. Contrary to labeling, this directive is not seen by the consumer because products on the market comply automatically with these requirements. Instead, it requires manufacturers to decrease the energy consumption of their products by establishing MEPS, therefore “pushing” the market away from the worst performing product. Moreover, in Tunisia the labeling and MEPS program for household appliances was set into force in 2004. The program was coordinated by the National Agency for Energy Management (ANME) with the involvement of the main public and private key stakeholders (INNORPI, CETIME, FEDELEC, ODC). The program was implemented by the Ministry of Energy and the Ministry of industry & Trade. It was found that Standards and Labelling is the most cost-effective way to reduce energy use and GHG emissions. The lessons learnt focus on how important is to engage all stakeholders, particularly appliance manufacturers through each stage of program development. Enforcement strategy policy and effective implementation process were deemed crucial to ensure a sustainable Market Transformation.

3.3 A labelling scheme for existing and new buildings

A) Short summary

To prepare a labelling scheme for new and existing building and provide incentives for implementation and compliance with the labelling scheme (it is NEEAP initiative as well).

B) Goal(s) of action/recommendation

This recommendation aims at establishing a system of certification and labeling of the energy performance of buildings and setting minimum energy performance requirements.

- Increase awareness regarding importance of buildings labelling
- Control the level of performance in building sector
- Reduce the overall energy bill on the end-user level and government levels

C) Extended description of action/recommendation

Minimum energy performance requirements should be developed based on surveys to set the actual energy performance levels of Lebanese buildings (residential/non-residential and new/existing). The surveys should be able to show buildings energy consumption regarding heating, cooling, ventilation, hot water, and lighting. Minimum energy performance requirements should take into consideration the annual energy consumption for residential and non-residential buildings and the percentage of energy from renewable sources in the total energy consumption. Surveys are essential to set the actual level of energy performance of Lebanese buildings. After setting a minimum energy performance and a label for the energy performance levels for each type of buildings, a methodology for calculating the energy performance should be developed while relying on the methodologies used within the BUILD_ME project. Its method for application on both new and existing buildings should be clear. A template of Energy Performance Certificate shall be developed. It should include the annual energy consumption, recommendations for the cost-optimal or cost-effective improvement of the energy performance of a building or building unit. These recommendations should be technically feasible in new buildings (envelope, equipment...) and existing buildings (renovation techniques...). This measure should also specify the qualifications of certifying bodies (auditors, consultants...) and inspection templates and methods. Additional efforts shall be focused on making the scheme mandatory.

D) Estimation of workload/time to achieve the action/recommendation

3 man-months for the data collection; 3 man-months for the tool (verification of validity); 6 man-months for the proposal of a Lebanese labelling scheme; 12 man-months to propose the steps of a mandatory scheme.

E) Timeline and Milestones

Step	Time required (months)
Data collection to develop a tool generating load curves including heating, cooling, ventilation, domestic hot water, lighting, and other equipment for each type of buildings (and rely on BEP tool).	3
Load curves of each consumption station are the basis of the tool Load curves of all devices will be assembled to generate the elementary load curve of the building.	6
The assembly of the buildings load curves generates the load curve of the neighborhood or geographic area chosen.	6
Generate a performance table for each type of building (kWh/m ² .year) and calculate the final energy savings and GHG reduction.	6
Propose a mandatory scheme	12

F) Stakeholders and Roles

Leading Stakeholders: Ministry of Energy and Water/ LCEC

Supporting Stakeholders: Urban Planning and other ministries, Order of Architects and Engineers, LGBC, LCEC

Relevant actors (e.g. will be affected or considered as audience) Consumers, energy auditors, developers, real estate companies

G) Risks

The only risk in this case is the lengthy procedure of having the scheme mandatory.

H) MRV

MEW is in charge of:

- Technical inspection
- Monitoring the percentage of new buildings labeled
- Monitoring the percentage of existing buildings labeled

J) Good practice example

This initiative is based on the recommendations of the Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the Energy Performance of Buildings.

3.4 Trainings on EE building design and construction

A) Short summary

To propose full training schemes tackling all aspects of the building from design to the construction.

B) Goal(s) of action/recommendation

- To raise awareness about energy efficiency among the professionals in the building sector
- To build the capacities of professionals working in the sector

C) Extended description of action/recommendation

- Organizing continuous training sessions for engineers and architects to help in the design and the choice of the energy efficiency measure based on the climatic zone, building type
- Organizing continuous training sessions for installers of energy efficiency solutions, building constructors (Frame installation, pipes insulation, infiltration...)
- Installing a certification system for contractors in the building and the industrial sectors
- Installing a certification system for Operation and Maintenance works
- Establishing periodic examination and certification

D) Estimation of workload/time to achieve the action/recommendation

6 man-months for preparing the training material for each group of professionals; 6 man-months for extensive trainings per topic;

E) Timeline and Milestones

Step	Time required (months)
Prepare training material to tackle the design phase, construction phase and monitoring & inspection phase	12
Propose and install certification schemes	4
Perform continuous trainings	6 (per topic)

F) Stakeholders and Roles

Leading Stakeholders: Ministry of Energy and Water/ LCEC.

Supporting Stakeholders: LGBC, OEA.

Relevant actors (e.g. will be affected or considered as audience) Energy managers, ESCOs, building designers and contractors.

G) Risks

The main risk is the availability of fund to be able to implement this recommendation.

H) MRV

Number of trainings and trained professionals to be monitored by the LCEC and MEW.

K) Good practice example

The Regional Center for Renewable Energy and Energy Efficiency (RCREEE) has implemented several training programs in place. RCREEE in collaboration with the Secretariat (Energy Department - League of Arab States) of the Arab Ministerial Council of Electricity developed PA-CEMP as a standardized in-depth professional certification program for Energy Managers tailored for the Arab region. PA-CEMP runs with central management and national delivery customized based on national context. It aims to assist EE policy makers and program administrators in planning and implementing Energy Efficiency plans and related measures and achieve energy targets.

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Annex 1: Technical Specifications Tables from TSBL 2005

Table A Reference Thermal Transmittance Values per Component as per TSBL 2005

Climatic Zone	Building Category	Maximum U-value ¹ (W/m ² .K)					
		Roof	Wall	Vertical Glazing ²	Skylight ²	Exposed Floor ³	Semi-Exposed Floor ⁴
Zone 1: Coastal	1	0.57	2.10	6.2	4.3	2.60	2.60
	2	0.57	2.10	6.2	4.3	2.60	2.60
Zone 2: Western Mid-mountain	1	0.57	0.77	4.3	4.3	0.76	1.35
	2	0.57	0.77	4.3	4.3	0.76	1.35
Zone 3: Inland Plateau	1	0.57	0.77	4.3	4.3	0.66	1.00
	2	0.57	0.77	4.3	4.3	0.66	1.00
Zone 4: High Mountain	1	0.44	0.55	2.8	2.8	0.55	0.80
	2	0.44	0.55	2.8	2.8	0.55	0.80

Table B: Reference Thermal Resistance and Width of Thermal Insulation for Slab on Ground as per TSBL 2005

Climatic Zone	Building Category	Minimum Thermal Resistance (m ² .K/W)	Insulation Width (m)
Zone 1: Coastal	1	NR	NR
	2	NR	NR
Zone 2: Western Mid-Mountain	1	0.75	1.00
	2	0.75	1.00
Zone 3: Inland Plateau	1	1.00	1.25
	2	1.00	1.25
Zone 4: High Mountain	1	1.25	1.5
	2	1.25	1.5

Table C Reference Effective Fenestration Ratio (EFR_{ref}) as per TSBL 2005

Climatic Zone	Building Category ¹	Maximum Effective Fenestration Ratio (EFR _{ref})
Zone 1: Coastal	1	11%
	2	10%
Zone 2: Western mid-mountain	1	13%
	2	13%
Zone 3: Inland Plateau	1	11%
	2	11%
Zone 4: High Mountain	1	16%
	2	21%

Table D Architectural Shading Factor (ASF) for Unprotected Windows as per TSBL 2005

PF - Fins or Overhangs	ASF per Orientation			
	N	NE,NW	E,W	S,SE,SW
PF < 0.05	0.26	0.47	0.82	1.00

Table E: Architectural Shading Factor (ASF) for Windows Protected by Overhangs Only as per TSBL 2005

PF - Overhangs	ASF per Orientation			
	N	NE,NW	E,W	S,SE,SW
$0.05 \leq PF < 0.15$	0.24	0.43	0.74	0.89
$0.15 \leq PF < 0.30$	0.23	0.40	0.68	0.80
$0.30 \leq PF < 0.50$	0.21	0.34	0.57	0.64
$0.50 \leq PF < 0.70$	0.19	0.31	0.49	0.54
$0.70 \leq PF < 0.90$	0.18	0.28	0.43	0.46
$0.90 \leq PF < 1.25$	0.17	0.26	0.38	0.41
$PF \geq 1.25$	0.16	0.24	0.31	0.34

