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

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

Prepared by:

Guidehouse Germany GmbH

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Guidehouse Germany GmbH
Albrechtstr. 10 c
10117 Berlin
T +49 30 7262 1410
guidehouse.com

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Authors:

Sven Schimschar, Riadh Bhar, Eslam Mahdy (Guidehouse)
Naela Al Daoud, Ali AlMarzouq (Royal Scientific Society)

Acknowledgement for inputs:

Dr. Adnan Kasawneh, Prof. Hani Obeid, Emil Alasis, Wael Nasrallah, Tala Awadallah

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Contact us at BUILD_ME@guidehouse.com
Visit us at www.buildings-mena.com

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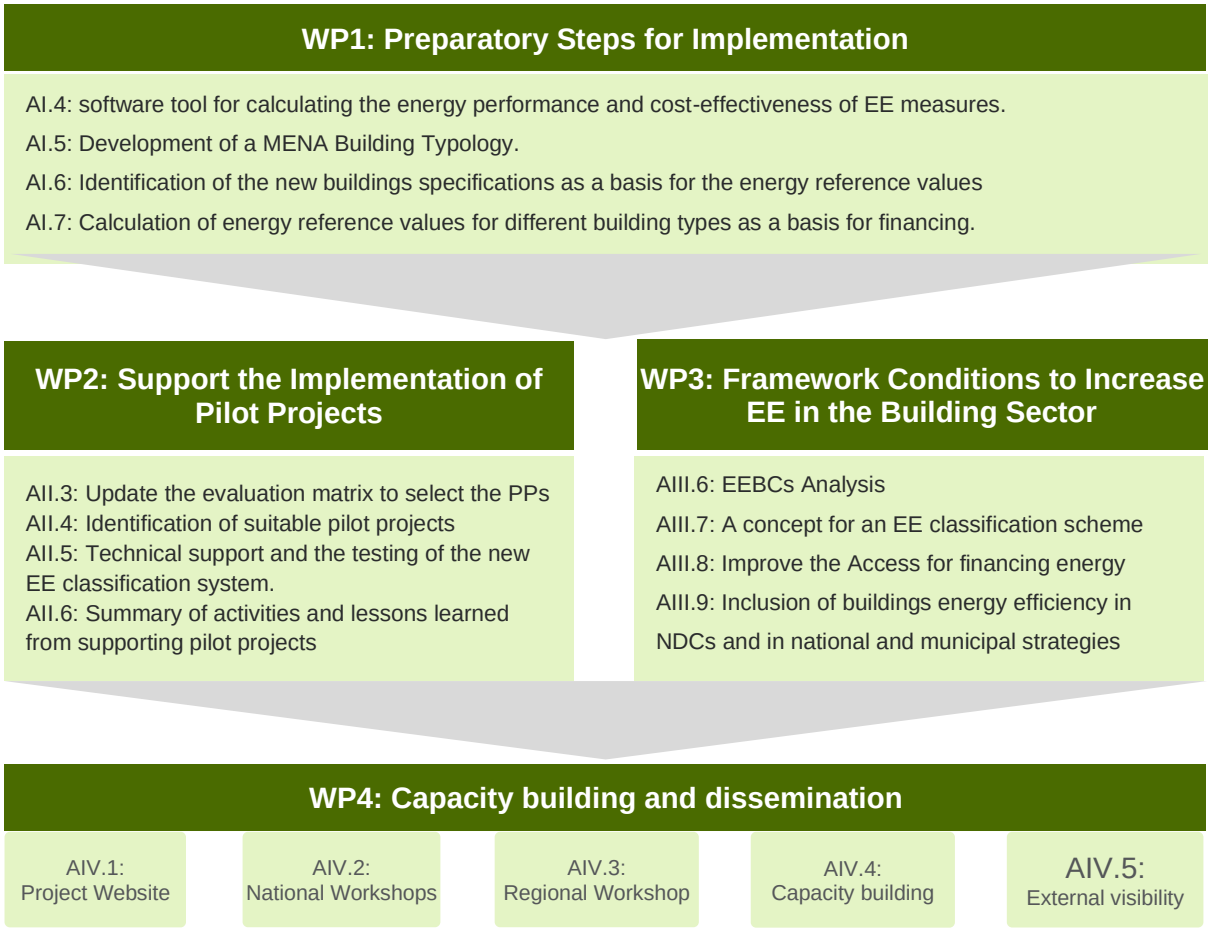
BUILD_ME BACKGROUND

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 live 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.

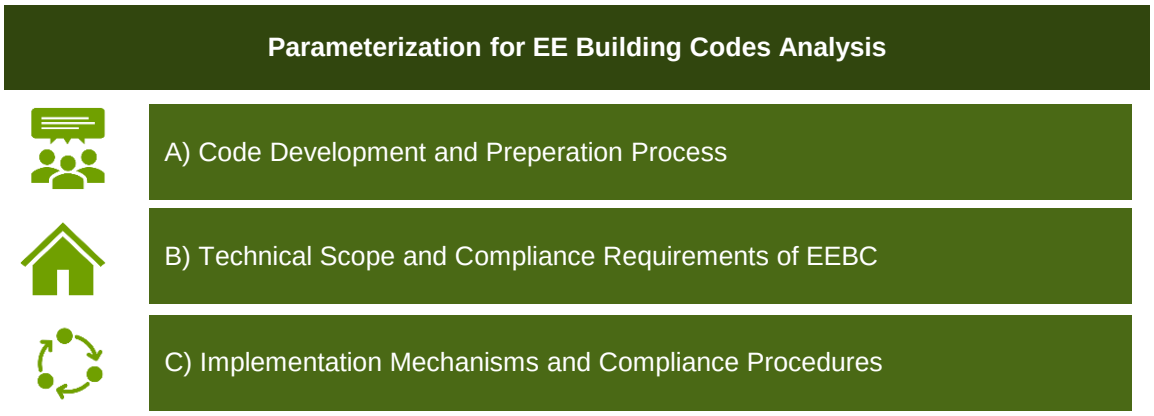
Table 1 A list of the categories of existing regulatory instruments for EE in the building Sector

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 Jordan

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

Jordan has issued several laws, guidelines and policy instruments that govern the energy efficiency in the building sector and since the mid-1980s, Jordan was one of the first countries in the Middle East to develop a thermal insulation code for buildings (Al-Hinti & Al-Sallami, 2017). The following tables show lists of the most relevant and recent laws, regulations, codes, manuals, guidelines and policies of energy efficiency in the building sector in Jordan. Those laws and instruments have been developed in two paths, the first focuses on the building sector where most of the laws, regulations and codes are developed and elaborated by the Ministry of Public Works & Housing (MPWH) and the Jordanian National Building Council (JNBC). The second set of laws and instruments have been primarily prepared and led by the Ministry of Energy and Mineral Resources (MEMR) and Energy and Minerals Regulatory Commission (EMRC), thus the main aim of those instruments is to focus on the energy and building systems, energy sector reforms and utilization of renewable energy.

Jordan National Building Council was formed pursuant to the Jordanian National Building Law No (7) for 1993 (MPWH, 2019). According to this Law, the Jordan National Building Council falls under the chairmanship of the Minister of Public Works and Housing and includes representatives from different governmental agencies and private sector as well. The Council is vested with many functions and powers such as the preparation of the principles of the Jordanian National Building Codes, elaboration of the various Jordanian National Building Codes, Issuance of Instructions on the application of the codes at all design and construction stages (MPWH, 2019).

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

Name	Type	Legal status	Implementation	Issuance Year	Issuing body
National Building Law (7), year 1993	Law	Mandatory	Enforced	1993	Royal Decree
Jordan Engineers Association, Law (15)	Law	Mandatory	Enforced	1972	Royal Decree
Jordan Construction Contractors Association, Law (13)	Law	Mandatory	Enforced	1987	Royal Decree
General Electricity Law, Temporary Law No. (64)	Law	Mandatory	Enforced	2002	Royal Decree

Name	Type	Legal status	Implementation	Issuance Year	Issuing body
Renewable Energy & Energy Efficiency Law, Law No. (13)	Law	Mandatory	Enforced	2012	Royal Decree
Amendment of Renewable Energy & Energy Efficiency Law Law No. (33) of 2014	Law	Mandatory	Enforced	2014	Royal Decree
Instructions for the Implementation National Building codes design, Execution, Supervision, Maintenance, Operation Stages, Public Safety Works and all Engineering Works Related There of	By-law	Mandatory	Enforced	2004	Jordan National Building Council (JNBC)
The Bylaw on Regulating Procedures and Means of Conserving Energy and improving Its Efficiency By-law No. (73) For year 2012	Bylaw	Fiscal/financial incentives	Implemented	2012	Royal Decree / Ministry of Energy and Mineral Resources

Name	Type	Legal status	Implementation	Issuance Year	Issuing body
By-law of Provisions and Conditions of Exempting Systems of Renewable Energy Sources and its Devices and Equipment, By-law No. (13) of 2015	Bylaw	Fiscal/financial incentives	Implemented	2015	
By-law of Provisions and Conditions of Exempting Systems of Renewable Energy Sources and its Devices and Equipment, By-law No. (50) of 2018	Bylaw	Fiscal/financial incentives	Implemented	2018	
By-law of Fund for the Promotion of Renewable Energy and Energy Conservation By-law No. (49) of 2015	Bylaw	Fiscal/financial incentives	Implemented	2015	
A National Green Growth Plan for Jordan	Strategy	Policy	Adopted	2017	Ministry of Environment, Jordan
Energy efficient buildings code	Code	Mandatory	Not enforced	2010(*)	JNBC
Mechanical ventilation and air conditioning code	Code	Mandatory	Not enforced	2018	JNBC

Name	Type	Legal status	Implementation	Issuance Year	Issuing body
Natural ventilation and health aspects Code	Code	Mandatory	Not enforced	1992(*)	JNBC
Solar Energy Code	Code	Mandatory	Not enforced	2012(*)	JNBC
Building Materials & Usage Code	Code	Mandatory	Not enforced	1988	JNBC
Internal Lighting Code	Code	Mandatory	Not enforced	1988	JNBC
Natural Lighting Code	Code	Mandatory	Not enforced	2018	JNBC
Central Heating Code	Code	Mandatory	Not enforced	2018	JNBC
Code for Waterproofing and moisture Insulation	Code	Mandatory	Not enforced	2002(*)	JNBC
Thermal Insulation Code	Code	Mandatory	Not enforced	2009	JNBC
Electrical Installations Code	Code	Mandatory	Not enforced	2008	JNBC

Notes:

(*): Under updating.

Table 4 below includes laws and regulations that focus on energy systems, energy sector and utilization of renewable energy. These laws and regulations were prepared and led by the Ministry of Energy and Mineral Resources (MEMR) and Energy and Minerals Regulatory Commission (EMRC), as the main aim of those instruments is to focus on the energy and building systems, energy sector reforms and utilization of renewable energy.

Table 4 list of the energy sector key laws and regulations relevant to the EE in the Building Sector

Name	Type	Legal status	Implementation	Issuance Year	Issuing body
General Electricity Law, Temporary Law No. (64)	Law	Mandatory	Enforced	2002	Royal Decree
Renewable Energy & Energy Efficiency Law, Law No. (13)	Law	Mandatory	Enforced	2012	Royal Decree
Amendment of Renewable Energy & Energy Efficiency Law Law No. (33) of 2014	Law	Mandatory	Enforced	2014	Royal Decree
The Bylaw on Regulating Procedures and Means of Conserving Energy and improving Its Efficiency Bylaw No. (73) For year 2012	Bylaw	Fiscal / financial incentives	Implmented	2012	Royal Decree / Ministry of Energy and Mineral Resources
By-law of Provisions and Conditions of Exempting Systems of Renewable Energy Sources and its Devices and Equipment, By-law No. (13) of 2015	Bylaw	Fiscal / financial incentives	Implmented	2015	
By-law of Provisions and Conditions of Exempting Systems of Renewable Energy Sources and its Devices and Equipment, By-law No. (50) of 2018	Bylaw	Fiscal / financial incentives	Implmented	2018	

Name	Type	Legal status	Implementation	Issuance Year	Issuing body
By-law of Fund for the Promotion of Renewable Energy and Energy Conservation By-law No. (49) of 2015	Bylaw	Fiscal / financial incentives	Implmented	2015	
The Reference Pricelist Record for The Calculation of Electrical Energy Purchase Prices from Renewable Energy	Directive / Guidelines	Fiscal / financial incentives	Implmented	2012	
The Directive for the Costs of Connecting Renewable Energy	Directive / Guidelines	Fiscal / financial incentives	Implmented	2012	
The Directive Governing the Sale of Electrical Energy Generated from Renewable Energy Systems	Directive / Guidelines	Fiscal / financial incentives	Implmented	2012	
The Directive for connecting renewable energy to the distribution system	Directive / Guidelines	Fiscal / financial incentives	Implmented	2012	Energy and Minerals Regulatory Commission
Guideline to renewable energy source systems using net metering meters on the transmission network	Directive / Guidelines	Fiscal / financial incentives	Implmented		
Chart explaining the procedures of connecting renewable energy sources	Directive / Guidelines	Fiscal / financial incentives	Implmented		
Templates to request connecting small-scale renewable energy sources	Directive / Guidelines	Fiscal / financial incentives	Implmented		

Name	Type	Legal status	Implementation	Issuance Year	Issuing body
Electricity Tariff	Tariff / Price list	Mandatory	Enforced	Updated regularly	

1.2 Analysis of Energy Codes for Buildings in Jordan.

1.2.1 *Code Development Process*

The Construction and Sustainable Buildings Center (CSBC) of RSS has worked since 1980 to prepare and update the national building codes, manuals, and technical specifications for Jordan National Building Council (JNBC) in accordance with the agreement signed with the Ministry of Public Works and Housing. The work plan for each stage is determined according to national priorities, feedback from application, industrial and technological development, and relevant national and international studies and references. The center prepares drafts of codes, manuals and specifications according to the priorities approved by JNBC and in accordance with the table of contents agreed upon at the beginning of work, and in line with the latest global releases and the latest technological and scientific developments in various fields of the construction industry, and in a manner that ensures compatibility in the content of drafts with the valid national laws and regulations.

