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

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

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

Prepared by:

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December 2021

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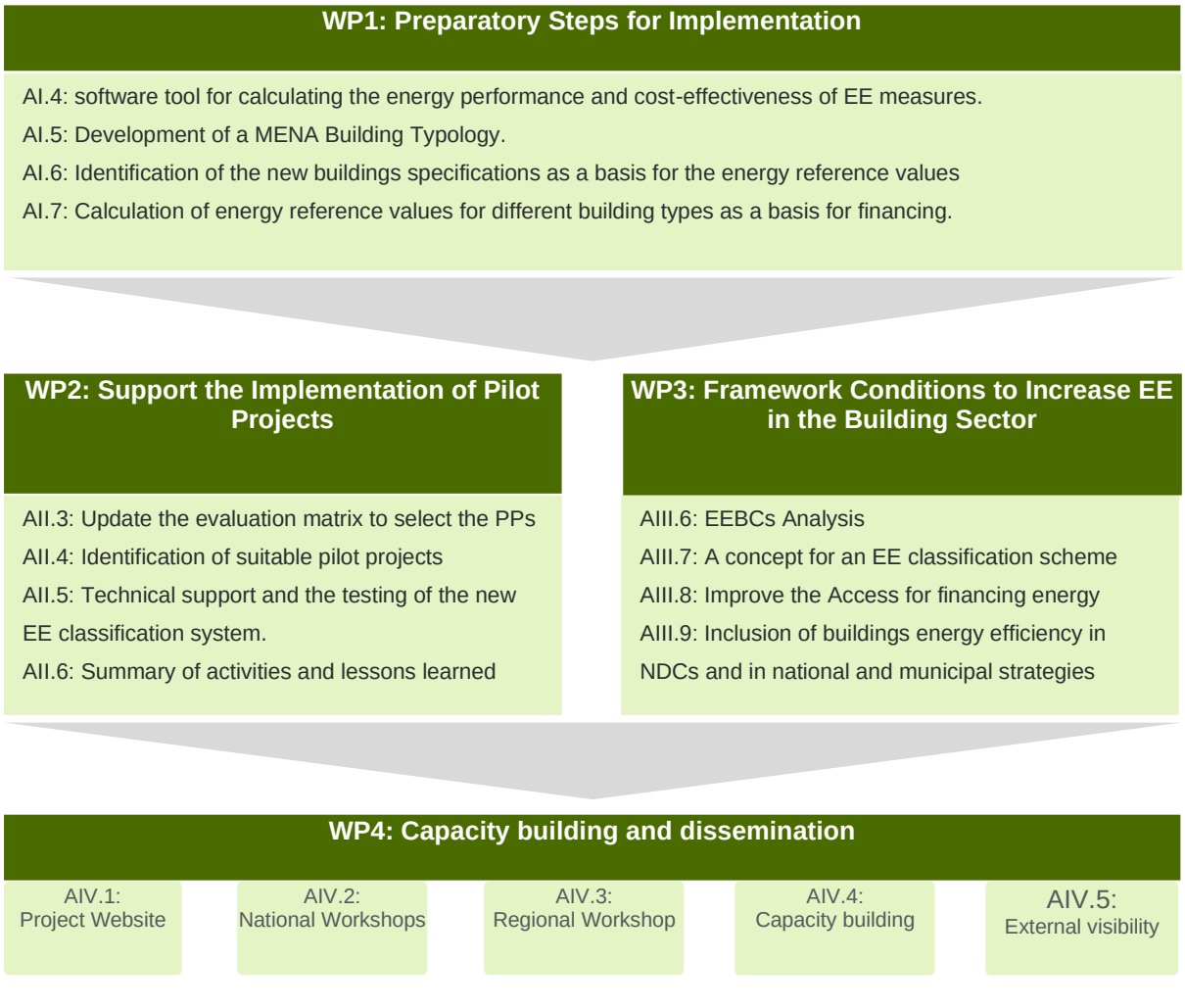
BUILD_ME background

Continuous population growth and economic developments as well as high urbanization rates increasing the demand fidehouseor 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