Table F: Architectural Shading Factor (ASF) for Windows Protected by Fins Only as per TSBL 2005

PF - Fins	ASF per Orientation			
	N	NE,NW	E,W	S,SE,SW
$0.05 \leq PF < 0.15$	0.23	0.42	0.76	0.92
$0.15 \leq PF < 0.25$	0.20	0.38	0.71	0.85
$0.25 \leq PF < 0.35$	0.19	0.35	0.67	0.78
$PF \geq 0.35$	0.17	0.32	0.63	0.74

Annex 2: Documentation of Expert Interviews and statements on EEBCs in Lebanon

Mrs. Sarah Jaber

Eco-Consulting

Contact Information

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Interviewee's Name (Respondent):	Mrs. Sarah Jaber
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Short Bio

Sara Jaber is a Senior Sustainability Engineer at EcoConsulting since 2011 working on BREEAM and LEED assessments, as well as other ecobuilding services including thermal modelling. She has been involved in over 40 projects in Lebanon and abroad ranging from small residential houses to large developments, comprising BREEAM Excellent and LEED Gold assessments. Sara holds a MEng in Applied Energy and a BEng of Mechanical Engineering from the American University of Beirut. She is also a LEED Accredited Professional and a Certified Energy Manager. Sara participates as a Group Coordinator (for Indoor Environmental Quality) in the Technical Committee for the development of the standard for Building Environmental Performance with the Lebanese Standards Institution (LIBNOR). Sara has been a lecturer on various workshops with EcoConsulting, including the "Eco-Building & LEED Green Associate Training" series of seminars since 2013. She was also a speaker at the Built It Green Lebanon conference in 2015 to present the Criteria for Green Buildings in Lebanon.

From your perspective, what are the main barriers to the enforcement of the EEBCs?

Technical challenges

What are the main technical Barriers to enforce the EEBCs? Please provide practical examples when possible.

Code complexity

From your perspective, how complex is the code? is it understandable for most architects, engineers, contractors and other stakeholders?

- TSBL 2005 and the new building code under preparation with Libnor are easy for architects and engineers. Even for other stakeholders who are not familiar with U values or other technical specifications for the building components, there are associated explanations with the standards, therefore it should be easy for them to understand the document.

Availability of technical compliance manuals and/or procedures

If such manuals or guidelines are available, how implementable are they? Does the code(s) provide clear steps and procedures for designers, engineers and for the local authority responsible for issuing the building permits and/or occupancy permits.

- Both TSBL 2005 and the new building code under preparation with Libnor weakness lies in the fact that they are addressed for designers and not for implementation. Compliance is done on paper and not verified in inspection and implementation.

From your perspective, what are the other technical challenges? Please elaborate here.

- If those standards became mandatory, the main barriers facing the urban planning and OEA will be the inspection on site as building components should be inspected at different stages of construction. In addition, challenges in terms of transparency and corruption will be faced.

From your perspective, what are the best practices to cope with the technical challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- Inspectors should be properly trained in order to be qualified to verify implemented EE measures.
- A third party should perform random selected checks on the conducted inspections in order to make sure that inspections are done properly. The only thing challenging is the transparency of the third party.
- Develop a qualification scheme for the inspectors who will handle the implementation and verification. This qualification can be done through LCEC as LCEC have already done qualification scheme for ESCOs.

The institutional and regulatory barriers

Mandatory code

If the code is not mandatory, what are the main barriers to make it mandatory? please also elaborate on the steps, processes and procedures towards making the EEBCs mandatory.

- Political barriers;
- A lot of existing businesses will be harmed if the standards go mandatory. Many businesses are owned by people who are well connected and have the power to hinder making the standards mandatory;
- It is very hard to go from a standard to a code in Lebanon;
- For existing buildings, it is very hard to enforce the building code In Lebanon as the end user or owner is not easily defined whether the residence is rented, owned etc...

Mandated entities

Do you think the institutional set-up is counteracting a successful implementation or enforcement? with clear assigned responsibilities to implement and enforce the EEBC?

- I don't have high hopes regarding the possibility of a successful enforcement of the standards especially due to the current crisis Lebanon is passing through. It is nearly impossible to have a mandatory building code now.

Coordination

Please describe the levels of coordination between national and local authorities responsible of implementation and enforcement of the code?

- The implementation of TSBL 2005 standards was done in few projects based on our initiative recommendations as Eco-consulting. However, those standards were never seen required by any national or local authority;
- NEEREA Building Envelope guidelines developed by LCEC refer to the TSBL 2005;
- The new building code under preparation in Libnor is still a design standard. But there are always discussions about how it can be implemented and verified but still not done yet.

Participation

How do you assess the effectiveness and involvement of relevant stakeholders in the development and implementation of the code?

- The committee TC205 started with more than 30 people, lately we are meeting around 6 people;
- The participation is not much effective in this committee and not all members are active. The rest are passive and inactive;
- Active members in the committee are active already in other committees and they are experts in the field since a long time;
- Some Private sector stakeholders and Representatives from different ministries have been inactive.

Do you think the code should be updated? If yes, what are the entities that should be involved in the updating processes?

- TSBL 2005 is better to be updated and merged in the new standards under preparation rather than updating it solely because it tackles only the building envelope.

Do you think the compliance manuals and guidelines should be updated?

- NA

In case of the lack of compliance manuals and guidelines, how could they be developed? What are the entities and stakeholders to be involved?

- The standard under preparation now is already a large document. The efforts are done to make it as simple as possible. The compliance manuals and guidelines can be developed at a later stage in a separate document that people can refer to;
- The document is written in a code language;
- Committee TC205 should be responsible for the developing compliance manuals and guidelines as they are the ones who worked on the standards themselves.

What are the other potential institutional issues and challenges?

The expert decided not to answer this question as it doesn't fall under her field of expertise.

From your experience, what are the potential best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries

- We need some form of enforcement. Before working on the new building code standards with Libnor, we have worked with OEA on green building criteria booklet where large projects who should apply for exceptions at the Directorate General of Urban Planning must follow these criteria. However, only 3 projects called EcoConsulting to understand how to apply the criteria in the booklet. This could mean either other projects were able to understand the criteria on their own or they didn't care.
- Develop proper implementation scheme in parallel with the development of the new standards, because implementation is critical as inspection should be done at design phase, and different construction phases.
- Projects usually go for LEED certification in Lebanon instead of adoption due to EE corporate requirement, marketing the image of the project or to get a subsidized loan.
- Implementation of the code in existing buildings could be done with a labelling scheme and incentives to attract the citizens. Still ownership in existing buildings is the main issue to tackle.

Capacity building and awareness challenges

What is the level of awareness/interest among the relevant/involved stakeholders about the EEBCs?

- Committee of TC205 at Libnor is formed of experts in the field.

What are the challenges related to the capacity building programs?

- One of the main challenges faced is that people still think that if a project adopted EE measures or is made eco-friendly then it will be more expensive which is not always the case.
- People think always about the price.
- People are not aware where and when to adopt building envelope measures (double wall, double glazing, insulation ...). This depends on the climatic zone and on the building type.

What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- Trainings for architects and people involved in design on where and when to apply EE measures. It should be understood that adoption of EE measures depends on the climatic zone, building type and end operation user.

Financial Issues

What is the additional cost resulting from the construction of a building according to the EEBCs compared to the Business as usual BAU construction in your country?

(this might be percentage referring to a study and/or different buildings types)

- BAU in Lebanon varies a lot in Lebanon. However, if the new standards or the TSBL 2005 are applied, no significant price increase will be noticed. I could say 5 to 10% increase would be added since people already started adding EE measures especially in big projects. However, more significant price would be noticed in smaller projects and projects in more rural areas due to the lack of awareness about EE measures as they still use single wall, single glazing, etc...

Are there any incentives for EE buildings or for compliance with the EEBCs (please mention them)? how successful are they? How do you assess the importance of such incentives?

- Future financial incentives should include a cap on the construction cost of the projects. Another idea would be to have separate financial initiatives one for small projects.
- Easier application and approval process in financial incentives could attract smaller projects.
- Incentives as Rebates on purchased energy efficient equipment or home appliances are highly successful for existing buildings.

How do you assess the availability of funds and financing options available when building comply with the EEBCs?

- Previous experience like NEEREA is a great and successful idea. Medium to High projects mostly benefited from NEEREA. However we need incentives that has easier procedure and that have access to a bigger number of smaller projects.