After the center completes the initial draft, the Ministry of Public Works and Housing will form a technical review committee that includes specialists from the public and private sectors, scientific and academic institutions, and relevant bodies on the subject of the draft in order to study the content of the initial draft and provide the necessary amendments. After reflecting the review committee's amendments to the initial draft, the linguistic and technical editorial work is carried out according to the methodology used to coordinate and produce the national building codes, guidelines and technical specifications, and then the final draft is submitted to the Ministry of Public Works and Housing.

The final draft is submitted to the technical committee of JNBC and then to JNBC for approval. After that, the draft is presented for 60 days in public libraries so that the specialist can review the content and make suggestions for amendment. Finally, the draft is submitted to the Cabinet for final approval, after which Hard copies are printed, and the new edition becomes active and available for use.

The Jordan National Building Council contracted the Royal Scientific Society/Construction and Sustainable Buildings Center (RSS/CSBC) to develop the "Energy Efficiency Buildings Code", to improve thermal performance and minimizing energy consumption in the building sector (T. Awadallah, 2009). Additionally, JNBC supplemented the EEBC with other detailed codes such as the Thermal Insulation Code, the Mechanical ventilation and air conditioning code.

This report focuses on the analysis of the mandatory Energy Efficient Buildings Code and Thermal Insulation Code. Since, the energy efficient buildings code contains the most important information the engineer needs to carry out the design, implementation, and operation of buildings in accordance with the requirements of the minimum energy efficiency in line with the national energy codes. While the thermal insulation code is an important part of the thermal design to create energy-efficient buildings, as it addresses the issue of thermal insulation in buildings and the basic requirements related to it, which leads to the establishment of modern, energy-efficient local buildings and achieves significant economic benefits at the national and individual levels.

Table 5 Development and Elaboration Process of EEBC in Jordan

Parameters	Description
The responsible governmental bodies	JNBC
The responsible non-governmental Bodies	RSS
Stakeholders involvement	▪ RSS ▪ Ministry of Public Works and Housing (MoPWH) ▪ Ministry of Energy and Mineral Resources (MEMR) ▪ Jordan Standards and Metrology Organization (JSMO) ▪ Ministry of Environment (MoEnv) ▪ Jordan Civil Defence Directorate (JCDD) ▪ Jordan Engineers Association (JEA) ▪ Jordan Construction Contractors Association (JCCA) ▪ Private Sector ▪ Academia
Frequency of code updating	yes
	5 Years and/or according to the national priorities, application feedback, budget/fund availability
	no
Coordination with NEEAP	yes In case of yes, please fill the next cell
	Jordan NEEAP 2018-2020 ▪ EE building codes enforcement (insulation code only) for 66000 new household and 5670 new buildings in territory sector (Hotels, Hospitals and Clinics, Education, Offices) during 2017-2020 ▪ Energy Efficiency Buildings Codes: - Finalization of the enforcement procedures - Effective date of enforcement of the codes -Effectiveness of the regulation implementation.
Coordination with NDCs	no

While there are several EEBCs in place and there are several enforcement plans, the continuous updating and development of energy codes and manuals faces several challenges such as the lack of the necessary financial support to update the related codes and manuals within the same duration, and to conduct the work in accordance with the latest national and

international references, in a manner that takes into account technological and industrial development. There is also a lack of a clear application methodology that defines the roles of different stakeholders in the application process, and set the specifications of materials, instrument, and devices which can be used for various energy applications in building process according to the national specifications and codes requirements.

1.2.2 *Technical Scope and Requirements of EEBCs in Jordan*

The Codes have been reviewed and endorsed by Technical Committees established with representatives from the Royal Scientific Society (RSS), the MPWH, the Jordan Engineering Association (JEA), the Association of the Jordanian Construction Contactors (JCCA), representatives from Universities and private sector stakeholders In terms of technical requirements of the EEBCs mandatory codes in Jordan, the codes cover a wide range of building characteristics and systems such as the Mechanical Ventilation and AC, Central Heating, Natural Ventilation and Natural lighting Codes.

The general current EEBC in Jordan consists of 8 chapters covering the following topics:

- Chapter 1 : Generalities
- Chapter 2 : Architectural requirements and principles for design of EE buildings
- Chapter 3 : Mechanical ventilation
- Chapter 4 : Heating and Air conditioning
- Chapter 5 : Water Heating
- Chapter 6 : Artificial lighting systems
- Chapter 7 : Electrical power
- Appendices

Meanwhile, work is underway to update the energy efficient buildings code and to prepare a Manual for the new code to clarify the requirements contained within it. The new draft code aims to provide information about the minimum energy efficiency requirements in buildings except for low-rise residential buildings (two floors or less), in the design, construction, operation and maintenance phase of the building, and by exploiting the renewable energy generated in the site itself.

The current thermal insulation code aims to set the principles of optimal thermal design for buildings, to help engineers and architects in isolating the building's outer shell in a correct and thoughtful way, which leads to the development of local buildings by improving their thermal performance, to be buildings that achieve thermal comfort and healthy atmosphere for its residents throughout the seasons of the year, which contributes to increasing their ability to work and production and to provide sustainable buildings that are energy-efficient and environmentally friendly. In 2018 the code’s manual was published to clarify the concepts and requirements included in the code, and to provide examples, calculations, experimental works conducted for different thermal insulations materials.

The Thermal Insulation Code consists of 5 chapters covering the following topics:

- Chapter 1 : Generalities
- Chapter 2 : Thermal insulation materials
- Chapter 3 : Building thermal design principles
- Chapter 4 : Thermal design calculations

- Chapter 5 : Design requirements
- Appendices

Energy codes provide the main climate data of temperatures, humidity, wind speed, radiation and other data for different zones in Jordan. The codes then provide guidelines for the main principles and methods of thermal design of the buildings, solar radiation, energy losses and gains. Additionally, the code offers various guidelines and recommendations for building forms, building orientation, passive solar techniques for thermal efficiency, natural ventilation, natural lighting, and the use of shading devices. Table 6 shows examples of the key EE building standards in the mandatory codes in Jordan to be applied on all new buildings and the extension of the existing buildings as well

Table 6 Key Technical scope and requirements of EEBCs in Jordan

General Requirements		
Type of the code	All	Mandatory multi-disciplinary engineering code, includes architectural, mechanical and electrical engineering, the new draft code main source in the ASHRAE 90.1 2016-2019
Covered building types	New Building	And refurbishment of existing buildings (ALL buildings) Includes residential and non-residential buildings, excludes industrial facilities and warehouses.
Building design, forms, orientation	Considered but not defined	All are recommendations and obligatory, based on climatic architectural design taking into consideration North-South long axis facing facades, compact design, etc.
Minimal Energy Performance Standards MEPS	Considered but not defined	Only tables of energy efficient specification, however, the new draft includes simulation performance assessment methods but not mandatory. The responsible body is the Ministry of Public works and housing.
Baseline definition	not considered	There is no definition for a baseline or a benchmark so far
Different climate zones considered in the code	considered and defined	• In the new draft of Energy Efficient Building Code 2020, new HVAC code, New Central Heating Code, there are 3 climate zones: Climate zone 1: Aqaba, Jordan Valley Climate zone 2: Maan, Ruweished, and Azraq Climate zone 3: Amman, Balqa, Salt, Irbid, Ajloun, Jerash, Ramtha, Zarqa, Mafraq, Maan, Tafeileh, Karak, Shoubak, Mudawara. • In the Current Energy efficient Building Code, no identification of Climate Zones
Thermal Comfort	considered and defined	Example: Dry bulb temperature between 21-27 °C degree, relative humidity between 25 – 50 % at wind speed of 0.5 - 1.5 m/s.

Building Systems		
Lighting	considered and defined	Mandatory requirements are for all buildings that has a power exceeding (600) K.F.A, and they are recommended for buildings that has less power. • Occupancy sensors are mandatory for areas more than (500) m^2. Also mandatory for closed offices exceeding the area of (30) m^2, and conference rooms, meeting rooms, classrooms, and storage areas. • One interior control device at least should be applied to areas with partitions. • For areas less than (1000) m2, a single control device should serve (250) m^2 area maximum. However, for areas exceeding (1000) m2, the control device should not serve an area exceeding (1000) m^2. • Control switches should be equipped with signal lights. • For areas exceeding (25) m^2 lit by natural light (daylight), a control device should be applied. This control device should be able to lower artificial lighting illumination by 50 percent at least. The control is only required for the day lighted area. • For Exit and Emergency Lighting, lighting units' power should not exceed (8) kW for each side of the unit. • For exterior spaces that consume (100) W or more, lamps of an efficiency (60) lumen/W at least should be applied. • Exterior lighting should have a photo sensor or astronomical timer (solar time) which automatically shuts off the lighting equipment in daytime and whenever daylight is available. •
Daylighting	considered and defined	In the Energy Efficient Building Code, the importance of natural lighting is shown by recommending minimizing electrical energy consumption and defining skylight and window lighting properties. Requirements for natural lighting are: • obstacle angle in front of window not more than 70 degrees • 50% of opening should be on at least 2 different sides, • ratio of window to wall area above10% for services, • 15% for residential functions, • visual lighting transmittance above 0.45, • skylight maximum area 12% from roof, • Light coloured internal surfaces. Recommendations for this section were as following: • organized distribution of windows • window height • Window location. From the Daylight Code:

		• Natural lighting and solar radiation should be designed to complement each other to reach optimum use of energy. • A sufficient amount of illumination should be provided from daylight in order for the design to work in overcast sky also. • The quality of daylight should be considered to avoid the use of discomforting direct light or glare formation or to avoid the overheating that comes from excess light. • All windows and opening should be designed to avoid glare or overheating • using daylight should aim to save electrical energy use from artificial lighting or heating or cooling systems used • When increasing window number, the thermal insulation code requirement should be taken into consideration regarding total u-values. Daylight efficacy should be 100 lumen/watt of solar power. • A sufficient amount of artificial lighting fixtures should be available to compensate any daylight illumination loss during daytime. • Artificial lighting and natural lighting design should be integrated together to provide sufficient levels of illuminations according to zones & function of the space, & to avoid glare. • For the case were Artificial lighting and natural lighting are mixed in the doing, Colour Rendition Index, CRI should not be less than 60%. • Side lighting is important in multi-story buildings, where the illumination level depends highly on the width and height of the opening, related to the height of the task inside the space. The relationship between the architectural space depth and height of the window from floor level when designing daylighting should be D= 2.5 x H. • Sun breakers and shading devices should be used to guarantee no admittance of direct solar radiation to spaces where it is not required, such as patient's rooms and computer rooms. • Top lighting allows daylight for spaces by 20% more than allowed space depth, when using clear glazing for top lighting, proper control systems should be used to prevent direct sunlight and overheating, where it might affect the visual comfort. Control is made by using diffusing glazing, or shading devices or glass boards with special treatment. • Table (X) should be used for cooling loads calculations resulted from daylight. • Side lighting and top lighting could be used together in a different combination for flexibility of daylight design. Side lighting for a room doubles the depth that can be lit by daylight. When using side sky ducts, it provides daylighting

		as well as ventilation. Better light can be done by providing reflectance surfaces for light to penetrate deeper into the space. • Horizontal shading devices should be used for all south oriented elevations and vertical shading devices should be used for all east and west oriented elevations • Indirect glare can be avoided by proper choices of interior elements, such as walls colours, texture and furniture. • Direct glare can be avoided by removing daylight sources (windows and openings) from the cone of vision (60 degrees) for occupants. • Angle of Incidence at a point should be different from the vision angle at the same point to avoid glare. Openings should be to the left of the user and work plane. • Reflectance coefficient should be between 50 and 60 % for the window surrounding surfaces, to minimize contrast between the window and the surrounding surfaces. • Reflectance coefficients inside the architectural space should be as the values in table (XX).
Domestic Hot Water Systems	considered and defined	• Hot water systems with a Storage capacity exceeding (300) liters, and power exceeding (15) kW, should be located in separate places and faraway from occupied zones. • If fossil fuels or electricity was used for the heating procedure, water temperature should not exceed (50) Celsius. • Hot water tanks should be insulated by at least 5 cm of proper thermal insulating material, and this material should be covered with a low emissivity coat. • Requirements in table (H.W.1) should be applied for the equipment efficiency. • Temperature controls for systems that heat water for up to (5) Celsius. • Temperature regulating valve has to be installed at hot water source point. • For hot water systems that include circulators for regulating water temperatures, a control device should be installed and adjusted to stop the cycle after 5 minutes of the end of the hot water cycle automatically.
Natural Ventilation	considered and defined	In the Energy Efficient Building Code, the importance of natural Ventilation is shown. It describes ventilation advantages and minimum ventilation rates needed for a healthy comfortable living. It also states requirements as the following: • Ventilation design consideration should be taken in the first phases of the design. • Avoid penetration of rainwater through ventilation points.