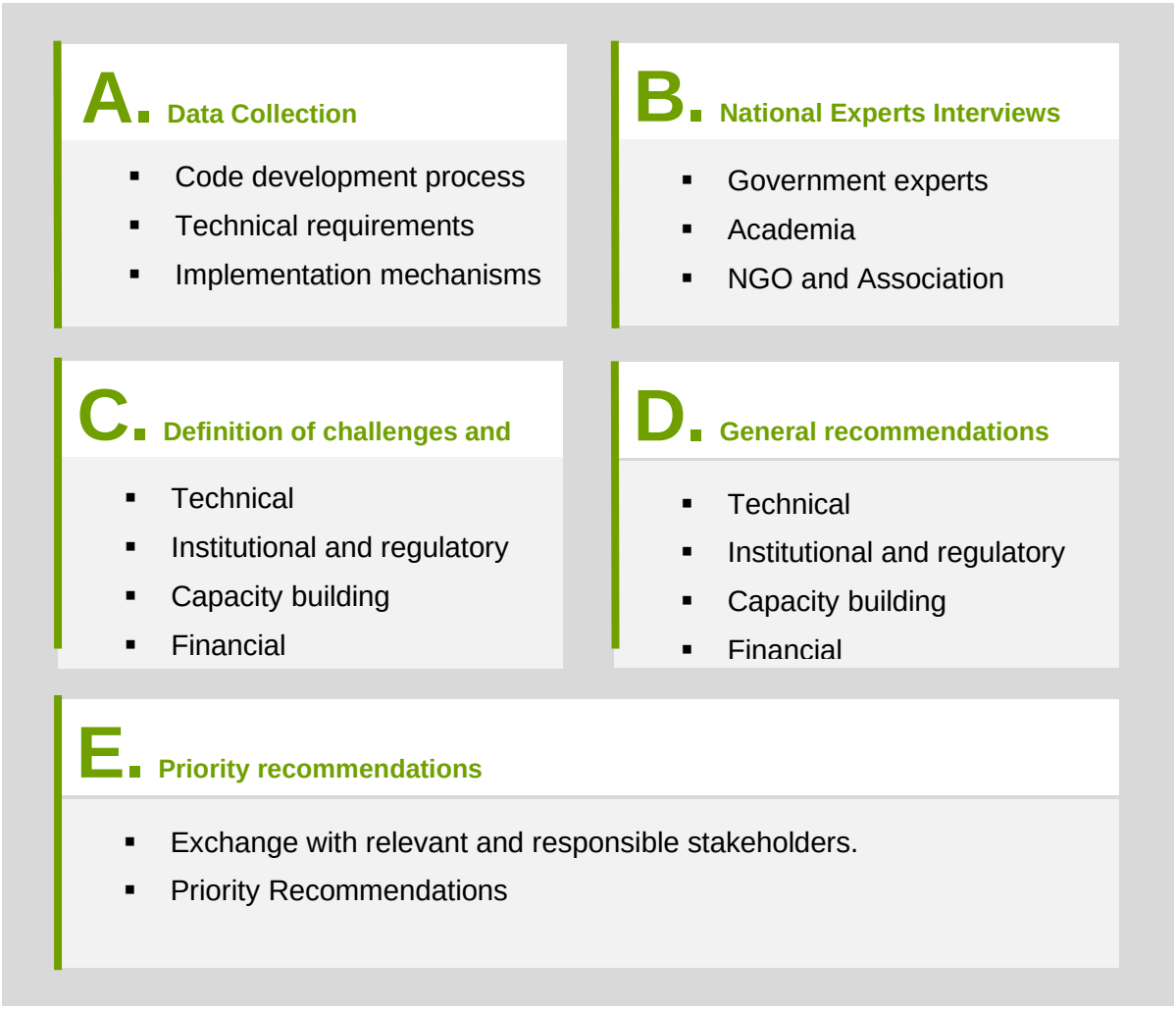
Energy efficiency building codes EEBCs constitute the basis for buildings construction. Through their national application, they establish an important lever for increasing energy efficiency in buildings. Effective policy to implement and enforce the EEBCs can serve as a tool to eliminate several challenges, 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.

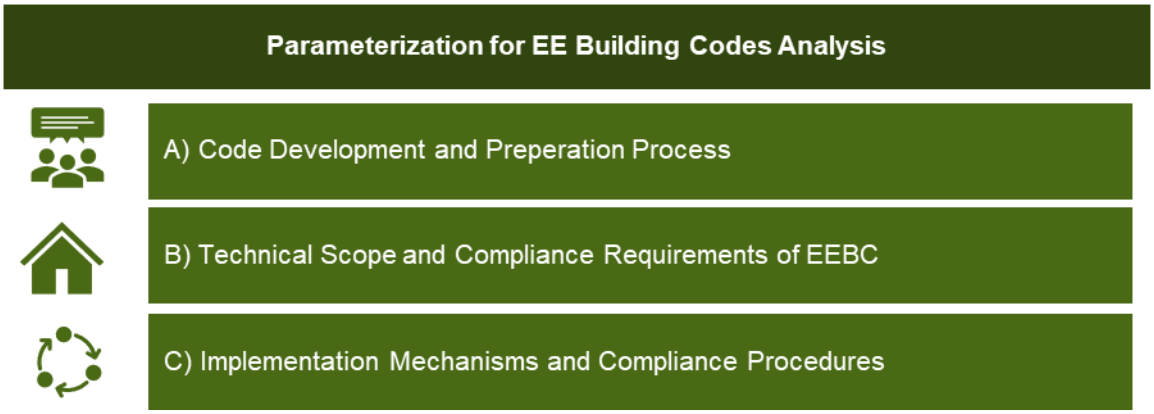
Table 1 A list of the categories of existing regulatory instruments for EE in the building Sector