What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- Focus on existing buildings
- Awareness on EE measures
- Financial incentives
- Reduction of custom fees on energy efficient appliances

Other challenges and barriers

How do you evaluate the availability of EE construction materials in the local market? (please provide examples)

- They are available but not as competitive as imported material.

How do you evaluate the availability of the data and info of EE construction materials in the local market?

- Data is a struggle! Big companies can share with you datasheets but smaller projects do not. So there is lack of EE material data.

From your perspective, what do you think of the following recommendations? please provide explanation, information, sources, ...etc.

1. To update the code in coordination with the Relevant Stakeholders	Recommended	please provide explanation and recommendations It should be done
2. To include the Minimal Energy Performance Standards MEPS in the code	Strongly recommended	please provide explanation and recommendations Definitely
3. To update and/or include the methodology for calculating the energy performance and/or energy demand	Recommended	please provide explanation and recommendations Recommended as separate standard because the document would become too big
4. To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	Recommended	please provide explanation and recommendations Recommended but also as a separate document. The booklet we did with OEA was not that big but people wouldn't read it though.
5. To include the compliance with EEBCs in the Building Permit Procedure	Strongly recommended	please provide explanation and recommendations Going mandatory in design stage is very important
6. To consider the EEBCs in the national strategies e.g. NEEAP, NDC	Recommended	please provide explanation and recommendations Since buildings are big part of the country's energy consumption.
7. To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	Recommended	please provide explanation and recommendations This is helpful because attending a training is much easier than reading a booklet on their own. After that, accessing the sections of the EEBC would be much easier for engineers and other professionals.
8. To provide training and awareness programs on the EEBCs for the municipalities and/or departments responsible of the issuing of building permits.	Recommended	please provide explanation and recommendations Professionals working in the permitting procedure should get a training to be able to verify the code at the design stage.
9. To establish funds and provide incentives for compliance with the EEBCs	Recommended	please provide explanation and recommendations It will be needed at some point especially in our current situation.

From your perspective, what are the priority actions to improve the implementation and enforcement of the EEBCs? Please be precise, preferably with clear assigned personalities, steps and practical examples when possible.

Priority one

Develop an implementation scheme where we should address what documents are needed at design stage while applying for a permit. In addition, identification of the number of site visits needed along with the needed documents and who is responsible for verification.

Priority two

Trainings for the inspection team for implementation to make sure they are qualified (urban planning, OEA, municipalities ...)

Priority three

A pilot period to be given where different projects from different sectors and different regions are checked.

Priority four

Verification 3rd party to ensure transparency.

Mr. Ali Berro

Beta Engineering

Contact Information

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Short Bio

Ali Berro is decisive, action oriented with 35 years of experience in Contracting & Consultancy field, with the last 16 years focused on Management, and the last 10 years in the Green buildings and renewable energy. He has a wide experience developing project scope, customer relationships, and continuous design improvement. He is the Founder of Beta Engineering specialized in E&M Works, (Solar, Refrigeration, Plumbing, HVAC, Electrical, Power, Low current, Municipal Solid Waste, Municipal Waste Water Treatment & Pumping Station, turnkey MEP projects etc...) Energy Audit, Green Building, and Renewable Energy. He is involved and have worked with IFC World Bank, WEC (World energy council), LGBC (Lebanese green building council) as well as ARZ to implement green buildings standards. Driven by new challenges and desire to be successful in all endeavors, he is always looking for new projects, especially in the green renewable energy field.

From your perspective, what are the main barriers to the enforcement of the EEBCs?

Technical challenges

What are the main technical Barriers to enforce the EEBCs? Please provide practical examples when possible.

Code complexity

From your perspective, how complex is the code? is it understandable for most architects, engineers, contractors and other stakeholders?

- We have excellent expertise in Lebanon.
- TSBL 2005 still didn't get approval to be mandatory.

Availability of technical compliance manuals and/or procedures

If such manuals or guidelines are available, how implementable are they? Does the code(s) provide clear steps and procedures for designers, engineers and for the local authority responsible for issuing the building permits and/or occupancy permits.

- A checklist document for the verification procedure can be prepared by the OEA. We need an inspection team responsible for the implementation and verification scheme and to be able to check the permits issued by the OEA. This team needs training. We start trainings for engineers with the OEA who operate on the permitting procedure. This training is done in a coordination with Urban planning and ministry of interior and municipalities an ministry of public works and transportation to make sure that every professional that is involved in the implementation and verification process is qualified to verify the building code measures.

From your perspective, what are the other technical challenges? Please elaborate here.

- There are many labeling systems now in Lebanon. Public and Private sector must join their efforts to come with a building code.

From your perspective, what are the best practices to cope with the technical challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- Start with planning then prepare the standards through the TC205 committee. Combine the efforts to make the standards a building code and then work on implementation and verification scheme.
- Coordination between all parties is a must.
- Include the standards in the courses studies in the universities and teach them how to do energy audits.
- Work on energy labels for the material and equipment with Libnor (MEPS)

The institutional and regulatory barriers

Mandatory code

If the code is not mandatory, what are the main barriers to make it mandatory? please also elaborate on the steps, processes and procedures towards making the EEBCs mandatory.

- There should be one umbrella that holds all the entities working on preparing the standards and building code.
- Lack of organization between the stakeholders (Libnor, IRI, Municipalities, urban planning ..)

Mandated entities

Do you think the institutional set-up is counteracting a successful implementation or enforcement? with clear assigned responsibilities to implement and enforce the EEBC?

- Training for concerned municipalities professionals in order to develop the needed expertise to be able to handle the verification process to cover all areas in Lebanon.
- Work with OEA to ensure to have enough space on the roof for SWH during the permitting procedure and enough space in shaft for piping.

Coordination

Please describe the levels of coordination between national and local authorities responsible of implementation and enforcement of the code?

- Lebanon is a small country with too many players who do not lack the expertise. Therefore, the coordination between the national and local authorities has to be done under one umbrella. This umbrella should be the entity responsible for combining the efforts between all stakeholders.

Participation

How do you assess the effectiveness and involvement of relevant stakeholders in the development and implementation of the code?

- Municipalities lack the expertise needed to verify the standards when implemented. Municipalities currently do not have the team who is ready to handle inspection. But this is a critical issue as municipalities are one of the key players who are involved in inspection and permits procedure, and will be more responsible when the standards become mandatory. They should start preparing from now.

Do you think the code should be updated? If yes, what are the entities that should be involved in the updating processes?

- The document of standards should be simplified for everyone to be able to understand it. Every 2 years it can be updated based on the feedback from the market and the involved stakeholders. The code should be simple

Do you think the compliance manuals and guidelines should be updated?

- The expert had no input on this point as it is included in the above and below rows.

In case of the lack of compliance manuals and guidelines, how could they be developed? What are the entities and stakeholders to be involved?

- OEA alone can't make the standards mandatory and can't develop guidelines on its own. Urban planning along with the Ministry of Interior are the main players to help OEA. OEA can provide a team of engineers to prepare the guidelines but this has to be coordinated with the urban planning, who is responsible for the inspection, in cooperation with the municipalities. Municipalities should have qualified teams able to follow the guidelines and verify them,

What are the other potential institutional issues and challenges?

- We need combined efforts to bring all the relevant stakeholders on one table to make the standards mandatory.

From your experience, what are the potential best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries

- Training for professionals at the municipalities to be able to verify implementation. This could be done via the help of special institutions or professional experts in the field.
- One umbrella to hold all the stakeholders together and the joined efforts (Libnor, IRI, Urban planning, municipalities)
- Trainings for all engineers and architects in the OEA at the permits checking phase.

Capacity building and awareness challenges

What is the level of awareness/interest among the relevant/involved stakeholders about the EEBCs?

- Awareness is very important to understand how much end user can save on the long run. Most people think only about the investment cost and capex.

What are the challenges related to the capacity building programs?

- Not everyone involved in the building code loop is qualified especially the municipalities who lack the expertise needed to be part of the verification process.
- Lack in EE awareness is present and young engineers are not getting involved in the energy efficiency field in their universities.

What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- Training should be done in a coordination with urban planning and ministry of interior and municipalities and ministry of public works and transportation to make sure that every professional that is involved in the implementation and verification process is qualified to verify the building code measures.
- Introduce EE in college and universities to prepare the mentality of the engineers to be ready for the EE market

Financial Issues

What is the additional cost resulting from the construction of a building according to the EEBCs compared to the Business as usual BAU construction in your country?