		• The distance between two parallel facades in residential buildings (or the distance between two parallel walls inside a courtyard should not exceed 5 times the height of the space in each floor. • Relative humidity indoors should be between 40% to 70% • Provide shading for ventilation point • Avoid positioning ventilation points near pollution sources, such as close to parking lots or other. Recommendations for this section were as the following: • Provide architectural solutions for protection from dust • Design to maximize benefit from natural ventilation • Provide small operable openings in big openings • additional ventilation equipment's for redirecting air • Recommended use of colestra brick and meshes in front of openings in order to cool the fresh air before it inters the indoor space. From the Natural Ventilation Code: For successful ventilation in design, the following should be considered, 1) control of un wanted ventilation, 2) air flow control, 3) force and movement of air, and 4) control of air flow from and to and in the right time. • To control of unwanted ventilation: perform infiltration test, to make sure that infiltration does not exceed 10 m3/hour/m2 at 50 Pascal. • To control of unwanted ventilation: Air barriers with architectural details for buildings of less than 1000 m2 area. • Single Side Ventilation: if ventilation is from one side only, the depth for ventilation is 6 m, but if heat gain is low, depths could reach 10 m. • Double Openings: ventilation is at 2-5 times of height from floor to ceiling. Ventilation requirements in offices • Table (XX) shows required ventilation to minimize CO2 concentrations for different level of activities. • For body odour control, eight L/s/person should be the minimum ventilation rate. • Volatile organic compounds (VOC) control come from from finishing materials used inside the space, if concentrations emitted are more 3000 mg/m3, people start to complain. • Respirable Particles/Particulate Matter PM10 • Radon, limit is 400 Bq/m³ • Relative humidity: accepted level is 40-70 percent. • solar heat gain should not exceed 60-90 w/m2 • one person per 12 m2 • heat gain from lighting fixtures should not exceed 12 w/m2

		• heat gain from office equipment should not exceed 15 w/m2 in areas more than 1000m2, and 25 w/m2 for areas less than 1000 m2 For Residential Buildings: In general, ACH should be 0.5-1. For lobbies, closed waiting rooms, and air locked areas, revolving doors should be provided. Smoking requirements should be taken into consideration.
Heating, ventilation & air conditioning (HVAC)	considered and defined	Air conditioning units should include an energy efficiency label according the Jordanian technical specification No. (1772-2), which shows data related to energy consumption used by the beneficiary for comparison between systems. It should include Maximum and Minimum Energy Efficiency Ratio (EER) shown in detailed tables in the Energy efficient building code.
Auxiliary energy for mechanical ventilation	considered and defined	Minimum Energy Efficiency Ratio (EER) shown in detailed tables in the Energy efficient building code.
Space cooling, air conditioning	considered and defined	Minimum Energy Efficiency Ratio (EER) shown in detailed tables in the Energy efficient building code.
Cooking	not considered	Not defined in the code
Electrical power	considered and defined	Defined by the Electrical works code of Jordan and the EEB code, all comply with energy efficient requirements.
Plug loads, appliances	considered and defined	Defined by the Electrical works code of Jordan, all comply with energy efficient requirements.
Plumbing	considered and defined	Defined by the Unified plumbing code of Jordan 2018
Appliances	considered and defined	Energy Labels are a requirement for all imported appliances, managed by the JISM (Jordan Institute for standards and meteorology)
Building Envelope		
Thermal Resistance/U value for walls	considered and defined	Based on the EEB code, and the thermal insulation code, the external wall U-value should not exceed 0.57
Thermal Resistance/U value for Roofs	considered and defined	Based on the EEB code, and the thermal insulation code, the roof U-value should not exceed 0.55

Thermal Resistance/U value for Ground Floor	considered and defined	Based on the EEB code, and the thermal insulation code, the roof U-value should not exceed 1.20
Shading and Fenestration	Choose an item.	Only total U-Value of Windows is defined in the Energy Efficient Building Code 2010, WWR shown in table (E.E.3) • Air leakage not more than 3 l/s for doors and 2 l/s for other vertical openings. • windows and doors sealing • Insulation of construction connections to avoid thermal bridges. only if shading devices were used, requirements are as the following: • Application of a void between external shading devices and windows. • The use of lightweight materials Recommendations when shading devices are use: • shading coefficient less than 0.2 • movable shading on east, south-east, west, west south facades • External shading is better than internal shading.
Window Wall Ratio and Openings	considered and defined	Based on the EEB code, and the thermal insulation code, Only examples are given for eligible uses of glass type within the total u-value of the external walls including fenestration that is 1.6.
Air tightness	considered and defined	Based on the EEB code, and the thermal insulation code, Should not exceed 3 Liters/second/m2 for revolving/swinging doors, and should not exceed 2 Liters/second/m2 for all windows.
Renewable Energy Applications		
Solar Hot Water	considered and defined	• Requirements for the solar collector systems mentioned in the Jordanian solar code are applied on all solar collector design for all buildings. Solar energy use for domestic water heating is obligatory for all new buildings where the consumption of domestic hot water is more than 1 liter per day per meter square occupied area, and provided that the ratio of occupied area, (minus the areas required for services) to the area of the roof does not exceed (4). However, it is allowed to add as many solar energy backup systems needed.

		• If the ratio exceeds (4), the requirements of energy efficient building code should be applied. • If amendments or additions to old solar collectors are needed, the requirements of the Jordanian solar code should be applied. • Exclusions: all buildings that are located or oriented in a way that prevents benefit from solar energy in any form, are exempts from applying the requirements of the code, but should comply with the energy efficient building code requirements.
Geothermal	not considered	------
Solar Cooling	not considered	------
PV-installation	considered and defined	• If PV systems are applied in new buildings, the requirements mentioned in the Jordanian solar code regarding the PV system design should be applied. • If amendments or additions to old PV systems are needed, the requirements of the Jordanian solar code should be applied. • PV application is not mandatory in Jordan.

1.2.3 Compliance procedures of EEBCs in Jordan

According to the National Building Law, JNBC is the owner of building codes in the Jordan and is responsible for developing and implementing them in all stages of the construction industry. The Council has the right to delegate the authority to follow the implementation of any code to the entity that possesses the expertise and competencies necessary to complete the required work. For example, the Council has delegated civil defense to follow up the implementation of fire codes in both, design and implementation stages. However, until now there is no decision for authorizing energy codes.

The Jordanian Engineers Association (JEA) also audit several building codes at the design stage as part of the association's internal system. In the field of energy codes, the association checks the application of the thermal insulation code, the mechanical ventilation and air conditioning code, and the central heating code at design stage.

While the EEBCs in Jordan follow the same structure by providing definitions, general approaches and detailed information about each specific topics of the Codes and then provide design requirements in the last chapters of the Codes. Those design requirements specify values and minimum requirements for the design of an energy efficient building including all the building characteristics such as the thermal insulation of the walls, U values for the different types of openings and external roofs, HVAC systems, openings, ventilation, lighting etc.

Compliance with building codes is compulsory and is mandated by the national building law but the enforcement mechanisms are not well defined in most of the EEBCs in Jordan. For instance, according to the EEBC, design documents and drawings of all new buildings and new extensions of the existing buildings must be inspected by a specialized party to verify that the building meet all the code requirements. Though, on-site inspection is rarely done to

ensure that the construction fulfills the code requirements, which resulted in inadequate compliance with the EEBCs (Al-Hinti & Al-Sallami, 2017).

Despite the importance of the energy topic at the national level, and its high cost, the energy codes did not take specificity for the application. Whereas the current national energy codes cover the minimum design requirements, they have not yet covered performance calculations nor verification software, and there is an urgent need to qualify a group of engineers working in the various stages of building according to the requirements of each stage, from designing, auditing, implementing, supervision and verification, in parallel with updating the content of the energy codes to ensure correct implementation.

1.3 Analysis of EEBCs Implementation Mechanisms in Jordan

A study done by (Al-Sallami , 2015), shows that although compliance with all building codes in Jordan is mandatory, only 9% of the buildings comply with the code and almost 77% of Jordan residential buildings do not have any type of thermal insulation (Al-Sallami , 2015).

While the national building law has clear and well documented building permits process and procedures with assigned responsibilities and roles such as the building permits procedural guidelines of Amman Municipality (Amman Municipality, 2019). Yet, to comply with the EEBCs, neither compliance manuals nor procedural guidelines are available.

In 2006 the Royal Scientific Society developed a draft for “Quality assurance system for residential buildings (apartments)”. The system aims to ensure the application of the law, instructions and building codes in all stages of engineering work, including design, audit, supervision, implementation, operation, maintenance, public safety works and all associated engineering works and the validity of buildings and residential apartments for occupancy and confirmation of that. The system does not check the mathematical values and design assumptions and does not exempt the designer and the implementer from the legal responsibility entrusted to them, rather, it checks the validity of procedural matters in the application of quality systems. To date, the system has not been approved by JNBC due to the restraint of some parties.

To ensure the development of a clear and integrated mechanism for implementing the codes, a comprehensive review of the process of preparing and implementing national building codes in general, and energy codes in particular, must be conducted with the participation of all concerned parties. The most important steps necessary to accomplish this national work can be summarized as follows:

- Review laws, legislations, regulations, and procedures related to the organization of the construction industry and the role assigned to each party and submit a proposal for amendment to the concerned authorities.
- Preparing a draft of a system for activating the application of the content of the national building codes in the various stages of construction and submitting the system for approval according to the official procedure. The draft must include the role assigned to each party within the application system, implementation incentives, and penalties in case of non-confirming works.
- Reviewing the energy codes and manuals, determining the need for updating and / or preparing other codes/ manuals in case the need arises to cover new topics not included in the current versions to ensure compatibility and comprehensiveness in the technical content and design requirements, and to set a timetable to ensure continuous review and update for a period not exceeding Five years.
- Establishing a national program for awareness, knowledge dissemination and capacity building for different stakeholders involved in the construction industry.

- Assigning a neutral third party to follow up the implementation of the system for the various stages of work.
- Provide the necessary funding to accomplish what was mentioned in the previous items.

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Table 7 Proposed Implementation Mechanisms of Thermal Insulation Code and EEBCs in Jordan

Parameters	Description
Implementation and compliance plans	The EEBCs suggested Implementation and compliance plans, but a limited number of activities had been executed, currently JNBC have signed a MoU with UNDP under SURE project to prepare a unified assessment guidelines for energy efficiency in the building sector, and to establish assessment unit for projects under construction (new projects).
The enforcement governmental bodies	The Jordan National Building Council (JNBC)
Is the compliance with EEBCs enforced in the procedures of obtaining the building/construction permits	no
Is the compliance with EEBCs enforced in the procedures of obtaining the occupancy permits	**no**
Who is accredited to verify the compliance with the code (e.g. auditors with a specific education or certification, ESCOS)?	Not available
Are adequate number of professionals and/or editors to prepare the energy calculation available in the market?	**no**
Are adequate number of professionals and/or editors to verify the compliance available in the market?	**no**
Entities responsible of issuing the building permits	• For Amman: Greater Amman Municipality (GAM) • For other governorates: The Ministry of Municipal Affairs (relevant municipality) • Jordanian Engineers Association JEA
Entities responsible of issuing the building occupancy permits	• For Amman: Greater Amman Municipality (GAM) • For other governorates: The Ministry of Municipal Affairs (relevant municipality)

Parameters	Description
Stakeholder's involvement in the implementation (e.g. Architects, engineers, industries, construction etc.)	• Ministry of Public Works and Housing • Ministry of Municipal Affairs • The Jordanian Engineers Association • The Jordanian Construction Contractors Association • Engineering Offices and Companies Authority • Investors • International organization
The activities to improve the readiness of the construction market relevant to Industries, construction, tender etc.	**no**
Capacity Building programs relevant to the EEBCs	**no**
Documentation of compliance processes exists or not?	**no**
Provision of technical support in design phase	**no**
Review of plans at design phase	**no**
Provision of technical support in construction	**no**
Inspection at construction	**no**
The number of Building delivered according to the EEBC	Not available
New governmental plans to enforce the code	**no**
Incentives to comply with the EEBC	**no**
Fines enforced in case of non-compliance	**no**
Other relevant ongoing projects and plans	• Updating the (Energy Efficient Buildings code) and preparing Manual for the new code draft. • Updating the (Solar Energy code) and preparing Manual for the new code draft. • Finalizing the first edition of the (Mechanical ventilation and air conditioning code Manual) and the (Central Heating Code Manual).