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 Egypt

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

Egypt has developed several laws, regulations and policy instruments that govern the energy efficiency in the building sector. Table 3 and Table 4 show lists of the most relevant and recent laws, regulations, codes and policies of energy efficiency in the building sector in Egypt. Most of those 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 Housing, Utilities and Urban Communities (MoHUUC) and its scientific arm Housing and Building National Research Centre (HBRC).

HBRC issued several voluntary codes, guidelines and standards such as EEBCs, the Code for Cooling and ACs, Code for Ventilation in Buildings, Egypt Code for House Design Standards and Electrical installations in buildings. Recently, HBRC started the processes of the preparation of Egypt first smart cities code (UN-Habitat, 2019). Some other rating systems have been prepared by HBRC such as the Green Pyramids Rating System and the Green Hospital Designs Guidelines.

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

Name	Type	Legal status	Implementation	Issuance Year	Issuing body
Unified Building Laws, no. 119	Law	Mandatory	Enforced	2008	Presidential decree
Implementing Regulations of the Unified Building Laws, no. 119	detailed bylaw	Mandatory	Enforced	2009	Prime minister decree
Egypt Energy Efficiency Residential Building Code (EERBC)	Code	Voluntary	Not enforced	2005	HBRC, MoHUUC
Egypt Energy Efficiency Commercial Building Code (EECBC)	Code	Voluntary	Not enforced	2009	
Egypt Code for cooling and air conditioning (3 parts)	Code	Voluntary	Not enforced	2004	
Egypt Code for House Design Standards	Code	Voluntary	Not enforced	2009	
Code for Ventilation in Buildings	Code	Voluntary	Not enforced	2013	

Name	Type	Legal status	Implementation	Issuance Year	Issuing body
Thermal insulation specifications	Guidelines	Voluntary	Not enforced	1998	
Electrical works specifications (several parts)	Guidelines	Voluntary	Not enforced	2004-2013	
Electricity code (3 parts)	Guidelines	Voluntary	Not enforced	1999	
Egypt first Smart cities code	Guidelines	Voluntary	Not enforced	Under development	HBRC, MoHUUC
Green Hospital Designs Guidelines	Guidelines	Voluntary	Not enforced	Under development	

Table 4 Existing rating and certification schemes prepared by governmental entities

Name	Type	Level of Implementation	Issuance Year	Issuing body
Green Pyramids Rating System for New Residential Buildings	Rating System	Voluntary	2010	HBRC
Green Pyramids Rating System for Community	Rating System	Voluntary		HBRC
Green Pyramids Rating System for Banks	Rating System	Voluntary		HBRC

The second set of laws and instruments have been primarily prepared and led by the Ministry of Electricity & Renewable Energy (MoERE), thus, those instruments focus on the electricity consumption in buildings, technical building systems such as heating, cooling and HVAC systems, energy sector reforms and utilization of renewable energy in the building sector.

Table 5 energy sector key laws, regulations, and codes relevant to the EE in the Building Sector

Name	Type	Legal status	Implementation	Year	Issuing body
New Egyptian Electricity Law, no. 87	Law	Mandatory	Enforced	2015	Presidential decree

Name	Type	Legal status	Implementation	Year	Issuing body
Renewable Energy Law, no. 203 Regarding the stimulation of producing electricity from renewable energy sources	Law	Fiscal/financial incentives	Enforced	2014	Presidential decree
Decree No. 1257 of the year 2014 for the five-year tariff adjustment plan	Law	Fiscal/financial incentives	Enforced	2014	Prime minister decree
Participation of private sector in infrastructure, services and public utilities projects, no. 67	Law	Fiscal/financial incentives	Enforced	2010	Presidential decree
Egypt renewable energy feed-in tariff capacity less than 50 M.W.	Guidelines	Fiscal/financial incentives	Implemented	2014	EgyptERA
Amendment of renewable energy feed-in tariff (first round)	Prime Minister Decree, no. 1947	Fiscal/financial incentives	Implemented	2014	Prime minister decree
Amendment of renewable energy feed-in tariff (second round)	Prime Minister Decree, no. 2532	Fiscal/financial incentives	Implemented	2016	Prime minister decree
Egyptian net metering scheme under circular (3)	Guidelines	Fiscal/financial incentives	Implemented	2017	EgyptERA
Promulgating the Investment Law, Law No. 72	Law	Fiscal/financial incentives	Implemented	2017	Presidential decree