(this might be percentage referring to a study and/or different buildings types)

- In the Capex yes additional cost will be added, but end user should understand the savings on the long term through the running cost. Therefore, clients need to be aware of the calculations of the payback period and the operational costs that will actually show how much the end user is saving due to this investment.

Are there any incentives for EE buildings or for compliance with the EEBCs (please mention them)? how successful are they? How do you assess the importance of such incentives?

- NEEREA financing mechanism. It was more successful in SWH and PV systems than in EE measures. The process in EE applications takes a lot of time in proposals and revisions.

How do you assess the availability of funds and financing options available when building comply with the EEBCs?

- NEEREA and LEA are good financing mechanisms but they didn't reach all people. It is better to give incentive son the EE material rather giving the money for the end user.

What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- Trainings for suppliers must be done too and give them incentives to push them market the energy efficient equipment.
- Study the market for all building types before giving incentives.
- We have to introduce net present value calculations, running cost, payback to convince the end user he is saving both energy and money.
- Energy Classification of buildings must be mandatory (A, B, C ...) because each class saves differently. Taxes of municipalities depends on the class of the building as an incentive to promote EE measures. So for example, class A will pay less than class B

Other challenges and barriers

How do you evaluate the availability of EE construction materials in the local market? (please provide examples)

- Some material are found locally others are imported. Local supplier should undergo training and follow the new trends in the EE material industries. We do have the technical capabilities to provide local material with good quality.

How do you evaluate the availability of the data and info of EE construction materials in the local market?

- Available but suppliers need trainings and incentives to push more the EE products in the market. Developers and suppliers will convince the clients with competitive process. They care about money and not energy.

From your perspective, what do you think of the following recommendations? please provide explanation, information, sources, ...etc.		
1. To update the code in coordination with the Relevant Stakeholders	Recommended	please provide explanation and recommendations We should update the existing standards of TSBL2005 and include it in the new standards being prepared with Libnor before going mandatory. This should be the first step.
2. To include the Minimal Energy Performance Standards MEPS in the code	Recommended	please provide explanation and recommendations Because not all people are familiar with the MEPS, they should be incorporated in the standards so people abide by the requirements regardless if they are aware of the MEPS or not.
3. To update and/or include the methodology for calculating the energy performance and/or energy demand	Strongly recommended	please provide explanation and recommendations There should be defined guidelines for the calculation methodology of the energy performance. This can be attached as annex in the standards document. This will assure transparency and will put all engineers on the same page and this will help OEA a lot in the permitting procedure.
4. To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	Strongly recommended	please provide explanation and recommendations This should be coordinated with OEA. All revisions and compliance manual should worked on closely under the umbrella of the OEA.
5. To include the compliance with EEBCs in the Building Permit Procedure	Strongly recommended	please provide explanation and recommendations This is very important to ensure the quality of the permitting procedure. OEA should have a qualified team for this task.
6. To consider the EEBCs in the national strategies e.g. NEEAP, NDC	Strongly recommended	please provide explanation and recommendations This will make the NEEAP rich and solid
7. To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	Strongly recommended	please provide explanation and recommendations Very important
8. To provide training and awareness programs on the EEBCs for the municipalities and/or departments responsible of the issuing of building permits.	Strongly recommended	please provide explanation and recommendations Very important and critical as municipalities are key players in the building permits. Decentralized verification will be allow us to cover all Lebanon and make it easier. Municipalities are the most important player in this.
9. To establish funds and provide incentives for compliance with the EEBCs	Recommended	please provide explanation and recommendations NEEREA was a good incentive but not everyone was able to benefit from it. Incentives must be for the end use and for all people. The incentives must be on the material. Reduce taxes on energy efficient material. This can be done with working with the suppliers and the government to support the EE material. This better than giving money for the end user.

From your perspective, what are the priority actions to improve the implementation and enforcement of the EEBCs? Please be precise, preferably with clear assigned personalities, steps and practical examples when possible.	
Priority one	Finish the standards documents
Priority two	Start the lobbying to go mandatory with the standards and have a building code with all the relevant stakeholders' efforts combined.
Priority three	Directly Work on the implementation and verification scheme in addition to the supervision of the procedure
Priority four	Development of Awareness and capacity building programs

Mr. Jack Ghosn
Order of Engineers and Architects (OEA)
Contact Information

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Date of filling in the questionnaire and/or the interview	21-05-2020

Jack holds in Diploma in mechanical engineering from the Lebanese University, Faculty of Engineering, Branch II, Roumieh. He was a delegate in the Orders of Engineers and Architects in Beirut since 2014. Currently, Jack is the President of Mechanical Engineers consultants – Branch 4 of Order of Engineers and Architects – Beirut. He is also a Member in ASHRAE Lebanese Chapter, Member in LGBC, Member in LSES, Member in OEA, Libnor Committee

From your perspective, what are the main barriers to the enforcement of the EEBCs?

Technical challenges

What are the main technical Barriers to enforce the EEBCs? Please provide practical examples when possible.

Code complexity

From your perspective, how complex is the code? is it understandable for most architects, engineers, contractors and other stakeholders?

- The Lebanese engineers are everywhere in the world and they have excellent skills and the great know-how in design and materials.

Availability of technical compliance manuals and/or procedures

If such manuals or guidelines are available, how implementable are they? Does the code(s) provide clear steps and procedures for designers, engineers and for the local authority responsible for issuing the building permits and/or occupancy permits.

- We started having mandatory SWH for some buildings. It is easy to go mandatory at the design phase and in the permitting procedure.
- Inspection should be done with several site visits in cooperation with the urban planning, OEA, ministry of energy and other parties.

From your perspective, what are the other technical challenges? Please elaborate here.

- We don't have an implementation and verification scheme. The verification on site should be done through the Urban Planning and not OEA.
- For example, on the plans you can easily check the double wall and insulation but in real and on site, there are no proofs if there's insulation or not.
- We are relying on the conciseness of the developer.

From your perspective, what are the best practices to cope with the technical challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- Have an inspection team from the Urban planning qualified to verify the measures on site.
- Architects are the key players. Architects and MEP engineers should combine their efforts and architects should have good knowledge about U values and other building specs that directly affect heating and cooling loads.
- Work on a scheme that targets overall U-value and not material. (For example, you should state an equivalent of a double wall. It can be different composition yet same U-Value or maybe better)

The institutional and regulatory barriers

Mandatory code

If the code is not mandatory, what are the main barriers to make it mandatory? please also elaborate on the steps, processes and procedures towards making the EEBCs mandatory.

- This code should have been done back in 2009 and 2010. Barriers will lie in the initial and running costs especially in the current status.
- We are working with theories only. No actual implementation is done.
- Some engineers responsible of inspection and verifications lack practical experience.

Mandated entities

Do you think the institutional set-up is counteracting a successful implementation or enforcement? with clear assigned responsibilities to implement and enforce the EEBC?

- Give authorities for the municipalities to be a key part of the verification procedure. Municipalities are already a major player in the permitting procedure. Once the standards will be mandatory, the role of municipalities will be more critical and they should be prepared with a qualified team to be able to verify the standards. In order for the implementation scheme to be successful, municipalities' role has to be optimized in order to be able to cover all areas in the country including the rural areas.

Coordination

Please describe the levels of coordination between national and local authorities responsible of implementation and enforcement of the code?

- Due to several structural reasons, there's lack of an organized coordination between the different stakeholders (OEA, urban planning, Ministry of interior etc..) This coordination should be optimized and combined efforts between all entities should be joined to lessen the time needed to issue the enforcement of the code and develop a clear implementation scheme with a qualified team of experts that will be responsible of the verification.

Participation

How do you assess the effectiveness and involvement of relevant stakeholders in the development and implementation of the code?

- There's lack of cooperation with the public sector. Urban planning are the key player when it comes to building and they are the entity responsible to do the code. We should get all entities on the table but urban planning is the one responsible for the building code.

Do you think the code should be updated? If yes, what are the entities that should be involved in the updating processes?

- It needs to be updated. Urban planning are the start point as it is the entity where the process of issuing the code begins. Therefore, urban planning has to have a team of experts working on the code updates and this team has to include mechanical and electrical engineers. This can be done through cooperation with the OEA.

Do you think the compliance manuals and guidelines should be updated?

- Building code should be done based on the climatic zones. Each zone recommends different EE measures.

In case of the lack of compliance manuals and guidelines, how could they be developed? What are the entities and stakeholders to be involved?

- The expert had on input on this point as it is included in the above and below rows.

What are the other potential institutional issues and challenges?

- Urban planning, which should be responsible for the inspection team, deals mainly with architecture and structure. They are limited in the practical skills. In order for the Urban Planning to have a qualified inspection team, they should up with OEA which has the needed skilled engineers that can handle the inspection procedure. On the other hand, urban planning should cooperate with private consultants in order to keep up with the technical trends that are being updated always.