Recently, the Jordanian National Building Council and UNDP's project (Sustainable Development and Resources Efficiency, SURE) have signed an MoU to update some of the national EEBCs, and to prepare unified assessment guidelines for energy efficiency in the building sector. This will include the update of thermal insulation code, a new green building and hospital code, a new outdoor lighting Code , and dissemination of energy efficiency principles and the establishment of a new unit at the JNBC to be responsible of the assessment of the projects under construction (Addustour, 2019).

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

The national building codes are prepared and updated according to a unified methodology to ensure consistency in form and content between national codes in general, and compatibility and harmony in the technical requirements between codes related to a specific topic. It is assumed that the codes will be updated every five years. However, due to the limited financial resources, the updating process is carried out according to the national priorities of each stage and within the available resources.

The process of preparing and updating the national building codes is done with the participation of stakeholders from various sectors and disciplines. This participation is well defined during code development stage, but it is still unclear during the stage of code implementation. The first step for codes implementation and enforcement is the presence of a decision by the authorities. Hence, it is important to provide the necessary financial resources to support the various stages of work, which include the following:

- Setting a clear mechanism for the process of applying the codes in the design and implementation stages, in a way the mechanism becomes part of the licensing and implementation system for projects that take place in Jordan. The mechanism must include authorization of a third party that works to follow up on the implementation and ensure a clear distribution of roles among the stakeholders. Also, it is necessary for the mechanism to include a clause covering the topic of examining devices and equipment, whether they are manufactured locally or imported, in accredited testing laboratories in accordance with the requirements of the national standards and codes to ensure efficient performance.
- Establishing national training program for engineers and technicians working in the construction sector, which is divided according to the stages of work, namely, design engineers, supervision engineers, implementation engineers and technicians, and inspection engineers.
- Raising people's awareness about the importance of using tested/ certified products, and applying codes in various stages of work, especially the implementation, and their effect for them at the stage of occupancy in terms of economic, health, comfort and safety.

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Table 8 Summary of status que of the Thermal Insulation Code and EEBCs in Jordan

Category	Parameters		Description
Code development process	The responsible governmental bodies		JNBC
	Stakeholders involvement		▪ RSS ▪ JNBC ▪ Ministry of Public Works and Housing (MoPWH) Ministry of Energy and Mineral Resources (MEMR) ▪ Ministry of Municipal Affairs ▪ Jordan Standards and Metrology Organization (JSMO) ▪ Ministry of Environment (MoEnv) ▪ Jordan Civil Defence Directorate (JCDD) ▪ Jordan Engineers Association (JEA) ▪ Jordan Construction Contractors Association (JCCA) ▪ Private Sector
	Frequency of code updating		Every five years and/or according to the national priorities, application feedback, budget/fund availability
	Coordination with NEEAP		Jordan NEEAP 2018-2020
	Coordination with NDCs		No
Technical scope and requirements of EEBCs in Jordan	Type of the Code		Both Prescriptive and Performance based
	Climate Zones in the code		• Three climate zones according to the new draft of Energy Efficient Building Code 2020, new HVAC code, • In the Current Energy efficient Building Code, no identification of Climate Zones.
	Building design and forms		
	Building envelope	Thermal Resistance/U value for walls and roofs	Yes, from the Energy Efficient Building Codes 2010, requirements for walls, floors, and roofs are available.
		Ground Floor	N/A

Category	Parameters		Description
		Fenestration, Shading and WWR	The total U-Value of Windows is defined in the Energy Efficient Buildings Code 2010, and WWR too.
	Thermal Comfort		Defined in the code.
	Building systems	Natural Ventilation	The requirements and recommendations for offices and residential buildings are available in both, energy efficient buildings code and natural ventilation code.
		Heating, ventilation & air conditioning (HVAC)	It should include Maximum and Minimum Energy Efficiency Ratio (EER) shown in detailed tables in the energy efficient buildings code.
		Domestic hot water system	Detailed requirements are available in EEBCS.
		Lighting	The mandatory requirements are for all buildings that has a power exceeding (600) K.F.A are available, and they are recommended for buildings that has less power.
		Daylighting	The requirements and recommendations are available in both, energy efficient buildings code and natural lighting code.
	Renewable Energy Applications	Solar Hot Water	The requirements and recommendations for Solar hot water and PV- installation are available in solar energy code.
		Geothermal	
		Solar Cooling	
		PV- installation	
	Minimal Energy Performance Standards		Yes
	Number of buildings delivered according to the code		Not available.
Analysis of Implementation Mechanisms	Implementation and compliance plans		Limited number of activities had been executed, SURE project.
	The enforcing governmental bodies		JNBC
	Is the compliance with EEBCs enforced in the procedures of obtaining the occupancy permits		No
	Entities responsible of issuing the building permits		Greater Amman Municipality (GAM), and Municipalities.
	Stakeholders involvement in the implementation (e.g. Architects, engineers, industries, construction etc)		Yes, Ministries, engineers and contractors' associations, private sector, NGO's.

Category	Parameters	Description
	Readiness of the construction market relevant to Industries, construction, tender etc	No
	Capacity Building programs relevant to the EEBCs	No
	Documentation of compliance	No
	Provision of technical support in design	No
	Provision of technical support in construction	No
	Building delivered according to the EEBC	Limited cases on the national level.
New governmental plans to enforce the code		SURE Project.
	What are the relevant ongoing projects and plans	- Updating the (Energy Efficient Buildings code) and preparing Manual for the new code draft. - Updating the (Solar Energy code) and preparing Manual for the new code draft. - Finalizing the first edition of the (Mechanical ventilation and air conditioning code Manual) and the (Central Heating Code Manual).

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 Jordan 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 Annex 1 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*

Experts find that the national energy codes are understandable for professional engineers and technical staff specialized in energy efficiency matters, since all codes are in Arabic, written in a clear language and include figures, tables, and illustrations, and linked to all other related codes. Even though, the codes are not linked to simplified checklists that can be used by the designer/ evaluator. While the building codes provide the minimum technical requirements for design, the manuals aim to clarify the design concept and requirements contained in the codes. In 2018, the first energy manual was published for Thermal Insulation Code; it came to define the building thermal design principles and the methods for calculating the thermal characteristics of different structural elements, and meanwhile the drafts of two manuals and codes for energy efficiency and solar energy are under review by the technical review committees. While Jordan Building Green Guide was published in 2012 and is referenced to Jordan's Building Codes as compulsory requirements. On the other hand, the manuals do not include the procedures related to the occupancy permits.

Towards codes implementation, there is a need to have a training programs and to establish a continuous educational development schemes to upgrade engineer's knowledge working at design and construction stages, and this includes designer, evaluator, consultant, contractor and supervision engineers. In addition, enforcement schemes shall be implemented properly, and clear third-party inspection authority shall be activated, to ensure the application of the codes requirements and avoid conflict of interest.

An example of the practices to cope with the technical challenges would be the case of League of Arab State (LAS) through Regional Centre of Renewable Energy and Energy Efficiency (RCREEE), they have held many workshops and implemented studies regarding this issue. In addition, MEDENEC project discussed the enforcement EEBCs in MENA region and summarised the result and the recommendations to enhance the enforcement process.

2.1.2 *The Institutional and Regulatory Challenges*

The national Codes are mandatory by law, but until now, there is no clear scheme for the enforcement and implementation, there is obligation to apply codes requirements at the design stage rather than at the construction stage, no entity is working currently to follow up the implementation in accordance with the requirements of the codes. While for the coordination between national and local authorities, there is a good level of linear collaboration between related authorities in the design stage, each one knows his role and territory in design.

However, for implementation, the level of collaboration is still not clear, especially for energy codes.

The current system for code development is well defined and established, since there is a number of levels for preparation, technical revision, and approval. After the decision is made to prepare or update certain code or manual by JNBC and the technical committee of JNBC, RSS prepare the first draft of the new code/ manual. After that, JNBC forms a technical review committee from different stakeholders involved in the draft content, i.e. public and private sectors, academia, designers and contractors. At the end of the review process, the second draft is submitted to the technical committee of JNBC for comments and approval. After that, the draft is submitted for the approval of JNBC and is presented for public in libraries for 60 days for any final comments, and then, the final draft is approved by the Cabinet as national code/ manual.

Nevertheless, the updating time cycle every 5 years shall be followed, it is important to look at the international standards to update properly, such as ASHRAE and CBCE, and to assure compatibility and coherence in the requirements of the national codes, and each manual/code should be updated in parallel with the related codes and manual. In addition, there is a need to develop a detailed checklist and conformity certificate to be add to the codes and manuals, and to translate the codes technical requirements into procedures and steps by using simplified language for the use of site workers and technicians so that the execution is done correctly. Meanwhile, a number of energy codes and manuals have been published, and another group is being updated, and some still need updating due to the update of a number of related codes.

While the process is satisfied during the stage of code development, the implementation stage needs careful analysis, defining different roles of stakeholders and developing procedures to check and approve code compliance during construction period. In addition to the lack of awareness of the requirements of the updated codes and their importance and how to properly implement by the worker at the construction sites.

In general, the process of EEBCs development, implementation, and enforcement needs strong coordination between different stakeholders through defining the authority responsible matrix, with relevant approvals and actions. The involved stakeholders mainly include MoPWH, JNBC, RSS, JEA, JCCA, JISMO, academia and universities, and private sector. In addition, the suggested improvement actions are:

- Enhance the level of stakeholders' involvement, support coordination and collaboration, and find more efficient ways to avoid conflict.
- Enhance the collaboration with NGOs for the development of complimentary systems/training/spread of expertise.
- Assign third party that is responsible of conformity and compliance EEBCs requirements.
- Designate a professional staff in each entity, which is responsible of occupancy permits issuance.

Some of the available practices are the following:

- JEA checks projects design and makes sure that they comply with the requirements of the codes according to the association internal system, and as part of the stage of issuing the necessary permits before starting the construction stage.
- Civil Defence is responsible for checking installation versus approved construction drawings for the fire prevention codes, and accessibility code.

2.1.3 *Capacity Building and Awareness Challenges*

There is a good level of awareness and high level of interest about EEBCs among the relevant/involved stakeholders, but maybe it is more focused on renewable energy rather than energy efficiency and energy saving. Awareness can be measured by number of EE-related certificates/workshops/training/seminars attended by the involved stakeholders but cannot guarantee proper implementation. These events should be attended by actual workers/builders/contractors/junior and senior designers, not top management only. In addition, the target group in the governmental entities do not achieved the purpose of capacity building program because many employees leave their jobs to another one in the entity itself or out. Moreover, there are very few examination/ official accreditations of persons in the EE field.

There is a need establish a national awareness and capacity building program that is connected to the national building codes and consists of training sessions for authorities' staff, design and supervision engineers, and technicians/ workers. Creation of a Certification programs will support the national efforts towards codes enforcement.

An example of the national efforts in this regard is the agreement signed between MoPWH and RSS in 2013 for capacity building, awareness and spreading knowledge. According to the agreement, RSS will establish an integrated program to educate the local community about the various sectors in which the Ministry of Public Works and Housing operates. The agreement includes three main pathways; the first is to qualify the staff of the Ministry of Public Works and Housing, the second is regarding the implementation of awareness campaigns for citizens, and the third is to implement an awareness media campaign. Unfortunately, the agreement still not activated due to lack of necessary financial support.

2.1.4 *Financial Challenges Related to the Implementation of EEBCs*

The percentage of additional cost resulting from the construction of a building according to the EEBCs compared to the Business As Usual (BAU) construction can be from (0) to (20) %, it depends on the type of project, size, location, and quality needed. If higher standards are required, the percentage will be higher; it might reach (30) % in some cases.

There are no incentives designated to compliance according to EEBCs in a direct way, but since these codes are, a main requirement of Jordan Green Building Guide, this guide is liked with incentives system specially the incentives given by GAM and municipalities. On the other hand, there is the zero-tax of EE related equipment/ devices/ materials incentive. Since the codes are obligatory, there are no incentives attached. However, simple incentives at the beginning of the implementation (such as credibility of the building/ consultant office/ contractor, certification, etc.) is recommended.