Name	Type	Legal status	Implementation	Year	Issuing body
Amendment Law No. 102 of 1986 on the Establishment of the New and Renewable Energy (NREA), no. 135	Law	Fiscal/financial incentives	Implemented	2014	Presidential decree
Periodical books on stimulation of producing electricity from renewable energy, including template contracts to connect solar power plant up to 50 M.W., or to install on grid solar system.	Guidelines	Fiscal/financial incentives	Implemented	2005-2019	EgyptERA
Technical Requirements for Connecting Small Scale PV (ssPV) Systems to Low Voltage Distribution Networks	Code	Proposed	Implemented	2014	
Connecting wind farm with the grid code	code	Proposed	Implemented	Not defined	
Electricity Distribution Code	Code	Mandatory	Implemented	2010	
New National Renewable Energy Strategy Egypt 2008	Policy	Adopted	Implemented	2008	MoERE Egyptian Holding Electricity Company

Name	Type	Legal status	Implementation	Year	Issuing body
The Grid-Connected Small-Scale Photovoltaic Systems project "Egypt-PV" Technical Requirements & Specs Guideline	guideline	Proposed	Implemented	2018	Egypt-PV in cooperation with IMC

1.2 Analysis of The EEBCs in Egypt.

1.2.1 *Code Development Process*

The Unified Building Law of 2008 no. 119 and its Implementing Regulations of 2009 (the detailed bylaw) are the fundamental legislation that administer the urban development and building construction in Egypt. The Unified Building Law and its bylaws are enforced through MoHUUC, governorates and the municipalities. Both the Unified Building Law of 2008 no. 119 and its bylaw of 2009 do not impose energy efficiency detailed requirements. Therefore, MoHUUC represented in its scientific arm The Housing and Building Research National Center (HBRC) decided to prepare The Energy Efficiency Building Codes EEBCs to be mandatory parts supplementing the overall Unified Building Law (Hanna D. G., 2011). At the time of writing this report (April 2020), the EEBCs have not been endorsed as mandatory codes.

This report will focus on the analysis of The EEBCs which come in two volumes:

- Egyptian Energy Efficiency Residential Buildings Code EEERBC (2005).
- Egyptian Energy Efficiency Commercial Buildings Code EECBC (2009).

Table 6 EEBCs Code development process in Egypt

Category	Parameters	Description
Code development process	The responsible governmental bodies	HBRC, MoHUUC
	Stakeholders involvement	▪ MoERE ▪ NUCA ▪ The Supreme Council of Energy ▪ Local and international experts ▪ Universities ▪ Engineers Syndicate
	Frequency of code updating	Every five years (did not take place)
	Plans to enforce the code	The establishment of EEBCs implementation and Activation Committee, to: ▪ Define the legal, institutional, technical and economic challenges of EEBCs enforcement. ▪ The elaboration of EEBCs implementation roadmap. ▪ The development of capacity building programs. ▪ Coordination between involved stakeholders. ▪ The preparation of EEBCs awareness plan. ▪ Preparation of semi-annual reports. ▪ public opinion polls and awareness assessment.
	Coordination with NEEAP	Egypt NEEAP 2018-2020 (recent coordination not at the time of code development)
	Coordination with NDCs	No

HBRC issued both codes and assisted by the Organization of Energy Planning (OEP) through the activities of the Energy Efficiency Improvement and Greenhouse Gas Reduction (EEIGGR) project, which is funded by the United Nations UNDP and the Global Environmental Facility (GEF). The codes preparation had been also supported by PA Consulting Group, DC, USA and The Deringer Group, Berkeley, CA, USA. The EEBCs development process has involved stakeholders such as Ministry of Electricity and Renewable Energy (MoERE), the New Urban Communities Authority (NUCA), the Supreme Energy Council and other international and local experts (HBRC & PA Consulting Group, 2005).