From your experience, what are the potential best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries

- Start to go mandatory with the standards gradually and step by step in parallel with the current crisis Lebanon is passing through.

Capacity building and awareness challenges

What is the level of awareness/interest among the relevant/involved stakeholders about the EEBCs?

- We had many seminars and trainings about building envelope components (double wall insulation, heights etc..) for engineers at OEA
- We have a lot of commercial buildings that do not include any EE measures (single glazing and single walls) as they want to be sold in the cheapest price. This is what the citizen ass for: affordable apartments. But the citizen of not aware of EE measures due to lack of awareness.

What are the challenges related to the capacity building programs?

- Engineers should be up to date in all engineering sectors. Private sector must be always following up the trends especially in the MEP sectors that are upgraded on a yearly basis or he's out the market.

What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- Cooperation with municipalities is a key factor.
- Including private sector in the urban planning together for conducting the inspection on sites.
- The government should help the citizens raise their awareness about EE measures.
- Initiative should start the public sector (urban planning or relevant ministries)

Financial Issues

What is the additional cost resulting from the construction of a building according to the EEBCs compared to the Business as usual BAU construction in your country?
(this might be percentage referring to a study and/or different buildings types)

- **The expert had no input on this point as it depends on different criteria and on the scale of the project.**

Are there any incentives for EE buildings or for compliance with the EEBCs (please mention them)? how successful are they? How do you assess the importance of such incentives?

- For example, in Cyprus, the government offered the developers extra investment of 10% if they implement SWH on the roofs of the buildings.
- Also in Dubai, they restricted a minimum U value for glass and walls.
- We can do such incentives in Lebanon. Incentives should start from the urban planning but they should include also the mechanical and electrical requirements (MEP).

How do you assess the availability of funds and financing options available when building comply with the EEBCs?

- Financing mechanisms available are not considered incentives when it comes to building but they were successful in PV systems especially in Zahle where there's grid available 24/7 for on grid installation.

What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- Start with the urban planning to find incentives that can push the investment in the building sector.
- Start with a defined plan, then have an implementation scheme and after that you can find the right incentives. After that, monitoring should be done.
- We can start with the incentives for existing buildings by for example exempting them from paying taxes for the ministry of finance for a year if they implement for example a SWH or any other EE system.

Other challenges and barriers

How do you evaluate the availability of EE construction materials in the local market? (please provide examples)

- We don't have available local EE material. We import all our building material except for the hollow block or plaster. We are a consuming market.

How do you evaluate the availability of the data and info of EE construction materials in the local market?

- We don't have local data.

From your perspective, what do you think of the following recommendations? please provide explanation, information, sources, ...etc.

To update the code in coordination with the Relevant Stakeholders	Recommended	please provide explanation and recommendations Yes we can start with the envelope first then after 2 or 3 years start working on the equipment. So gradually update the code.
To include the Minimal Energy Performance Standards MEPS in the code	Recommended	please provide explanation and recommendations It is important to go with high standards equipment for sure but we should start with focusing on the building envelope first. We can start with gradually updating the classes of equipment because people can't go directly from non-efficient equipment to A+ equipment. It has to be done step by step to allow the people to adapt with the code.
To update and/or include the methodology for calculating the energy performance and/or energy demand	Strongly recommended	please provide explanation and recommendations Default values are not the same as in the softwares. We should have testing facilities. Therefore, a defined methodology must be developed. This can be done horizontally where each entity starts with its responsibilities (Urban planning, IRI, OEA etc ...)
To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	Recommended	please provide explanation and recommendations Search for the best U value. Focus on the U factor not the composition of building components. State what is equivalent starting from U values?
To include the compliance with EEBCs in the Building Permit Procedure	Recommended	please provide explanation and recommendations
To consider the EEBCs in the national strategies e.g. NEEAP, NDC	Recommended	please provide explanation and recommendations
To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	Recommended	please provide explanation and recommendations
To provide training and awareness programs on the EEBCs for the municipalities and/or departments responsible of the issuing of building permits.	Recommended	please provide explanation and recommendations
To establish funds and provide incentives for compliance with the EEBCs	Recommended	please provide explanation and recommendations

From your perspective, what are the priority actions to improve the implementation and enforcement of the EEBCs? Please be precise, preferably with clear assigned personalities, steps and practical examples when possible.

<p>Priority one Roof investment and the already existing building code should be maintained. We should start by setting the improvement the building envelope material as priority number one, in order to reduce the heating and cooling loads and thus reduce the consumption of energy.</p>
<p>Priority two After that, work on the COP requirements of the equipment,</p>
<p>Priority three Start working on control and automation because it is very important now. To reach a code that includes automation, this could takes us 6 to 7 years.</p>
<p>Priority four Don't underestimate the role of Municipalities. They must be part of the inspection team and they should have trainings for their employees in order to have a quality site inspection.</p>

Mr. Aram Yeretzian
 Prime Design Architects
Contact Information

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Short Bio

Aram Yeretzian is an architect with a Bachelor of Architecture from the AUB (1989), and a Master of Science in Architecture degree "Advanced Environmental and Energy Studies" from the University of East London in 2004 (joint program with the Center for Alternative Technology, Wales). Following 8 years of work with Cabinets d'Architectes L'Arch in France, on architectural and urban planning projects, he co-founded (in 1999) Prime Design Architects, a professional practice that focuses on research, design and supervision of sustainable architectural. Since 2015, Aram holds a joint position for climate responsive buildings at the Departments of Architecture and Civil and Environmental Engineering at AUB. Aram is a member Sustainability and Energy committee at the Order of Engineers and Architects in Beirut. He is a founding member of the Lebanon Green Building Council and served as president from 2012 to 2014. Moreover, he lectures in conferences that address sustainability issues, serves as a jury member in several universities, and represents the Ministry of Environment in issues related to the environmental aspects of buildings.

From your perspective, what are the main barriers to the enforcement of the EEBCs?

Technical challenges

What are the main technical Barriers to enforce the EEBCs? Please provide practical examples when possible.

Code complexity

From your perspective, how complex is the code? is it understandable for most architects, engineers, contractors and other stakeholders?

- The standards prepared with Libnor are voluntary now;
- Given that this is the first draft of the standards, the parameters used are not technically challenging. The intent was to provide criteria and guidelines that are easily technically achievable;
- The standards aim at improving the performance of buildings.

Availability of technical compliance manuals and/or procedures

If such manuals or guidelines are available, how implementable are they? Does the code(s) provide clear steps and procedures for designers, engineers and for the local authority responsible for issuing the building permits and/or occupancy permits.

From your perspective, what are the other technical challenges? Please elaborate here.

- Difficulty is in misconceptions among people about the cost of measures and don't take into account the long term payback period where they are actually paying less due to savings.
- Execution is not verified or monitored.

From your perspective, what are the best practices to cope with the technical challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- Develop an implementation and verification scheme for the measures to ensure the quality of work done and ensure it is done as per the standards.
- Conduct capacity building programs and trainings for all people involved in the building industry. Start with the design engineers and the syndicate of real estate developers.

The institutional and regulatory barriers

Mandatory code

If the code is not mandatory, what are the main barriers to make it mandatory? please also elaborate on the steps, processes and procedures towards making the EEBCs mandatory.

- Standards are phased in order to become mandatory and this needs time and effort.
- We have developed the Green Building booklet with criteria that has to be applied for projects that has to pass by the higher council of urban planning. They only choose one item or so. We still don't have a clear answer why it is not used yet though we did two elaborate presentations for OEA and the general directorate of urban planning. We also suggested that these criteria can be applied for public buildings but it didn't work too.
- Barriers are due to corruption and lack of transparency in the process.

Mandated entities

Do you think the institutional set-up is counteracting a successful implementation or enforcement? with clear assigned responsibilities to implement and enforce the EEBC?

Identification of a 3rd party verification team that constitutes of specialists and experts that will perform the inspection with quality and transparency.

Coordination

Please describe the levels of coordination between national and local authorities responsible of implementation and enforcement of the code?

The expert mainly focused on the technical barriers and the capacity building barriers since they lie in his field as a private sector from one side and a lecturer at the university from the other side. Same comment complies for the below empty rows in this section.

Participation

How do you assess the effectiveness and involvement of relevant stakeholders in the development and implementation of the code?

The expert mainly focused on the technical barriers and the capacity building barriers since they lie in his field as a private sector from one side and a lecturer at the university from the other side.

Do you think the code should be updated? If yes, what are the entities that should be involved in the updating processes?

The expert mainly focused on the technical barriers and the capacity building barriers since they lie in his field as a private sector from one side and a lecturer at the university from the other side.