Meanwhile, most of the available funds and financing options when building comply with the EEBCs are related to PV. An example is the EU funds to Jordan through REEP program that implemented in the past 5 years. The best practices to cope with the challenges/barriers discussed above should be based upon revealing the economic effect obtained if the buildings comply with EEBC. The economic effect means the total JD the stakeholder will obtain from complying with codes during the operational life of project.

In Jordan, the National Energy Efficiency Action Plan (NEEAP) through (JREEF) and MEMR is one of the tangible studies, includes KPIs and proofs.

2.1.5 *Other Relevant Challenges and Barriers*

- Energy efficient construction materials are available and in reasonable prices, the problem is in the know-how in implementation on site- to avoid thermal bridges and so on.

- Some designers/contractors are not aware of some incentives that can be given if proper EE materials/equipment/devices are used in the project.
- The data and info of EE construction materials in the local market is available and accessible, but the problem is in the knowledge of importance of such implementations in the construction, and availability of numerical data on saving percentages and payback periods (life cycle cost).

2.2 General Recommendations

For the list of recommendations and experts' explanation, please refer to the attached Questionnaire forms in Annex 1 of this report. This general list of recommendation has been concluded from the interviews and the suggested actions as main priorities to improve the EEBCs implementation and enforcement are the following:

a) Establish a national capacity building and awareness program that is connected to the national building codes and provides a continuous educational development schemes to upgrade engineer's knowledge working at design and construction stages

b) Adopting an enforcement schemes and activating a clear third-party inspection with dictated staff and responsibilities to ensure the application of the codes requirements and avoid conflict of interest.

c) Adopting Coordination mechanism between different stakeholders through defining the authority responsible matrix, with relevant approvals and actions.

d) Follow the updating time cycle for Codes and manuals continuously and in parallel, develop a detailed checklist, conformity certificate, and translate the codes technical requirements into procedures and steps by using simplified language.

e) Establish funds and provide incentives for compliance with the EEBC.

f) Prepare special manual for illustrating the methods for the calculation of energy performance, energy demand, and energy audit in industrial and commercial sector.

g) Establish a Software/Online List for investigation check.

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 (evaluation is available in Annex 2) 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)

The second step was to look on the experts' statements on the prepared set of recommendations (as a part of the expert interviews questionnaires) as shown in Table 9.

Table 9 Priority recommendations based on the experts' interviews

Recommendations	Expert statements
1. To update the code in coordination with the Relevant Stakeholders	recommended by almost all expert
2. To include the Minimal Energy Performance Standards MEPS in the code	recommended by a few experts
3. To update and/or include the methodology for calculating the energy performance and/or energy demand	recommended by almost all expert
4. To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	Strongly recommended by all expert
5. To include the compliance with EEBCs in the Building Permit Procedure	Strongly recommended by all expert
6. To consider the EEBCs in the national strategies e.g. NEEAP, NDC	Strongly recommended by all expert
7. To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	recommended by almost all expert
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 by all expert
9. To establish funds and provide incentives for compliance with the EEBCs	recommended by almost all expert

The analysis of the status of the EEBCs in Jordan including the expert interviews have been discussed with the Jordan National Building Council JNBC. JNBC is part of the Ministry of Public Works and Housing (MoPWH) and is the governmental entity responsible for the development of the Building Codes in Jordan. The discussion with JNBC was held in a form of online meetings and several exchanges through emails. Based on the analysis, experts interviews and the discussions with JNBC, the following recommendations have been identified as priority recommendations.

a) A national capacity building and awareness program

b) Development of an inspection scheme

c) Provide support to the JNBC to initiate a second round to review the codes

d) Prepare a manual for illustrating the methods for the calculation of energy performance

3. Priority Recommendations to improve the EEBCs in Jordan

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 national capacity building and awareness program

A) Short summary

Establish a national awareness program that is connected to the national building codes (especially energy efficiency buildings codes EEBCs which are: Energy efficient buildings code, Mechanical ventilation and air conditioning code, Natural ventilation and health aspects Code , Solar Energy Code, Building Materials & Usage Code, Internal Lighting Code , Natural Lighting Code , Central Heating Code , Code for Waterproofing and moisture Insulation, Thermal Insulation Code, Electrical Installations Code) and provide a continuous educational development schemes to upgrade engineers', architects', project developers' and construction professionals' knowledge working at design and construction stages. In addition, the capacity building and awareness programs will be extended to the Jordanian municipalities staff as they are responsible to follow up on the codes' compliance in the new constructed buildings.

B) Goal(s) of action/recommendation

- To raise awareness and building capacities about national building codes (especially energy efficiency buildings codes) among the engineers, architects, project developers and construction professionals in the building sector
- To raise awareness and building capacities about national building codes (especially energy efficiency buildings codes) of the Jordanian municipalities staff

C) Extended description of action/recommendation

- *Organizing Training Courses and Awareness Campaigns:* organize training courses and awareness campaigns for different target groups to increase the awareness of energy efficiency buildings codes and its requirements, compliance and verification procedures.
- *Website Development:* Create an attractive and user-friendly website for sharing codes requirements, compliance checklist, compliance procedure and announcements on the upcoming training courses and awareness campaigns. Alternatively, this can be done as a seperate page on the website of JNBC and/or RSS.
- *Development of a Simplified Guideline for EEBCs:* provide professionals working in the buildings sector with a simplified guideline containing the EEBCs requirements

for compliance to avoid any misunderstanding or difficulties in reading the codes itself.

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

- 4 - 6 months for the development of the training courses and the awareness campaign materials
- 6 – 12 months to conduct the training courses and the awareness campaigns (considering that at least one training course and one awareness campaign will be conduct in each governorate in Jordan which are 12)

E) Timeline and Milestones

Action Step	Estimated Duration	Workload
Development of the training courses and the awareness campaign materials including the *Development of a Simplified Guideline for EEBCs*	4 - 6 months	40 – 120 man-days
Identification of relevant target groups	1 week	5 man-days
Coordination, send invitations, logistics	1 month for all events (for each governorate)	20 man-days
Conduct Trainings and awareness campaigns	6 – 12 months	120 – 240 man-days
Total		**185 – 360 man-days**

F) Stakeholders and Roles

Leading Stakeholders: Jordan National Building Council "JNBC"

Supporting Stakeholders:

Royal Scientific Society "RSS", Jordan Engineers Associations "JEA", Ministry of Energy and Mineral Resources "MEMR", Ministry of Public Works and Housing "MoPIC"

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

Engineers, Architects, Project Developers, Construction Professionals and Municipalities Staff.

G) Risks

- *Risk:* Lack of availability of the financial and human resources needed for conduct the training courses and the awareness campaigns

  Mitigation: Searching for national and international donors and potential funds that could secure the needed resources.

  Risk: insufficient participation from the target groups to the training courses and the awareness campaigns

  Mitigation: Use different means of communication for announcing the event including the website, social media accounts, phone calls, etc. in addition, sending official letter to relevant entities.

H) MRV

Each activity will be monitored by the JNBC and a report shall be prepared afterwards including number of participants, training materials, feedback and learned lessons. In

addition. Post training survey to assess the effectiveness of the training shall be distributed among the participants.
Good practice example An awareness session about ISO50001 has been conducted by Jordan Standards and Metrology Organization “JSMO” for relevant industrial stakeholders to explain energy management systems and how to apply it in their entities.

3.2 Development of an inspection scheme

A) Short summary

Develop an inspection scheme to ensure the compliance with energy efficiency codes requirements especially for high energy consumption buildings. Inspection for compliance with codes performed by JNBC for new construction buildings. More efforts shall be paid for large consumers as every measure will has high impact on the energy used in the building.

B) Goal(s) of action/recommendation

- To develop an inspection scheme for compliance with EEBCs for high energy consumption buildings (ex: large MFH with total floor area > 1500 m2, large office and commercial buildings, hotels and large healthcare facilities)

C) Extended description of action/recommendation

- *Develop an inspection scheme along with all related procedures and checklists:* special inspection scheme for high energy consumption buildings will be developed to ensure the compliance with the EEBCs. Related procedure, checklists, forms and other documents sha be prepared as well.
- The inspection scheme shall include and clearly define the procedures that to be taken to ensure the compliance with the EEBCs. This shall also include the definition of the roles of the involved stakeholders e.g., JNBC, RSS, Jordan Engineers Associations.

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

- 6 - 12 months for the development of the inspection scheme (including formal approvals)
- 3 months for testing the scheme and finalizing it.

E) Timeline and Milestones

Action Step	Estimated Duration	Workload
Development of the inspection scheme (including formal approvals)	6 - 12 months	40 – 160 man-days
Testing and Finalizing	6 months	120 man-days
Total		**120– 160 man-days**

F) Stakeholders and Roles

Leading Stakeholders: Jordan National Building Council “JNBC”

Supporting Stakeholders: Royal Scientific Society “RSS”, Jordan Engineers Associations “JEA”, Ministry of Energy and Mineral Resources “MEMR”, Ministry of Public Works and Housing “MoPIC”, municipalities

Relevant actors (e.g., will be affected or considered as audience): Owner of high energy consumption buildings

G) Risks

- *Risk:* Lack of availability of the financial and human resources needed for the development of the inspection scheme

Mitigation: Searching for national and international donors and potential funds that could secure the needed resources.
H) MRV The development of the scheme will be done by relevant stakeholders with the leadership and supervision of the JNBC. JNBC will be monitoring the process and verify the compliance of the scheme is complying with the current national laws and regulations. In addition, testing and evaluation of the scheme will be performed before the official launch to ensure the reliability and the applicability of the scheme.
Good practice example The launch of the Sustainable Building Units “SBU” at the JNBC which is responsible to check the compliance of new construction buildings with the thermal insulation code.

3.3 Provide support to the JNBC to initiate a second round to review the codes

A) Short summary

Provide support to the JNBC to initiate a second round to review the codes that were not reviewed in the first round. Noting that the JNBC and RSS have completed the revision for number of the codes in 2019 related to energy efficiency and renewable energy in the first round.

B) Goal(s) of action/recommendation

- To update and/or include the methodology for calculating the energy performance and/or energy demand.
- To develop/improve the EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities.
- Increase the number of members of the codes revision committees and involve more relevant stakeholders (where needed).

C) Extended description of action/recommendation

- *Provide technical support to the JNBC through consultancy services:* JNBC will hire technical experts/request for technical consultation to review the codes, update/add the methodology for calculating the energy performance and/or energy demand and to develop/improve the EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities
- *JNBC will increase the number of members of the codes revision committees and involve more relevant stakeholders (where needed)*

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

- 12 - 24 months for the complete the second round of codes review (including governmental processes)
- 1 – 2 months to review the number of JNBC committees' members and to suggest a new member

E) Timeline and Milestones

Action Step	Estimated Duration	Workload
Completion of the second round of codes review	12 - 24 months	240 - 480 man-days
Review the number of JNBC committees' members and to suggest a new member	1 – 2 months	20 - 40 man-days
Total		**260 - 520 man-days**

F) Stakeholders and Roles

Leading Stakeholders: Jordan National Building Council "JNBC"

Supporting Stakeholders: Royal Scientific Society "RSS", Jordan Engineers Associations "JEA", Ministry of Energy and Mineral Resources "MEMR", Ministry of Public Works and Housing "MoPIC", NGOs, Private sectors

Relevant actors (e.g., will be affected or considered as audience): Public and Private sectors e.g., architects, construction companies and municipalities.

G) Risks

- *Risk:* Lack of availability of the financial and human resources needed for completion of the second round of codes review

  Mitigation: Searching for national and international donors and potential funds that could secure the needed resources.
- *Risk:* insufficient participation in JNBC committees
  Mitigation: Provide sufficient remuneration for committees' members

H) MRV

JNBC will lead and supervise the whole process. Evaluation of the technical committees can be performed afterwards.

Good practice example

The first round of codes review which was performed by the RSS on 2019

3.4 Prepare a manual for illustrating the methods for the calculation of energy performance

A) Short summary

A manual for illustrating the methods for the calculation of energy performance of buildings shall be prepared. This manual should explain a clear methodology and steps to calculate the energy demand and required energy audits relevant to the EEBCs in Jordan.

B) Goal(s) of action/recommendation

- To prepare a manual for calculating energy performance of buildings in Jordan.