1.2.2 *Technical Scope and Requirements of EEBCs in Egypt*

The EEERBC consists of 10 chapters covering the following topics:

1. Scope and Compliance
2. General Requirements
3. Building Envelope
4. Natural Ventilation and Thermal Comfort
5. Air Conditioning and Mechanical Ventilation
6. Domestic Water Heating System
7. Daylighting and Artificial Lighting
8. Electrical Power Systems
9. Whole Building Performance
10. Definitions, Abbreviations and Acronyms

Egypt Energy Efficiency Commercial Building Code (EEECBC) covers the same topics with additional chapter for daylighting (HBRC & The Organization for Energy Planning, PA Consultin, 2006). Both codes have focused on providing formats or a framework for EE rather than specific values with a few exception where stringent numbers have been defined (HBRC, Planning, & PA Consulting Group, 2005) with a structure similar to the Standard ASHRAE 90.1. Both EERBC and EECBC have seven appendixes that cover climatic conditions, construction, calculating u-factors and wall heat capacities, calculating for the building envelope performance (trade-off option), thermal comfort and natural ventilation, lighting and electrical power.

In order to provide flexibility and permit the use of innovative approaches to achieve effective utilization of energy, The EEBCs tried to provide short texts describing the codes requirement and elaborated more complex requirements in the appendices. In many chapters, the requirements are provided by building size, for example, the HVAC requirements for small buildings are intended to be very simple in comparison with the HVAC requirements for the other larger buildings. The codes did not provide firm performance indicators apart from the minimum performance standards for a few parameters such as building windows and openings. The codes mentioned that the final detailed performance standards will depend on the result of further Energy and Economic Analysis (HBRC & The Organization for Energy Planning, PA Consultin, 2006). As per the discussion with HBRC this study has been carried out.

Table 7 Key Technical scope and requirements of EEBCs in Egypt

Parameters		Description
Type of the code		Both prescriptive, performance based and trade off
Climate zones in the code		Eight climate zones: - - North Coast Region - - Delta and Cairo Region - - Region of Northern Upper Egypt - - Region of Southern Upper Egypt - - East Coast Region - - Altiplano Region - - Desert Region - - Region of Southern Egypt
Building design and forms		NA
Building envelope	Thermal Resistance/U value for walls and roofs	Prescriptive requirements: Minimum required R values in m^2°C/W for conditioned buildings and unconditioned buildings for roof and five different orientation for walls (N, NE/NW, E/W, SE/SW, S). <u>Envelope Trade-Off Compliance in OTTV for residential buildings:</u> - Cairo: Walls: OTTV ≤ 45 W/ m^2, Roofs: OTTV ≤ 25 W/ m^2 - Alexandria: Walls: OTTV ≤ 40 W/ m2, Roofs: OTTV ≤ 20 W/ m2 <u>Envelope Trade-Off Compliance in OTTV for commercial buildings:</u> - Cairo: Walls: OTTV ≤ 95 W/ m^2, Roofs: OTTV ≤ 26.3 W/ m^2 - Alexandria: Walls: OTTV ≤ 90 W/ m2, Roofs: OTTV ≤ 26 W/ m2
	Ground Floor	NA
	Fenestration, Shading and WWR	Equations are provided to calculate WWR in relation to the SGR and SHGC for conditioned buildings and unconditioned buildings in Cairo and Alexandria.
Thermal Comfort		Dry bulb temperature between 21-27 °C degree, relative humidity between 25 – 50 % at wind speed of 0.5 - 1.5 m/s.

Parameters		Description
Building systems	Natural Ventilation	- For residential buildings: All occupied spaces within residences must be provided with adequate cross-ventilation using openable windows and /or skylights. All residential buildings of more than 3 stories must provide access from each residential unit to a ventilation shaft. - For commercial buildings provided in Liter per second for various space functions and number of persons per 100 m2 floor area.
	Heating, ventilation & air conditioning (HVAC)	For Residential areas: - Heating, ventilating and air-conditioning systems must be sized in accordance with the generally accepted engineering standards. - AC Units must be of specific capacities of 0.20-0.28 kW cooling/m2 of air-conditioned floor area - Minimum Energy Efficiency of Window ACs: EER 10 and COP 2.93 and EER 10 and COP of 2.93-3.23 for Split ACs. For Commercial areas: - Simplified requirements for Single Zone Systems - Different complex requirements for Multiple Zone Systems - Minimum efficiency for electrically operated air-conditioners and condensing units, water chilling packages, Heat Rejection Equipment etc.
	Domestic hot water system	For Residential Buildings: - Must comply with the relevant municipal codes. - Water Heating units for residential occupancy units of sizes greater than 100-liter storage and/or greater than 15 kW heating capacity must be located separate from used spaces. - 90% efficiency for Electric Inputs less than 12kW, Capacity 50-450 Litres, with $\Delta T < 45^oC$ - 85% efficiency for Gas Fired with storage capacity more than 36 litre, with $\Delta T > 45^oC$ - 80% efficiency for Gas Fired less than 38 litres storage capacity, with $\Delta T = 50^oC$