Do you think the compliance manuals and guidelines should be updated?

The expert mainly focused on the technical barriers and the capacity building barriers since they lie in his field as a private sector from one side and a lecturer at the university from the other side.

In case of the lack of compliance manuals and guidelines, how could they be developed? What are the entities and stakeholders to be involved?

The expert mainly focused on the technical barriers and the capacity building barriers since they lie in his field as a private sector from one side and a lecturer at the university from the other side.

What are the other potential institutional issues and challenges?

The expert mainly focused on the technical barriers and the capacity building barriers since they lie in his field as a private sector from one side and a lecturer at the university from the other side.

From your experience, what are the potential best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries

- Coordination between urban planning, OEA and experts in the building industry is a must but the process is not that transparent in some entities;
- Many initiatives are proposed but municipalities should play an important role to make the implementation successful.

Capacity Building and awareness challenges

What is the level of awareness/interest among the relevant/involved stakeholders about the EEBCs?

- All the groups working in this field constitute of very knowledgeable experts including people in OEA, Libnor, LGBC etc... And what links everyone is that they all understand the potential Lebanon have in its climate and typology;
- The capacity the Lebanese experts have is excellent.

What are the challenges related to the capacity building programs?

- Challenges are in the remaining people in the building industry. At a certain level, people really don't care to change what they have been used to be doing. It is related to mentality;
- Recent graduates do not have enough access and exposure to EE measures and building codes in university. I conduct lectures at OEA for young engineers to introduce them to the green criteria and the standards we are preparing with Libnor in order to increase their interest in this very important topic. We highlight the wide applicability of EEBCs in our country;
- Challenges are in trainings for the elder age of engineers or stakeholders or the people in municipalities. More can be done with municipalities.

What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- More conferences, trainings and seminars for everyone included in the building industry especially all architects and engineers and without forgetting the developers;
- Academic courses at universities should include EE measures, EE design, passive design, green criteria etc...
- Target professional in technical schools and this is extremely important. Trainings must be done for them in modules and each module represents a subject over 2 to 3 days per module. This will increase the quality of buildings in all aspects;
- Focus on execution as much as on design.

Financial Issues

What is the additional cost resulting from the construction of a building according to the EEBCs compared to the Business as usual BAU construction in your country?
(this might be percentage referring to a study and/or different buildings types)

- Huge misconception in cost. People think that the more efficient the building the more it becomes expensive. This could be true in some cases which can result in 5 to 10% and could go up for 20% in fantastic project. This depends on the scale of the projects and its complexity. However, when you apply passive strategy in buildings by optimizing the window to wall ratios, roofs, tilted slabs, orientation etc..., you will end up with a lower cost. These passive measures can enhance the performance of the building without adding extra costs;
- Speaking of active systems (heat pumps, ACs grey water treatment systems, etc...), they could lead to a higher initial cost. However if you take into consideration the payback period and long term efficiency, the overall cost will not be more expensive;
- The increase in residential building's cost will be minimal. It would be like 4 or 6%.

Are there any incentives for EE buildings or for compliance with the EEBCs (please mention them)? how successful are they? How do you assess the importance of such incentives?

- Yes there are incentives for double wall for example, but detailing the work is very important and must be taken into consideration.

How do you assess the availability of funds and financing options available when building comply with the EEBCs?

- Financial incentive are available in the form of low interest loans.

What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- Building industry is a slow industry therefore you need to incentivise people (developers, builders contractors etc..) in order to adhere to these standards and apply them.
- Reducing municipal taxes is an interesting initiative. (decentralized approach)

Other challenges and barriers

How do you evaluate the availability of EE construction materials in the local market? (please provide examples)

- The material available are very conventional (fossil fuel based insulation for example)
- There are no hybrid forms of insulation or natural forms of insulation which are used abroad.
- Options in glazing are very minimal in Lebanon.
- We should look into the sustainable aspect of building industry and support the local industry. It requires governmental support.

How do you evaluate the availability of the data and info of EE construction materials in the local market?

- We don't have enough local EE material to create a database for building material.

From your perspective, what do you think of the following recommendations? please provide explanation, information, sources, ...etc.

To update the code in coordination with the Relevant Stakeholders	Recommended	please provide explanation and recommendations
To include the Minimal Energy Performance Standards MEPS in the code	Strongly recommended	please provide explanation and recommendations It has to be a consolidated approach. Equipment are very important and not only should the concertation be on envelope.
To update and/or include the methodology for calculating the energy performance and/or energy demand	Strongly recommended	please provide explanation and recommendations This needs to be done gradually. But the challenging aspect is how the engineers will be able to adhere to it. It is feasible when we have a good strategy. This can come as a 2 nd step after the standards after like 2 years. We can start with the nomenclature and defining the technical specifications.
To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	Strongly recommended	please provide explanation and recommendations
To include the compliance with EEBCs in the Building Permit Procedure	Recommended	please provide explanation and recommendations
To consider the EEBCs in the national strategies e.g. NEEAP, NDC	Recommended	please provide explanation and recommendations
To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	Recommended	please provide explanation and recommendations
To provide training and awareness programs on the EEBCs for the municipalities and/or departments responsible of the issuing of building permits.	Recommended	please provide explanation and recommendations
To establish funds and provide incentives for compliance with the EEBCs	Recommended	please provide explanation and recommendations

From your perspective, what are the priority actions to improve the implementation and enforcement of the EEBCs? Please be precise, preferably with clear assigned personalities, steps and practical examples when possible.

- Priority one
Completing the Libnor standards document under preparation with the TC205 committee.
- Priority two
Identification of the proper methods of capacity building associated with this document.
- Priority three
Identification of the associated incentive mechanisms.
- Priority four
Identification of the verification scheme.
- Priority 5
Phasing of the standards document. Updated document should address more complexity.

Priority 6

Don't neglect the already existing buildings and renovation schemes at multiple levels as there are much opportunity present to improve the energy performance of these buildings. A plan should be set to tackle the existing buildings that can start with data collection from these buildings in order to set defined renovation methodologies based on each building component. This can be done through municipalities.

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Short Bio

Riad Assaf is a mechanical engineer and holds a Ph.D. in Automation and Cognitive Engineering from Bordeaux University. He is an international expert in stone industries businesses development.

He is active in several ASHRAE technical committees, Voting Member in SSPC169 (Climatic Data for Building Design Standards), and TC01.01 Handbook Subcommittee Chair (Fundamentals: Psychrometrics, Thermodynamics and Refrigeration Cycles).

He is active in LIBNOR TC205, TC207, TC2197, TC3018. He represents Lebanon as national expert in ISO/TC207 and ISO/TC059/SC17.

He is an active member of LGBC. He co-developed the 'Lebanese Standard for Energy Efficient HVAC Equipment' and ARZ 1.0 Green Building Rating System. He is now LGBC Project manager of EU funded project 'ARZ 2.0: Advancing the ARZ GBRs' which final delivery is on September 30th, 2022.

He is a university professor and teaches in many departments i.e. Mechanical Engineering, Electro-mechanical Engineering, Architecture, Data Science, Engineering Social and Cooperative Economy Projects.

From your perspective, what are the main barriers to the enforcement of the EEBCs?
Technical challenges

What are the main technical Barriers to enforce the EEBCs? Please provide practical examples when possible.

Code complexity

From your perspective, how complex is the code? is it understandable for most architects, engineers, contractors and other stakeholders?

- OEA criteria and TSBL 2005 are simple and not complex. The problem relies in the Maestro of the building industry aka the architects;
- I teach the TSBL 2005 for my students in university, it is very user friendly and it is easy for all engineers to understand it.

Availability of technical compliance manuals and/or procedures

If such manuals or guidelines are available, how implementable are they? Does the code(s) provide clear steps and procedures for designers, engineers and for the local authority responsible for issuing the building permits and/or occupancy permits.

- There are no minimum requirements in the permits. Therefore, developers and clients will go for the cheapest cost.

From your perspective, what are the other technical challenges? Please elaborate here.

- Architects are the main barrier since architects are still in old school mentality and they do not accept any comment from other engineers or experts;
- Big projects are taken by big and very well-known architects in the country but they stick to their designs and do not accept any trend or updates on new technologies;
- The double wall was implemented because of the revenues developers had in its implementation;
- New young architects are more flexible and open to the new ideas. However, their engineering trainings are being mostly done in big architectural companies and they are affected by the mentality of the older architects;
- Passive design needs tools such modelling. Architects are not familiar with modelling. MEP engineers in colleges are not prepared technically for architectural engineering.