C) Extended description of action/recommendation

- *Preparation of a manual for energy performance calculations:* Based on the EEBCs, the manual will provide a detailed and clear methodology to calculate the energy performance of buildings in Jordan.
- *Suggesting/recommending of a tool/software to calculate the energy performance based on the methodology.*

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

- 6 - 12 months for the preparation of a manual for energy performance calculations
- 4 – 6 months to integrate the tool/software with the manual

E) Timeline and Milestones

Action Step	Estimated Duration	Workload
preparation of a manual for energy performance calculations	6 - 12 months	120 - 240 man-days
Integration of a tool/software with the manual	4 - 6 months	80 - 120 man-days
Total		**200 - 360 man-days**

F) Stakeholders and Roles

Leading Stakeholders: Jordan National Building Council “JNBC”

Supporting Stakeholders: Royal Scientific Society “RSS”, Jordan Engineers Associations “JEA”, Ministry of Energy and Mineral Resources “MEMR”, Ministry of Public Works and Housing “MoPIC”

Relevant actors (e.g., will be affected or considered as audience): Engineers, Architects, Project Developers, Construction Professionals and Municipalities Staff.

G) Risks

- *Risk:* Lack of availability of the financial and human resources needed for the preparation of the manual
  Mitigation: Searching for national and international donors and potential funds that could secure the needed resources.

- *Risk:* Adopt a tool/software for energy calculation
  Mitigation: Suggesting a verified and tested tool such as BEP tool.

H) MRV

JNBC will lead, supervise and monitor the preparation process of the manual. The suggested tool/software will be validated to be approved and integrated with the manual.

Good practice example

N.A.

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Annex 1: Documentation of Expert Interviews and statements on EEBCs in Jordan

Dr. Adnan Kasawneh NGO, Royal Scientific Society (RSS) **Contact Information**	
Country	Jordan
Interviewee's Name (Respondent)	Dr. Adnan Kasawneh
Affiliation	NGO, Royal Scientific Society (RSS)
Position	Director of Testing Laboratories
Years of experience	25
E-mail	adnan.elkhasawneh@rss.jo
Telephone no.:	(+962) 77 742 2016
Date of filling in the questionnaire and/or the interview	21/6/2020
Short Bio (100 – 150 words)	Civil Engineer and Researcher in the field of building codes, building materials, and earthquake engineering. Throughout his professional career, he worked during (2010 - 2014) on developing and updating the national building codes and manuals including energy publications such as Jordanian Energy Efficient Building Code, Photovoltaic Systems Code, Central Heating Code, Mechanical Ventilation and Air Conditioning Code, and Jordan Green Buildings Guide. In addition, he was responsible for managing the works and meetings of the technical review committees for the draft of energy codes and manuals. Currently he is the Director of Testing Laboratories At RSS, where he manages the work within the testing laboratories according to the latest national and international specifications, standards and references. This includes tests related to the thermal properties of materials used in the construction industry.

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 most of EEBCs written in that way to be understandable and easy to apply for the professional Engineers and technical staff specialized in energy efficiency matters. Meanwhile the codes is slightly difficult to use by the engineers with either fields of knowledge let say architects or civil 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?
Some of the existing codes have no manuals for describing the codes itself. I believe that the manuals will be helpful for all parties (engineers and local authorities) to easy use the codes in the field or in design.
From your perspective, what are the other technical challenges? Please elaborate here.
The lack of training procedures is playing important role for disseminating the deep knowledge of the existing codes. Therefore, I suggest paying more attention to conduct special training for technical and engineers who are dealing with implementation of the energy codes.
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.

- Developing technical manuals for all energy efficiency existing codes
- Conducting specialized training for all the related parties
- Developing local regulations for implementing the codes
- Intensives for the code users in their construction practice

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 codes are mandatory but in the practice, there are some differences in code compliance during construction, I believe that the Jordanian regulation should cover these gabs.
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?
No. At this time, I believe there is no specific setup or plan for this purpose.
Coordination
Please describe the levels of coordination between national and local authorities responsible of implementation and enforcement of the code?
The level of coordination between two levels is very weak and is not acceptable to see the code enforcement on the practice. I think it limited only on papers and approval the designs issues**.**
Participation
How do you assess the effectiveness and involvement of relevant stakeholders in the development and implementation of the code?
This topic is divided for two stages. First stage in the process of developing the code itself (It is acceptable) Second: it is during the implementations (It is unacceptable).
Do you think the code should be updated? If yes, what are the entities that should be involved in the updating processes?
Of course, some of the codes should be updated. Ministry of Energy, Royale Scientific Society, Universities experts, Ministry of Public works, Private sector, JISMO, JCCA and JEA.
Do you think the compliance manuals and guidelines should be updated?
Some of the existing codes and manuals should be updated.
In case of the lack of compliance manuals and guidelines, how could they be developed? What are the entities and stakeholders to be involved?
MoPWH, National Jordanian Code Council, Royale Scientific Society, JEA, Private sector and field Experts
What are the other potential institutional issues and challenges?
It should clear coordination plan belonged to one authority which should be responsible about all the related issues.
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
There is a need for networking the process according approved plan.
Capacity Building and awareness challenges
What is the level of awareness/interest among the relevant/involved stakeholders about the EEBCs?
Not bad level.
What are the challenges related to the capacity building programs?
I assure that it should be a training programme for the governmental and private sector employees to be more aware about the codes implementations and it is impact in the field.
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.
Developing motivations system and conducting awareness sessions between the engineering communities.

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)
5-7%
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?
No
How do you asses the availability of funds and financing options available when building comply with the EEBCs?
I think there are small funds for the solar system only.
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.
Code enforcement is the only way to cope with above-mentioned challenges.
Other challenges and barriers
How do you evaluate the availability of EE construction materials in the local market? (please provide examples)
The EE related materials are widely available and used in Jordanian market such as LED lights, motors with VFD's, and A/C equipment.
How do you evaluate the availability of the data and info of EE construction materials in the local market?
Not bad. Many of suppliers are cooperative.

From your perspective, what do you think of the following recommendations? please provide explanation, information, sources, …etc.		
10. To update the code in coordination with the Relevant Stakeholders	**Recommended**	To be on the same level with international updates in this field
11. To include the Minimal Energy Performance Standards MEPS in the code	**Not relevant**	It is existing in the available codes
12. To update and/or include the methodology for calculating the energy performance and/or energy demand	**Recommended**	It is an important idea and should be implemented
13. To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	**Recommended**	It will be helpful for all stakeholders and relevant people
14. To include the compliance with EEBCs in the Building Permit Procedure	**Strongly recommended**	It will improve the process
15. To consider the EEBCs in the national strategies e.g. NEEAP, NDC	**Strongly recommended**	For sure, it is an important issue will be reflected positively.
16. To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	**Recommended**	It is an important and should be continuous process
17. To provide training and awareness programs on the EEBCs for the municipalities and/or departments responsible of the issuing of building permits.	**Recommended**	Needs for code awareness
18. To establish funds and provide incentives for compliance with the EEBCs	**Strongly recommended**	This issue needs a fund in different stages

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: Selecting third party organization that is capable to control the process of implementation and enforcement the code requirements.

Priority two: conducting wide training course for all the involved party (engineering offices, governmental engineers, technicians …) in this task by one responsible organization or Office.

Priority three: continuously updating the codes and manuals

Priority four: developing intensives system for people using EEC in there constructions.

Prof. Hani Obeid

Academia, recently retired from Applied Sciences University

Contact Information

Country	Jordan
Interviewee's Name (Respondent)	Prof. Hani Obeid
Affiliation	Academia, recently retired from Applied Sciences University
Position	Professor of electrical engineering
Years of experience	More than 30
E-mail	haniob@gmail.com
Telephone no.:	(+962) 79 589 0271
Date of filling in the questionnaire and/or the interview	16/6/2020
Short Bio (100 – 150 words)	Dr Obeid was a professor of electrical engineering at Applied Sciences University, Amman – Jordan. He obtained his M.Sc. and PhD degrees in Power Systems and Networks from Leningrad Polytechnic Institute (St. Petersburg Technical State University) in 1974 and 1980 respectively. He is a Senior Member/IEEE, registered as P. Eng. in Jordan and at Arab Engineering Association. He was the Director of renewable energy center at University of Applied Sciences. Prof. Obeid has 8 technical engineering books, published more than 30 scientific papers in power system engineering. He prepared the Lightning Protection Code, Manual for Electrical Installation Code, participate in preparing the new edition of Photovoltaic Systems Code and Manual as Co-author. He was an Editorial-in-Chief for ACEEE journal on electrical and power engineering and is a member of several technical committees at JEA, member of editorial board of Jordanian Journal for Applied Sciences, member of scientific research 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 code EEBC is written in a clear language with understandable figures, tables, and illustrations.

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 new manual for thermal insulation Code was issued in 2018. There are many details showing the correct procedures for executing construction details in buildings. The manual lacks the correct steps for technicians on how to install the insulating materials for various elements of the building (windows, barriers, skylights, shutters ...etc.). There is a need to specify the local materials and their availability in local market.

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

One of challenges in my opinion is how to implement the codes in real life and what are the methods and procedures to enforce their implementation. Another one is how to check that the new construction complies with the provisions of the 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.
The best practice I think to cope with technical challenges is to organize training courses for engineers and technicians to explain the various aspects of the Code and proper implementation, focusing on development of technical details to enable them to understand the requirements of the Code.
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 Code is mandatory in Jordan. Jordan issued the Renewable Energy & Energy Efficiency Law # 13 in 2012.
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 think the institutional set-up at present is not effective in follow-up the implementation of the Code. There are different local agencies involved in Code implementation (Ministry of Public Works and Housing, Jordan Engineers Association, Local Authorities). The responsibilities should be defined clearly among these bodies.
Coordination Please describe the levels of coordination between national and local authorities responsible of implementation and enforcement of the code?
I do not have enough information to elaborate on the coordination.
Participation How do you assess the effectiveness and involvement of relevant stakeholders in the development and implementation of the code?
The involvement of the relevant stakeholders in implementation of the Codes is varied and depends whether the stakeholders are private or public authority. The involvement of private stakeholders is very limited due to the lack of technical capability, while the involvement of public stakeholders is more sensible.
Do you think the code should be updated? If yes, what are the entities that should be involved in the updating processes?
The present EEBC code was issued in 2010, and at present is in the process of updating.
Do you think the compliance manuals and guidelines should be updated?
A guide manual for EEBC code is now at development stage.
In case of the lack of compliance manuals and guidelines, how could they be developed? What are the entities and stakeholders to be involved?
There are representatives of various public and private agencies participating in preparing and developing the guide manuals for EEBC.
What are the other potential institutional issues and challenges?
The challenges are related mainly for proper implementation and adopting practical methods and procedures for checking how the various provisions of the Code are implemented in the construction business.
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
From my experience, the potential practice is to include the provisions of EEBC in the technical specifications, and to provide incentives for energy efficiency buildings.
Capacity Building and awareness challenges
What is the level of awareness/interest among the relevant/involved stakeholders about the EEBCs?
The awareness/interest among the relevant stakeholders about EEBC is limited at present time, but it is growing in small steps, and the interest will be increased if the economic aspects of energy efficiency is correctly presented.
What are the challenges related to the capacity building programs?
The challenges related to the capacity building programs are how to build their strength and sustainability in terms of improvement the organizational infrastructure (facilities, services, education and professional development).
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

The best practice to cope with challenges is to maximize learning at three levels of capacity development: individual, organizational, and enabling environment. In other words, to improve the quality of the organization and to make the working environment more attractive in terms of improving incentives and governance.

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 concern for the design engineers and investors regarding implementation of EEBC is the extra cost comparing with the traditional building. This extra cost is related to the present value of the construction, while if we calculate the cost over operational life (life cycle cost), we will obtain real cost saving. There are several studies about the cost saving because of implementing energy efficiency methods, but we lack reliable information regarding the increased in capital cost because of Implementation provisions of the Code. For example, the following table shows potential of improving energy efficiency – case studies:
Potential of improving energy efficiency-case studies:

Company Name	Total cost saving (JOD)	Energy consumption (JOD/YR)	Saving (%)	Investment required (JOD)
Arab Center for Heart & Special Surgery	67989	313832	22	123102
Movenpick Resort & Spa Dead Sea	76821	15731	12	69052
Movenpick Resort Aqaba	86449	358223	24	164819
Four Seasons Hotel (Amman)	120307	648569	19	170670
Jordan Kuwait Bank	17854	103505	17	23579

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 incentives are tax reduction on energy saving equipment, financial aid to use LED lights in houses.

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

In limited cases a fund or financial option is available when building comply with EEBC. The funds may be available if a donor will finance the building.

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

The best practice should be based upon revealing the economic effect obtained if the buildings comply with EEBC. The economic effect means the total JD the stakeholder will obtain from complying with codes during the operational life of project.

Other challenges and barriers

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

Insulating materials, energy saving lamps and products are available in the local market. For example: rock wall, polystyrene, lightweight bricks, LED lights and energy saving split units.

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

Data and technical specifications are available for materials and equipment available in the local market.