Parameters		Description
	Lighting	For residential: - Incandescent lamps: 10 – 12.6 of minimum Allowable Lamp Efficacy, depending on Lamp power, 750-1000 hr lamp life - Fluorescent: 36-56 of minimum Allowable Lamp Efficacy, depending on Lamp power, 5000-1000 hr lamp life - Compact Fluorescent 52-66 of minimum Allowable Lamp Efficacy, depending on Lamp power, 7000-10000 hr lamp life - Maximum Allowable Lighting Power Density 15 W/m2 (avg.). For commercial: - LPD Requirements and Illuminance Recommendations.
	Daylighting	For residential buildings: - Angle of obstruction (X) not greater than 70^0 - WWR not less than 10% for service zones and 15% for living rooms. - Glass of visual Lighting Transmittance (VLT) not less than 0.45. - Internal surface colors for walls and ceiling must be light, but not medium or dark. For commercial buildings: - Angle of obstruction (X) not greater than 70 - WWR not less than 20% for service zones and 15% for commercial zones - Glass of visual Lighting Transmittance (VLT) not less than 40% - Internal surface colors for walls and ceiling must be light, but not medium or dark.
Renewable Energy Applications	Solar Hot Water	Not provided
	Geothermal	
	Solar Cooling	
	PV-installation	
Minimal Energy Performance Standards		The code states that all used material and appliances should have energy performance labels. It also refers to ACs labels (MEPS) in the Air conditioning section. (without mentioning specific required minimum values).

1.2.3 *Compliance Paths of EEBCs in Egypt*

The EEEBCs provide different compliance paths including: a specific compliance parameters and values, trade-off approach or overall energy consumption. To comply with the codes, the building must either satisfy the perspective requirements of each section in the code or must satisfy the whole-building energy performance compliance path described in the last chapter of the code. For example, the building envelope requirements are provided in detailed values for both Alexandria and Cairo for conditioned and non-conditioned building (Annex 1 provides example of Building Envelope requirements in Egypt EE building codes). But for other requirements such as the HVAC system, the code offers two trade-off flexible compliance paths (examples of such flexible trade-off are provided in Annex 1).

Regarding the second compliance path or the whole-building performance as called in the code, the proposed design can only comply with this path if the annual energy costs of the proposed design, do not exceed those of the standard design as determined in the code, this will include the preparation of the following:

- Analysis procedures, including comprehensive analysis of energy, climate, costs, renewable energy potentials etc.
- Determining energy costs for the proposed design
- Determining energy costs for the standard design

The compliance documents of a building should show all data and features of the building design, systems, and equipment in details in order to permit a determination of the compliance by the responsible authorities. In order to ensure general understanding of the code, the code refers to the preparation of a compliance guidebook to be used as a supporting document. It is expected that the guidebook will explain most of the terms and other technical aspects providing examples and benchmarks. However, at the time of writing this report (April 2020), the compliance guidebook has not been published.

1.3 Analysis of EEBCs Implementation Mechanisms in Egypt

HBRC intends to promulgate the residential and commercial codes as a mandatory section of the overall building code (HBRC & The Organization for Energy Planning, PA Consultin, 2006). Therefore, HBRC planned a program to implement those codes, which includes a number of activities such as compliance training for architects, engineers and manufactures, conducting number of pilot projects, public outreach activities and the creation of administration responsible of the enforcement of the code. This implementation plan included the following actions and activities (Hanna G. B., 2011).:

- Compliance training for key building industry players, architects, engineers, manufactures, code official and local authorities under guidance of the Ministry for Local Governments, Training courses done every year for a week.
- Developing a compliance manual.
- Developing compliance forms and procedures plus enforcement and inspection.
- Procedures and checklists, (partially developed with an Excel sheet).
- Public outreach and information programs.
- Creation of an appropriate energy code administration structure.

According to HBRC, this proposed enforcement program and activities have not been fulfilled or still are in the early phases of implementation (CES-MED, 2016).