From your perspective, what are the best practices to cope with the technical challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- We need more specialists in the technical execution. We need the know-how in the execution of joints, thermal bridges etc... Technical schools should be more tackled;
- Guidance of engineers to go for more high technical schools because we are in need for such qualified expertise.
- Architects are not well prepared to design buildings or set the correct orientations in different climatic zones or so. MEP engineers are needed as this is their job, so combined efforts between all engineers, each in his sector, are recommended.

The institutional and regulatory barriers

Mandatory code

If the code is not mandatory, what are the main barriers to make it mandatory? please also elaborate on the steps, processes and procedures towards making the EEBCs mandatory.

- Standards are prepared and they are voluntary. They should be in the form of a decree in order to become mandatory;
- The permits less than 250 m² do not need for a mechanical engineer signatures. This is a problem as the energy consumption is mainly in HVAC systems. MEP signatures starting zero square meters were cancelled and this caused a huge problems;
- TSBL 2005 stayed voluntary because the permitting procedure is controlled by the architects who are from an old school mentality.

Mandated entities

Do you think the institutional set-up is counteracting a successful implementation or enforcement? with clear assigned responsibilities to implement and enforce the EEBC?

- The structure of the procedure in permitting and the existing building codes is mainly controlled by architects and not MEP engineers.

Coordination

Please describe the levels of coordination between national and local authorities responsible of implementation and enforcement of the code?

- Coordination between Libnor, ministry of public works and transportation, urban planning and ministry of energy and water is a must. However, there will be challenges faced from the developers and real estate market as in their opinion, this will affect their investments in the building industry.

Participation

How do you assess the effectiveness and involvement of relevant stakeholders in the development and implementation of the code?

- Municipalities should play a very important role in the verification process in coordination with the urban planning and OEA. But we cannot currently rely on municipalities on the follow up on site because they lack the expertise;
- The OEA is managed within the law. It is not a syndicate. Therefore, engineers within the OEA, there should an organization plan to distribute the engineers into teams of design, practical, inspection, industrial etc...

Do you think the code should be updated? If yes, what are the entities that should be involved in the updating processes?

- The expert had no input on this point as it is already included in what he has stated in this section.

Do you think the compliance manuals and guidelines should be updated?

- The expert had no input on this point as it is already included in what he has stated in this section.

In case of the lack of compliance manuals and guidelines, how could they be developed? What are the entities and stakeholders to be involved?

- OEA plays a major role in this. OEA has all the skilled engineers from architects, civil engineers, mechanical engineers and electrical engineers. OEA have the resources needed to be greatly involved in preparing these guidelines.

What are the other potential institutional issues and challenges?

- You can't enforce a specific type of material in double wall or insulation for example. But you can enforce in overhang and fins which lead massive savings when combined with the window to wall ratio.

From your experience, what are the potential best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries

- Gradual enforcement of the standards is not feasible because steps in gradual enforcement will take so much time and the world is developing fast. We need to move fast with the trends and the same institutional barriers will be found in every step. So enforcement for all measures at the same time is better and will reduce time;
- We need a building code to force the developers to adhere to the standards. There's no other way. Once the code is mandatory, everyone will be forced to implement as per the standards.

Capacity Building and awareness challenges

What is the level of awareness/interest among the relevant/involved stakeholders about the EEBCs?

- There's lack of awareness and it should be pushed from bottom of the pyramid up to its peak.

What are the challenges related to the capacity building programs?

- People at higher ranks think they have all the know-how.

What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- Tackle technical schools as one the capacity building programs targets;
- Start the trainings for the technical professionals then move to the academic engineers;
- Start with the younger generation of engineers to develop a better mentality in dealing with the technical professionals;
- The strategy must be settled to start with the capacity building programs with technicians then engineers and people in the building-business industry.

Financial Issues

What is the additional cost resulting from the construction of a building according to the EEBCs compared to the Business as usual BAU construction in your country?
(this might be percentage referring to a study and/or different buildings types)

- People should look into the NPV and the return on investment values. The end user must be aware of the savings associated with the implementation of EE measures.

Are there any incentives for EE buildings or for compliance with the EEBCs (please mention them)? how successful are they? How do you assess the importance of such incentives?

- The mentality of the old generation is a critical problem facing the already existing financial mechanisms.

How do you assess the availability of funds and financing options available when building comply with the EEBCs?

- As mentioned above, financing mechanisms are present to support EE measures. However, due to the lack of awareness in the younger generation and old mentality of the old generation, they are not as efficient as they should be.

What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- Increase the electricity tariff is the solution. This will push people to search for the most economical solution that will save both energy and cost.

Other challenges and barriers

How do you evaluate the availability of EE construction materials in the local market? (please provide examples)

- Recycling is a very important step to find raw material and reuse them;
- Having local quarries is a must in Lebanon, but we need to set rehabilitation plans along with the extraction contracts to be mandatory in order to decrease the harms on the environment;
- Waste is a rich resource we have to use it.

How do you evaluate the availability of the data and info of EE construction materials in the local market?

- Data is available but we are not using it. There are many sources of databases but not being used. In addition, data about buildings and EE material are not collected in the first place.

From your perspective, what do you think of the following recommendations? please provide explanation, information, sources, ...etc.

To update the code in coordination with the Relevant Stakeholders	Recommended	please provide explanation and recommendations
To include the Minimal Energy Performance Standards MEPS in the code	Strongly recommended	please provide explanation and recommendations Recommended under the condition of having the option of constant updates on MEPS following the fast updates in the technologies. This can be done in a separate document from the code.
To update and/or include the methodology for calculating the energy performance and/or energy demand	Not important	please provide explanation and recommendations No recommended. The methodologies depend on simulations and softwares are constantly upgraded and in public sector, we cannot favour a software company over another. We can set the main parameters to be taken into consideration in different measures (envelope, equipment etc...) but this will make the document bigger. This can be done in a separate document.
To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	Not important	please provide explanation and recommendations We are working on Green Building Standard. But we still didn't review it so I can't have an answer now.
To include the compliance with EEBCs in the Building Permit Procedure	Recommended	please provide explanation and recommendations
To consider the EEBCs in the national strategies e.g. NEEAP, NDC	Recommended	please provide explanation and recommendations
To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	Recommended	please provide explanation and recommendations
To provide training and awareness programs on the EEBCs for the municipalities and/or departments responsible of the issuing of building permits.	Recommended	please provide explanation and recommendations
To establish funds and provide incentives for compliance with the EEBCs	Recommended	please provide explanation and recommendations

From your perspective, what are the priority actions to improve the implementation and enforcement of the EEBCs? Please be precise, preferably with clear assigned personalities, steps, and practical examples when possible.

Priority one

One main priority that would have a huge impact: Raising the electricity tariff is the starting key and everything else will follow.

Mr. Rodolphe Haddad

Urban Planning

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Short Bio

Rodolphe Haddad is Principal Architect at the General Directorate of Urban Planning for more than 20 years now, in addition to freelance Architecture practice since graduation in 1992 from ALBA of Balamand University. Rodolphe's career path at DGU has diversified job responsibilities and special assignments, which showed great leadership ability associated with team building spirit and communication skills. Positive and problem solving attitude was essential to excel in a public service assignments; this attitude and special architectural flair promoted the "monitoring" mission to an "advisory" one for more than 1700 projects guiding their respective Architects and Engineers at the Architectural committee and/or Superior Council of Urban Planning. The successful temporary missions as chief of department in Jbeil and Jezzine were fruitful enough to show interest in a "permanent" assignment as chief of department. Rodolphe successfully contributed to professional bodies in Lebanon and the Arab world as principal or associate in the organization of known events further to protecting nature and defending built environment.

From your perspective, what are the main barriers to the enforcement of the EEBCs?

Technical challenges

What are the main technical Barriers to enforce the EEBCs? Please provide practical examples when possible.

Code complexity

From your perspective, how complex is the code? is it understandable for most architects, engineers, contractors and other stakeholders?

- The document being prepared now by the TC205 committee with Libnor is not complex and it is addressed to experts and engineers.

Availability of technical compliance manuals and/or procedures

If such manuals or guidelines are available, how implementable are they? Does the code(s) provide clear steps and procedures for designers, engineers and for the local authority responsible for issuing the building permits and/or occupancy permits.

- No need for compliance manuals. The document is very clear;
- The building code must be included in the permits. Therefore, the entity issuing the permits should be the entity verifying the implementation and the compatibility with the building code. This should be coordinated between the urban planning and the OEA.

From your perspective, what are the other technical challenges? Please elaborate here.

- There are no technical barriers or challenges entitled. And it is the responsibility of the General Directorate of Urban Planning to set the building code clear and explain it if needed.