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	It is important to attract housing society, commercial and industrial chambers.
2. To include the Minimal Energy Performance Standards MEPS in the code	Recommended	Minimal Energy Performance Standards are number of performance requirements for an energy using device, The EEBC in Jordan mainly directed to construction of the building (HVAC, lighting, and losses in electrical installations), so it is recommended to include more technical details of equipment in building construction as MEPS.

3. To update and/or include the methodology for calculating the energy performance and/or energy demand	Not relevant	This topic is related to energy audit and energy conservation and methods of calculation that is a subject of another code.
4. To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	Recommended	The manual is under development.
5. To include the compliance with EEBCs in the Building Permit Procedure	Recommended	The Jordan Engineers Association is stamping all design drawings with stamp that the drawings comply with Jordanian Building Codes. It is recommended to review the procedure to make sure that the design is really is complying with Building Codes, including EEBC.
6. To consider the EEBCs in the national strategies e.g. NEEAP, NDC	Recommended	I cannot elaborate on this item because I do not have enough information about NEEAP and NDC in Jordan.
7. To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	Strongly recommended	Training programs are important for implementation of EEBC; the training should be focused on implementation of EEBC in the design and preparation of Contract Documents, and should take care of practical side in the process of building construction.
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	The training programs should be designed at national level, but coordinated with municipalities and branches of JEA in different parts of Jordan.
9. To establish funds and provide incentives for compliance with the EEBCs	Recommended	Funds are important for conducting training and incentives are necessary to encourage stakeholder to implement EEBC.

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: Establish funds and provide incentives for compliance with the EEBC, this is a government policy and Ministry of energy and Ministry of Public Works should act in this direction.
Priority two: Prepare and conduct training courses. Royal Scientific Society is capable of preparing and conducting these courses in cooperation with experts in the field of energy efficiency.
Priority three: Include MEPS in the code; Jordanian National Building Council and Royal Scientific Society are capable of performing this task.
Priority four: Prepare special manual for illustrating the methods for the calculation of energy performance, energy demand, and energy audit in industrial and commercial sector. Royal Scientific Society is capable to do the job with experts in energy field.

Eng. Wael Nasrallah

Private Sector, W&I CONSULTING

Contact Information

Country	Jordan
Interviewee's Name (Respondent)	Eng. Wael Nasrallah
Affiliation	Private Sector, W&I CONSULTING
Position	Head of Mechanical Engineering Division
Years of experience	18
E-mail	wael2001jo@yahoo.com
Telephone no.:	(+962) 79 542 6208
Date of filling in the questionnaire and/or the interview	18/6/2020

Short Bio (100 – 150 words)	Mechanical Engineer have Extensive experience in the design and supervision of mechanical works for various engineering projects including commercial, industrial, hospitals and health care, schools, housing and residential, water and public health projects. Member of review committees of Jordanian Disabled Code, Jordanian Fire Fighting Code, Jordanian Green Building Guide, Jordanian Energy Efficient Building Code, and Jordanian Uniform Plumbing Code. Preparation of the Illustrative Technical Manual of Jordanian Plumbing Code(Co-translator), Central Heating Code, Commissioning Guide, the Manual of Jordanian Central Heating Code, the Energy Efficient Buildings Code and Manual, and participation in preparing the new edition of Photovoltaic Systems Code and Manual as Co-author.

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 followings are the main technical barriers: 1- The lack of experience and knowhow for the (consultant, designers ...etc.) at the design stage. 2- At the implantation stage the lack of experience for the supervision staff and the contractor personnel as well. 3- Since the implementation of EEBCs requires an additional cost sometimes the owner of building try to ignore some requirements because of these costs. 4- The sanctions due the commitment of applying the EEBCs requirements are not sufficient to prevent these felonies. When the sanctions are less than the cost of EEBCs, it is easy to pay the financial sanction rather than implementing the EEBCs requirements. The codes in general are not complex especially most of EEBCs have manual or illustrative guide that explain the codes in each stage of construction but most of engineers used to design the buildings using software and based on past experience that haven't taken the main issues of EEBCs in consideration.
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?
The codes contain clear procedure for all engineers and designers who are engage in each stage of construction but I think it's very useful and helpful if each code has a technical conformity manual or detailed checklist that focus on the most important requirements of code
From your perspective, what are the other technical challenges? Please elaborate here.
As I mentioned above
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.
I think League of Arab State (LAS) through Regional Centre of Renewable Energy and Energy Efficiency (RCREEE) have held many workshops and implemented studies regarding this issue, also MEDENEC project discussed the enforcement EEBCs in MENA region and summarised the result and the recommendations to enhance the enforcement process. From my perceptive, I think we need to review our legislations specially the sanctions clauses and the requirements of occupancy permits. The sanctions shall reflect the real effect of felonies of not implementing the requirements of EEBC and to not affordable in some cases, also to link the occupancy of permits with implementing EEBCs > In addition, to make sure that the process of implementing the requirements of EEBCs is going in right way, it is very necessary to assign third party for this purpose.
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.

In Jordan, all codes are mandatory, I think to develop a guide or a technical specification as a code to be mandatory applying we have to follow the following steps:
1. Forming a technical committee to study the proposed subjects that we want to adopt as a separate code amendment on a current valid code.
2. The membership of this committee shall be represented from all entities that are responsible and in charge in construction stages i.e. Architect designers, contractors and suppliers
3. The codes must be enclosed with a checklist and compliance sheet for the requirements of EEFBCs. The codes shall be prepared in a simple and understandable language for all stakeholders.
4. After finalising the preparation of a code, it is necessary to hold awareness campaign that focus on importance of new codes or amendments and to get feedback from all stakeholders.
5. It is a crucial issue of enforcement the codes through updating some clauses in national building law> the new clauses shall be restricted and set a real efficient sanction.
6. Execution of a capacity-building plan for all stakeholders.

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 institutional set up of code enforcement is good so far, but the authorities, which are responsible of issuing occupancy permits, do not have adequate and sufficient staff to follow up the implementation of codes during construction, this challenge is focused in municipalities in general.

Coordination

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

I think the coordination between the national and local entities is diplomatic rather than technical one.

Participation

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

The effectiveness of all stakeholders needs to be evaluated by doing survey for representative projects to find out where is the gap and lack of involvement; anyway, the stage of construction is not effective commitment.

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

I think all EEBCs are almost new, and there is no need to update these codes. At least incoming 3 years rather enforcement the codes.

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

In addition, the manuals and guides are new but I think it is necessary to develop a detailed checklist and conformity certificate to be add to the manuals and guides.

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

Developing the new manuals should be as I mentioned of developing new codes preparing procedure i.e. Stakeholders such as contractors , JEA, RSS, academia, suppliers, testing and commissioning companies and ministry of municipalities.

What are the other potential institutional issues and challenges?

Absence of **third parties** that are responsible of conformity and compliance EEBCs requirements.

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

Designate a professional staff in each authority, which is responsible of occupancy permits issuance. The staff shall be responsible of issuing certificate that prove the works and specifications are fulfilled according to the EEBCs.

Capacity Building and awareness challenges

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

I think that the level of awareness is very general and focused on renewable energy greater than energy efficiency and energy saving

What are the challenges related to the capacity building programs?

Since the most of entities and stakeholders of EEBCs, enforcements are governmental once. The target group in these governmental entities is not achieved the purpose of capacity building program because many employees leave their jobs to another one in the entity itself or out.

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

No information!

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)
I think it varies from 10-15%, not more than.
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?
There are no incentives designated to compliance according to EEBCs in a direct way, but since these codes are, a main requirement of Jordan Green Building Guide, this guide is liked with incentives system specially the incentives given by the municipalities.
How do you asses the availability of funds and financing options available when building comply with the EEBCs?
There are many funds regarding EEBCs , EU funds to HKJ through REEP program that implemented in the past 5 years one of the success stories
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.
No information!

Other challenges and barriers
How do you evaluate the availability of EE construction materials in the local market? (please provide examples)
I think it is available, but the issue is the high price.
How do you evaluate the availability of the data and info of EE construction materials in the local market?
The availability of data must be published through governmental channels like ministry of industry and trade and supplies in coordination with stakeholders in construction process to assure the creditability and reliability of products and suppliers also.

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**	Recommended.
2. To include the Minimal Energy Performance Standards MEPS in the code	**Recommended**	Recommended.
3. To update and/or include the methodology for calculating the energy performance and/or energy demand	**Strongly recommended**	Strongly recommended
4. To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	**Strongly recommended**	Strongly recommended (highly importance)
5. To include the compliance with EEBCs in the Building Permit Procedure	**Strongly recommended**	Strongly recommended (highly importance)
6. To consider the EEBCs in the national strategies e.g. NEEAP, NDC	**Strongly recommended**	The EEBCs is already considered in NEEAP and in NDC
7. To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	**Recommended**	recommended
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**	Strongly recommended

From your perspective, what do you think of the following recommendations? please provide explanation, information, sources, …etc.		
9. To establish funds and provide incentives for compliance with the EEBCs	Recommended	Recommended but already we have JREEEF – Ministry of Energy

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 : updating legislation and focusing on incentives and sanctions
Priority two : hiring third party for compliance process
Priority three: capacity building targeting stability of involved employees.
Priority four: compliance and detailed checklist for each work in EEBCs.

Eng. Wael Nasrallah **Private Sector, W&I CONSULTING** **Contact Information**	
Country	Jordan
Interviewee's Name (Respondent)	Eng. Wael Nasrallah
Affiliation	Private Sector, W&I CONSULTING
Position	Head of Mechanical Engineering Division
Years of experience	22
E-mail	wael2001jo@yahoo.com
Telephone no.:	(+962) 79 542 6208
Date of filling in the questionnaire and/or the interview	16/6/2020
Short Bio (100 – 150 words)	Mechanical Engineer have Extensive experience in the design and supervision of mechanical works for various engineering projects including commercial, industrial, hospitals and health care, schools, housing and residential, water and public health projects. Member of review committees of Jordanian Disabled Code, Jordanian Fire Fighting Code, Jordanian Green Building Guide, Jordanian Energy Efficient Building Code, and Jordanian Uniform Plumbing Code. Preparation of the Illustrative Technical Manual of Jordanian Plumbing Code(Co-translator), Central Heating Code, Commissioning Guide, the Manual of Jordanian Central Heating Code, the Energy Efficient Buildings Code and Manual, and participation in preparing the new edition of Photovoltaic Systems Code and Manual as Co-author.

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 code is understandable, related codes have already ITM's with full details. There is no continuous educational development schemes to upgrade engineers' knowledge.

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?

Codes provide very clear guides to be complied with.

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

Training programs directed to design, supervision, and contracting engineers are highly needed.
On the other hand, enforcement schemes shall be implemented properly.

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.

1- Upgrading technical capacity of JEA's technical review staff held responsible for reviewing drawings, specs and all other engineering scopes related to code compliance.
2- Developing clear enforcement plan.

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.

Codes are mandatory, real life practice indicated that there are recorded gaps in code compliance during construction. Regulations shall cover such code violations.

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?

Until now, there is no clear scheme.

Coordination

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

Except the drawings, which are held responsible to check installation versus approved construction drawings, there is no such definitive procedure to check code compliance during construction period.

Participation

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

The process is quite satisfied during the stage of code development. Implementation stage needs careful analysis, defining different roles of stakeholders and developing procedures to check and approve code compliance during construction period.

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

Some of the codes need updates. Update time cycles shall be followed.

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

Yes

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

JNBC, RSS, JEA, Field Experts.

What are the other potential institutional issues and challenges?

Coordination between different stakeholders is an issue.

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

Defining Authority responsible matrix, with relevant approvals and actions.

Capacity Building and awareness challenges

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

There is a good level of awareness.

What are the challenges related to the capacity building programs?

1- Expanding training sessions for design and supervision engineers
2- Expanding the knowledge of the Authorities staff.
3- Certification programs.

What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.
Activation of professional responsibilities and indemnities among engineers.

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)
Maybe 10 -15 %
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?
No
How do you asses the availability of funds and financing options available when building comply with the EEBCs?
Except those related to PV, there is no financing for such compliance.
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.
It is not a matter of incentives as the codes are mandatory. It is a matter of enforcement.

Other challenges and barriers
How do you evaluate the availability of EE construction materials in the local market? (please provide examples)
The EE materials are widely available in the market, LED lights, motors with VFD's, and A/C equipment are examples.
How do you evaluate the availability of the data and info of EE construction materials in the local market?
Data are well available; suppliers are cooperative in this regard.

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	**Strongly recommended**	To match international experience.
2. To include the Minimal Energy Performance Standards MEPS in the code	**Not relevant**	Already provided in the relevant code content
3. To update and/or include the methodology for calculating the energy performance and/or energy demand	**Strongly recommended**	This is important for defining benchmarks, and quantifying energy savings. LCC could be of great assist to owners and decision makers.
4. To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	**Strongly recommended**	This will help designers, supervisors, as well as contractors.
5. To include the compliance with EEBCs in the Building Permit Procedure	**Strongly recommended**	This well enhance compliance process
6. To consider the EEBCs in the national strategies e.g. NEEAP, NDC	**Strongly recommended**	This will affect energy strategy plan of the country.
7. To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	**Strongly recommended**	This is a continuous process, and is essential for the industry.