Table 8 Implementation Mechanisms of EEBCs in Egypt

Category	Parameters	Description
Analysis of Implementation Mechanisms	Implementation and compliance plans	The EEBCs suggested Implementation and compliance plans, but a limited number of activities had been executed
	The enforcing governmental bodies	▪ EEBCs implementation and Activation Committee (under the Energy Supreme Council) ▪ MoHUUC ▪ MoERE ▪ Concerned entity/local municipality
	Is the compliance with EEBCs enforced in the procedures of obtaining the occupancy permits	No
	Entities responsible of issuing the building permits	▪ Municipalities and governorates of existing cities. ▪ Urban communities' development departments of new cities (NUCA).
	Stakeholders involvement in the implementation (e.g. Architects, engineers, industries, construction etc)	▪ Engineers Syndicate ▪ Universities ▪ Architects
	Readiness of the construction market relevant to Industries, construction, tender etc	Limited number of activities: ▪ EEBCs: no provided details on that. ▪ NEEAP: proposed number of activities to enforce the codes. ▪ Launching a website for information and database of EE in all sectors. ▪ The establishment of Egyptian Energy Efficiency Cluster Initiative EEECI, including research centers, funding agencies, chambers of commerce and industry.
	Capacity Building programs relevant to the EEBCs	No
	Documentation of compliance	No

Category	Parameters	Description
	Provision of technical support in design	Not provided
	Provision of technical support in construction	Not provided
	Building delivered according to the EEBC	None
	New governmental plans to enforce the code	MoU between MoERE and MHUUC to facilitate the enforcement and implementation the EEBCs.
	What are the relevant ongoing projects and plans	None

Egypt has taken a limited number of steps towards an effective enforcement of the EEBCs. For example, in November 2015, the MoERE and MHUUC signed a MoU to facilitate the enforcement and implementation of the two codes. The MoU refers to cooperation in the fields of information exchange, energy consumption in the building sector and the elaboration of a strategic plan to set up an institutional structure (involving various relevant ministries and governmental agencies) that will facilitate the implementation and enforcement of the EEBCs (NUCA , 2015). Egypt National Energy Efficiency Action plan ENEEAP has suggested the establishment of the EEBCs implementation and Activation Committee. This committee will define the legal, institutional, technical and economic challenges of EEBCs enforcement and prepare an EEBCs implementation roadmap. The committee will also do some other activities in order to increase readiness of the construction and building sector to comply with the EEBCs.

1.4 Summary of the Status Quo of the EEBCs in Egypt

The two EEBCs for residential and commercial buildings have been developed and issued by HBRC. The enforcement and implementation of the codes did not take place and no record of any buildings delivered according the to the EEBCs. The complexity of some requirements, the lack of clear enforcement procedures, compliance manuals and training of municipal employees and not including EEBCs within the procedures of obtaining the building permits appear to be among the main reasons for not enforcing the EEBCs. The barriers of implementation will be further investigated in the next steps of this study.

Table 9 Summary of status quo of the EEBCs in Egypt

Category	Parameters		Description
Code development process	The responsible governmental bodies		HBRC, MoHUUC
	Stakeholders involvement		▪ MoERE ▪ NUCA ▪ The Supreme Council of Energy ▪ Local and international experts
	Frequency of code updating		Every five years (did not take place)
	Coordination with NEEAP		Yes
	Coordination with NDCs		No
Technical scope and requirements of EEBCs in Egypt	Type of the Code		Prescriptive, performance based and trade off
	Climate Zones in the code		Eight climate zones
	Building design and forms		NA
	Building envelop	Thermal Resistance/U value for walls and roofs	Yes. For conditioned buildings and unconditioned buildings in the climate zones of Cairo and Alexandria.
		Ground Floor	NA
		Fenestration, Shading and WWR	Yes. For conditioned buildings and unconditioned buildings in Cairo and Alexandria.
	Thermal Comfort		Yes. Defined.
	Building systems	Natural Ventilation	- Yes.
		Heating, ventilation & air conditioning (HVAC)	Yes. For Residential areas and Commercial areas. Minimum Energy Efficiency requirements are provided.
		Domestic hot water system	Yes. For Residential areas and Commercial areas. Minimum Energy Efficiency requirements are provided
		Lighting	Yes. For Residential areas and Commercial areas. Minimum Allowable Lamp Efficacies are provided.
		Daylighting	Yes. For Residential areas and Commercial areas.
	Renewable Energy	Solar Hot Water	Not provided
		Geothermal	