From your perspective, what are the best practices to cope with the technical challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- We should not neglect the existing buildings and the renovation projects. These should be put as top priority

The institutional and regulatory barriers

Mandatory code

If the code is not mandatory, what are the main barriers to make it mandatory? please also elaborate on the steps, processes and procedures towards making the EEBCs mandatory.

- The process of the enforcement of the code in Lebanon is very slow especially in the first phase. And this is directly related to the inspection team entity at the urban planning.

Mandated entities

Do you think the institutional set-up is counteracting a successful implementation or enforcement? with clear assigned responsibilities to implement and enforce the EEBC?

- The current inspection teams available are the urban planning or the municipalities are not qualified and ready to be assigned the responsibilities of the verification on site. This is because most of engineers are architects and civil engineers. We need MEP engineers and we need practical experts teams.

Coordination

Please describe the levels of coordination between national and local authorities responsible of implementation and enforcement of the code?

- The OEA should monitor the work of its engineers. This is very important.
- A checklist with minimum requirements in permits must be prepared by the OEA in coordination with the urban planning.

Participation

How do you assess the effectiveness and involvement of relevant stakeholders in the development and implementation of the code?

- TC205 committee is a very active group. It constitutes of excellent experts in the field. Even the private sector is active in this committee.

Do you think the code should be updated? If yes, what are the entities that should be involved in the updating processes?

- The Urban Planning is the entity that should be responsible for updating the code.

Do you think the compliance manuals and guidelines should be updated?

- The expert had no input on this point as it does not lie in his field of expertise. Same applies for the below empty rows.

In case of the lack of compliance manuals and guidelines, how could they be developed? What are the entities and stakeholders to be involved?

What are the other potential institutional issues and challenges?

- Cooperation between OEA and urban planning needs to be optimized. Urban planning has all the expertise in architecture and civil engineering as they constitute the majority of the engineers in this entity. OEA has the resources to include the mechanical and electrical expertise. Those two entities can work together closely for a smoother process and lessen the institutional barriers present,

From your experience, what are the potential best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries

- Have an inspection team that will be responsible for the implementation and verification of the building code that constitute of qualified experts that have the needed both design and practical know how in EE measures.

Capacity Building and awareness challenges

What is the level of awareness/interest among the relevant/involved stakeholders about the EEBCs?

- There are a lot of experts and professionals in this domain;
- Most of engineers are now familiar with the standards and building requirements.

What are the challenges related to the capacity building programs?

- Once the standards become mandatory, all stakeholders are forced to deal with it. Therefore trainings and capacity building programs will follow.

What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- OEA to push the engineers in the permitting sector to be more efficient;
- Trainings for all engineers on EE measures, from design to implementation and verification;
- Training for the professionals responsible for permits and inspection at the municipalities to adhere to the new standards.
- Introduce the building code and new standards in the universities for all engineering sectors;
- Prepare the young engineers in colleges and with the help of OEA, to develop a green mentality to be ready for the market.

Financial Issues

What is the additional cost resulting from the construction of a building according to the EEBCs compared to the Business as usual BAU construction in your country?

(this might be percentage referring to a study and/or different buildings types)

- The initial cost of investment will be higher with the implementation of the new standards. However, it will be paid back through the running costs and the savings on the long run. You will find here an objection from the developers and here where the challenges will mainly lie, as their concern is to get the lowest investment costs.

Are there any incentives for EE buildings or for compliance with the EEBCs (please mention them)? how successful are they? How do you assess the importance of such incentives?

- Now it is the best time to enforce a new building code. This is due to the fact the building industry is currently down due to the crisis and therefore we won't find much objections or barriers from the developers' side.

How do you assess the availability of funds and financing options available when building comply with the EEBCs?

- We have two current problems: liquidity and capital ceiling. Therefore, financial incentives are hard to be addressed now.

What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

- To find the right incentives, we have to develop an implementation and verification scheme first, based on the feedback, we can find out what is the right type of incentives that can be given;
- For example, increasing investments based on adoption of certain RE or EE measures though this could not be healthy in some cases for the urban planning itself. Any incentive that doesn't comply with the environmental concerns must not be taken into consideration. I don't agree with such incentives in the building industry.

Other challenges and barriers

How do you evaluate the availability of EE construction materials in the local market? (please provide examples)

- We have locally the hollow blocks, concrete and insulation material.

How do you evaluate the availability of the data and info of EE construction materials in the local market?

- We have the data associated with the local EE material mentioned above. We do have datasheets and the technical specifications for the hollow blocks, concrete and insulation material that are locally manufactured.

From your perspective, what do you think of the following recommendations? please provide explanation, information, sources, ...etc.

5- To update the code in coordination with the Relevant Stakeholders	Recommended	please provide explanation and recommendations
6- To include the Minimal Energy Performance Standards MEPS in the code	Recommended	please provide explanation and recommendations
7- To update and/or include the methodology for calculating the energy performance and/or energy demand	Recommended	please provide explanation and recommendations
8- To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	Recommended	please provide explanation and recommendations
9- To include the compliance with EEBCs in the Building Permit Procedure	Recommended	please provide explanation and recommendations
10- To consider the EEBCs in the national strategies e.g. NEEAP, NDC	Recommended	please provide explanation and recommendations
11- To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	Recommended	please provide explanation and recommendations
12- To provide training and awareness programs on the EEBCs for the municipalities and/or departments responsible of the issuing of building permits.	Recommended	please provide explanation and recommendations
13- To establish funds and provide incentives for compliance with the EEBCs	Recommended	please provide explanation and recommendations

From your perspective, what are the priority actions to improve the implementation and enforcement of the EEBCs? Please be precise, preferably with clear assigned personalities, steps and practical examples when possible.

Priority one

The enforcement of the building code will start with the Urban Planning and it will take time.

Priority two

Cooperation between Libnor, OEA, Ministry of Energy and Water and Urban Planning is very important to be maintained.

Priority three

Combined efforts from all associated stakeholders to be present more than ever.

Priority four

Gradually start with an implementation and verification scheme for existing buildings and renovation projects, then move to target the new buildings.

Annex 3: Evaluation of the General recommendations

Aspects	Recommendations	Evaluation criteria			
		Highest potential to achieve BUILD_ME objectives	Governmental and political support to the recommendations	Relevant stakeholders' interest and support	Timeframe of implementing the recommendations
Technical	Capacity building: Train inspectors to verify the different measures installation at different construction phases;	High	High	High	High
	Create a checklist with minimum requirement for permits;	Medium	High	High	High
	Create a checklist for the implementation and verification procedure;	Medium	High	High	High
	Develop a qualification scheme for inspectors who will handle the implementation and verification;	Medium	High	High	Low
	Do random inspection by a third party, to make sure that the inspection is done properly;	Medium	High	Low	Low
	Create an energy label for material and equipment, create a database for energy efficient material;	High	High	High	High
	Start to work on automation code because it is important and needs time;	Medium	High	High	Low
	Support the local energy efficiency industry; Include existing buildings and renovations in relevant codes	Medium	High	Low	Low
	Institutional and regulatory	Create a labelling scheme for existing building and provide incentives for implementation;(it is NEEAP initiative as well)	High	High	High
Develop proper implementation monitoring and inspection scheme of energy efficiency measures;		Medium	High	High	High
Create an umbrella that holds all the entities working on the codes and standards;		Medium	High	High	Low
Collaborate with municipalities in the verification scheme to cover all Lebanon		Medium	High	High	Low
Simplify and regularly update the standards documents		High	High	High	High
Create code based on the climatic zones;		High	High	High	High
Start to go mandatory with the standards gradually;		Medium	High	High	Low
Engineers within the OEA should be distributed into teams for design, practical, inspection, etc		High	High	High	Low
Capacity Building and awareness	Organize trainings for architects and engineers to help in the design and the choice of the energy efficiency measure based on the climatic zone, building type...);	High	High	High	High
	Train the municipalities team to handle the inspection;	Medium	High	High	Low
	Include standards and energy efficiency courses in the universities program;	High	High	High	High

	Tackle all the persons involved in the building sector: architects, engineers, owners, technicians, etc.;	Yellow		Red
	Train professional in technical schools;	Yellow		Green
	Start from technician and up to the engineers and project developer	Green	Yellow	Red
	Introduce financing incentives for existing buildings;	Green	Yellow	Red
	Reduction of custom fees on energy efficiency appliances and material;	Yellow		
Financial	Provide incentives or subsidies energy efficiency material rather than give money directly to the end user. (Incentives to the supplier directly);	Green	Yellow	Green
	Present running cost and payback period examples for the end user;	Yellow		Red
	Introduce taxes on the energy class of the building;	Red		
	Increase electricity tariff. This is impossible to tackle	Red		

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