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**	Lack of code awareness among those targeted sectors.
9. To establish funds and provide incentives for compliance with the EEBCs	**Strongly recommended**	All the above need funding.

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 Enhance training among engineers, contractors, and officials.
Priority two Define enforcement procedures with dictated staff and responsibilities
Priority three Code and ITM continuous updates and developments.
Priority four Defining energy benchmarks: Heating per SQM, Cooling per SQM …etc.

Eng. Emil Alasis NGO, Europe Aid Program **Contact Information**	
Country	Jordan
Interviewee's Name (Respondent)	Eng. Emil Alasis
Affiliation	NGO, Europe Aid Program
Position	Team Leader
Years of experience	38
E-mail	alasis.emil@gmail.com
Telephone no.:	(+962) 79 652 2858
Date of filling in the questionnaire and/or the interview	28/6/2020
Short Bio (100 – 150 words)	Mechanical Engineer and Technical Consultant dealing with RE and EE studies - development, installations, commissioning and operation, holding almost 30 years of experience in the area of Thermal and Electrical RE and EE project development. Throughout his professional career, he has worked on a scientific basis on research, development, supervision, installation, construction, commissioning and operation of projects and investments of renewable energy sources (RES) as well as EE and saving ones. Moreover, he involved in the elaboration and preparation of technical, economic and environmental studies. Currently, he is the Team Leader of the Europe Aid Program "Technical Assistance to the Renewable Energy and Energy Efficiency Programme in Jordan" (REEE II TA)" For supporting Jordan in the Renewable Energy and Energy Efficiency Technologies and Applications since November 2016.

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 codes are not complex, but more training is needed to get engineers familiar with them. This can be through workshops and training for young professionals.

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?
More clear steps are needed through guidelines and design examples. This is very important for the building permits issuing authorities.
From your perspective, what are the other technical challenges? Please elaborate here.
Most codes are not up to date. In addition, codes should available free for all stakeholders.
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.
Training, certifications, and enforcement of continuing education.
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.
Law enforcement is the only way.
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?
Currently, It is not successful because more work is needed from the permits issuing authorities. More work should be done with the authorities.
Coordination Please describe the levels of coordination between national and local authorities responsible of implementation and enforcement of the code?
Coordination is not efficient.
Participation How do you assess the effectiveness and involvement of relevant stakeholders in the development and implementation of the code?
The level of involvement is good but it should be improved to update the codes.
Do you think the code should be updated? If yes, what are the entities that should be involved in the updating processes?
Yes, it should be updated. Jordan Engineers Association (JEA), Universities, local consultants. Ministry of Public Work and Housing.
Do you think the compliance manuals and guidelines should be updated?
Yes.
In case of the lack of compliance manuals and guidelines, how could they be developed? What are the entities and stakeholders to be involved?
Jordan Engineers Association (JEA), Universities, local consultants, Ministry of Public Work and Housing, and the permit issuing agencies.
What are the other potential institutional issues and challenges?
Availability of fund to update manuals and codes
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
To get external funding projects to update the codes and perform trainings

Capacity Building and awareness challenges
What is the level of awareness/interest among the relevant/involved stakeholders about the EEBCs?
There is a high interest if free training is available.
What are the challenges related to the capacity building programs?
Funding and good incentives for stakeholders and citizens.
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.
To get external funding projects to update the codes and perform trainings

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)
It cost more. May be more than 30%
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 current incentives are working well but more is needed.
How do you asses the availability of funds and financing options available when building comply with the EEBCs?
There is not much funds
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.
External fund to be spent to update the codes. In addition, fund for continuous improvement.

Other challenges and barriers
How do you evaluate the availability of EE construction materials in the local market? (please provide examples)
40%
How do you evaluate the availability of the data and info of EE construction materials in the local market?
Very limit data is available. There is a need for a national database.

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
2. To include the Minimal Energy Performance Standards MEPS in the code	**Recommended**	please provide explanation and recommendations
3. To update and/or include the methodology for calculating the energy performance and/or energy demand	**Recommended**	please provide explanation and recommendations
4. To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	**Recommended**	please provide explanation and recommendations
5. To include the compliance with EEBCs in the Building Permit Procedure	**Recommended**	please provide explanation and recommendations
6. To consider the EEBCs in the national strategies e.g. NEEAP, NDC	**Recommended**	please provide explanation and recommendations
7. To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	**Recommended**	please provide explanation and recommendations

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
9. 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 Establish a fund, may external, to update the codes and manuals
Priority two Update all related codes and manuals and establish continuous updates
Priority three Make all codes and manuals available for free
Priority four Free training for stakeholders and certifications

Eng. Tala Awadallah

Academia, German Jordanian University (GJU)

Contact Information

Country	Jordan
Interviewee's Name (Respondent)	Eng. Tala Awadallah
Affiliation	Academia, German Jordanian University (GJU)
Position	Dean's Assistant for Graduate Studies, Instructor at the School of Architecture and Built Environment, GJU
Years of experience	17
E-mail	tala.awadallah@gju.edu.jo talaawadallah@yahoo.com
Telephone no.:	(+962) 79 5545764
Date of filling in the questionnaire and/or the interview	!7/6/2020
Short Bio (100 – 150 words)	Architect holds Master degree in Sustainable architecture, the thesis title "Energy Consumption Optimization, in Infill Building, According to Orientation, using thermal simulations, in Amman, Jordan". She worked at the Royal Scientific Society from 2003 to 2011, and now she is working at the German Jordanian University since 2012. In addition to her work at GJU, she is working as National Consultant for Providing Technical Assistance to Upscaling Energy Efficiency Programs in the Arab Region, Jordan. ESCWA, United Nations since March 2019, and participating in preparing the new edition of Energy Efficient Buildings Code and Manual. She is LEED accredited Professional, and the Main Author & Manager of the "Jordanian Green Building Guideline" Amman, (2013), in addition to her participation in conducting many studies and in publishing scientific papers.

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?
Yes, highly understandable, all codes are in Arabic, are to address engineers, and linked to all other related codes. However, the codes are not linked to simplified checklists that can be used by the designer/ evaluator.
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?
The new- updated code(s) provide clear steps and procedures for designers, engineers but not clear checklists for the local authority responsible for issuing the building permits and/or occupancy permits if applicable. The local authority only check according to old codes not new ones. Manuals are being drafted from 2018 to 2020 through the RSS and JNBC.
From your perspective, what are the other technical challenges? Please elaborate here.
Old codes are being implemented not new ones, this is due to the authority experience in the old ones not the new. No clear third-party inspection authority is yet implemented and activated, to avoid conflict of interest.
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.
Not Known.
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 code is mandatory, design requirements are obligatory, JEA checks the designs and gives permits for construction, and however, checking the implementation is the job of the site engineer and contractor, proper implementation also depend on technical builders. Lack of conformity comes from the fact that some projects use day-by-day foreign worker with basic or no training, building in what they know best, not according to the new/updated/needed methods, such as the avoidance of thermal bridges, gaps, proper sealing.
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?
Enforcement and implementation is still not activated, entity responsible as a third party authority not yet activated (JNBC with GAM has created the Sustainable Unit for evaluation/inspection/enforcement not activated).
Coordination Please describe the levels of coordination between national and local authorities responsible of implementation and enforcement of the code?
There is a high level of linear-collaboration between related authorities in the design stage; each one knows his role and territory in design. However, for implementation, the level of collaboration is still not clear in EE related applications.
Participation How do you assess the effectiveness and involvement of relevant stakeholders in the development and implementation of the code?
Technical committees are formed of many/different stakeholders from different representatives; at least half of the committee contribute efficiently/technically/form experience into updating the options/steps in the codes. These experts reflect market needs/ market availability/ capacity building/ etc. into the requirements.
Do you think the code should be updated? If yes, what are the entities that should be involved in the updating processes?
All EE related codes are being updated/ created from 2018 until 2020; each manual/code should be updates at least every 5 years. Should look at universal/international standards to update properly, such as ASHRAE and CBCE, etc.
Do you think the compliance manuals and guidelines should be updated?
All manuals are being updated/ created from 2018 until 2020; each manual/code should be updates at least every 5 years.
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 current system for code development is well defined and established, since there is a number of levels for preparation, technical revision and provisional revisions done by a committee formed from technical expertise from all sectors in Jordan, (Private and public, engineering and academia, builders and designers, etc.)
What are the other potential institutional issues and challenges?
The collaboration with NGOs for the development of complimentary systems/training/spread 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
The proper collaboration between public and private sectors, finding more efficient ways to avoid conflict.
Capacity Building and awareness challenges

What is the level of awareness/interest among the relevant/involved stakeholders about the EEBCs?
High level of interest, EE is one of the most needed element in design/construction/operation phases, for all related parties. Awareness can be measured by number of EE-related certificates/workshops/training/seminars attended by the involved stakeholders, but cannot guarantee proper implementation!
What are the challenges related to the capacity building programs?
The guarantee of proper implementation after the capacity-building event. There are very few examination/test/official accreditation of persons in the EE field. These events should be attended by actual workers/builders/contractors/junior and senior designers, not Top-management only!
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.
Green building council training programs and seminars, JREEF training, RSS training.
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 percentage can be from 0 to 20 percent, it depends on the type of project, size, location, and quality needed. If higher standards are required, the percentage will be higher. Of course, the percentage is more than 20 percent if compared to local-non-compliance practices.
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 only incentives I know about are the zero-tax of EE related equipment/ devices/ materials. The codes are obligatory, thus there are no incentives attached. However, simple incentives at the beginning of the implementation (such as credibility of the building/ consultant office/ contractor, certification, etc.) is recommended.
How do you asses the availability of funds and financing options available when building comply with the EEBCs?
The documentation process and logistics (proofs, guarantees, bonds, كفالات, etc.) are somehow exhausting to the investor/ contractor, therefore, they sometimes prefer not to go through theses process for these incentives, unless it's a very big project, where these incentives and tangible and efficient.
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.
I think the National Energy Efficiency Action Plan (NEEAP) through (JREEF) and MEMR is one of the tangible studies, includes KPIs and proofs.
Other challenges and barriers
How do you evaluate the availability of EE construction materials in the local market? (please provide examples)
EE construction materials are available and in reasonable prices, the problem is in the know-how in implementation on site- to avoid thermal bridges and so on. The other problem is that some designers/contractors are not aware of some incentives that can be given if proper EE materials/equipment/devices are used in the project.
How do you evaluate the availability of the data and info of EE construction materials in the local market?
The data is available and accessible, but the problem is in the knowledge of importance of such implementations in the construction, and availability of numerical data on saving percentages and payback periods (life cycle cost).

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	The private sector, public sector and the academia.
2.	To include the Minimal Energy Performance Standards MEPS in the code	Recommended	Easy-access lists or software
3.	To update and/or include the methodology for calculating the energy performance and/or energy demand	Recommended	Easy-access lists and software, free of charge and applicable
4.	To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	Recommended	Already in the draft format 2020 by RSS and JNBC
5.	To include the compliance with EEBCs in the Building Permit Procedure	Recommended	Who is responsible of checking during and after construction, difficult to include
6.	To consider the EEBCs in the national strategies e.g. NEEAP, NDC	Recommended	Already included

7.	To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	**Recommended**	Not always taken seriously
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**	Very important but should be taken seriously be implantation personal
9.	To establish funds and provide incentives for compliance with the EEBCs	**Recommended**	Should find ways to avoid manipulation and misconduct

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: Establish a third-party specialised task force for inspection- prioritised to project area and type
Priority two: Establish a Software/Online List for investigation check
Priority three: Training of designers, builders, and investigation committee
Priority four: Updating of EEBC and related codes.

Annex 2: Evaluation of the General Recommendations

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
Establish a national capacity building and awareness program that is connected to the national building codes and provides a continuous educational development schemes to upgrade engineer's knowledge working at design and construction stages				
Adopting an enforcement schemes and activating a clear third-party inspection with dictated staff and responsibilities to ensure the application of the codes requirements and avoid conflict of interest.				
Adopting Coordination mechanism between different stakeholders through defining the authority responsible matrix, with relevant approvals and actions.				
Follow the updating time cycle for Codes and manuals continuously and in parallel, develop a detailed checklist, conformity certificate, and translate the codes technical requirements into procedures and steps by using simplified language.				
Establish funds and provide incentives for compliance with the EEBC.				
Prepare special manual for illustrating the methods for the calculation of energy performance, energy demand, and energy audit in industrial and commercial sector.				
Establish a Software/Online List for investigation check.				

_Get in contact with us

Guidehouse Germany GmbH
Albrechtstr. 10C
10117 Berlin
+49 (0)30 297735790
www.guidehouse.com

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