Category	Parameters		Description
	Applications	Solar Cooling	
		PV- installation	
	Minimal Energy Performance Standards		The code states that all used material and appliances should have energy performance labels. It also refers to ACs labels (MEPS) in the Air conditioning section. (without mentioning specific required minimum values)
Proposed Implementation Mechanisms	Implementation and compliance plans		Limited number of activities had been executed
	The enforcing governmental bodies		▪ MoHUUC ▪ MoERE
	Is the compliance with EEBCs enforced in the procedures of obtaining the occupancy permits		No
	Entities responsible of issuing the building permits		▪ Municipalities and governorates of existing cities. ▪ City departments of new cities (NUCA).
	Stakeholders involvement in the implementation (e.g. Architects, engineers, industries, construction etc)		▪ . Engineers Syndicate ▪ Universities ▪ Architects
	Readiness of the construction market relevant to Industries, construction, tender etc		Limited number of activities:
	Capacity Building programs relevant to the EEBCs		No
	Documentation of compliance		No
	Provision of technical support in design		Not provided
	Provision of technical support in construction		Not provided
	Building delivered according to the EEBC		None
	New governmental plans to enforce the code		MoU between MoERE and MHUUC to facilitate the enforcement and implementation the EEBCs.
	What are the relevant ongoing projects and plans		None

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 Egypt 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 2 of this report. The questionnaires covered several aspects around the topic including the technical aspects, the institutional and regulatory barriers, financial issues, the capacity building and awareness challenges. The questionnaires also included questions to define the key and general recommendations for the improvement of the EEBCs and better enforcement informant and implementation of the codes.

2.1 Challenges and Barriers of the Enforcement and Implementation of EEBCs

2.1.1 *The Technical Challenges*

Experts find the EEBCs in Egypt tend to be slightly complex specifically to engineers/architects who are not experienced in energy efficiency measures. The code provides relatively clear steps for new buildings only, therefore while updating the code clear steps should be also provided for retrofitting of buildings. Many also agree that the codes need further updating according to the recent market developments. Some of the experts believe that having a compliance manual will ease the process of understanding and implementing the codes. Others believe that devising brief checklist of the minimum requirements instead of extensive schedules and calculations could be a good start for the code implementation. According to one of the experts, a draft of a compliance manual was already developed by HBRC but not yet published.

Regarding the energy performance calculation methodology, it is included in chapter 10 of the code and it was also previously planned to add a calculation method (software tool) for the complex building forms to compare the energy consumption of similar buildings to it. The idea of having a simple calculation tool (software tool) for energy performance evaluation was recommended again by more than one of the interviewed experts. Some engineers and architects tend to be aware of the calculations/standards of the code however they fall short on implementation due to the unwillingness of the contractors/developers to increase construction costs.

Another technical barrier is faced whenever the EEBC requires Measurement and Verification (M&V) during building operation, in such case there might be some technical barriers, for example, in setting a correct M&V plan, defining measurement points, intervals, devices, as well as roles and responsibilities.

2.1.2 *The Institutional and Regulatory Challenges*

All codes issued by HBRC are considered as indicative/voluntary codes until the respective Minister issues a decree/decision to mandate it. The EEBC issuance was never followed by this decree to be mandatory or enforced. The two main building related codes that are being strictly enforced in Egypt are the Egyptian firefighting code (enforced by the Civil Defence Authority) and the structural code (enforced by insurance collaborative). These two compliance certificates are obligatory to receive the building permit, therefore, they are followed and implemented. It was recommended several times by experts to ensure the

code mandating is enforced and its compliance is required in the building permit procedure even if this is done gradually to achieve increased code implementation in the end. Having a stand-alone neutral entity that acts as a referee and reviews the compliance with the EE code to issue the compliance certificate, likewise the firefighting code and structural safety codes, is a repeated recommendation as well.

The key barrier to enforcement is the lack of awareness of the benefits of EE measures among architects, owners, manufacturers, legislators etc., especially the financial benefits. For the code to be mandatory, a cost benefit analysis is needed first to showcase the financial benefits of applying the code to convince the decision makers.

Raising awareness and mandating energy efficiency codes should be both done parallelly to ensure uptake of the implementation. In addition, there has to be full integration of the industry to ensure the availability of the needed materials and systems in the market with specifications that fulfil the code requirements. Also, financial incentives should be employed to encourage code compliance.

The interviewed experts suggested different scenarios of mandating the code gradually:

- Mandating some measures related to the building envelope only. According to studies conducted in Cairo University, if this code is mandated and EE measures were applied to the building envelope only, energy consumption will be reduced by 8-10% on the national level and by 30-40% in the building sector.
- Mandating the code only for large scale projects (determined by projects GFA/expected energy consumption) as for such projects it will be feasible to monitor and ensure that codes are being followed.
- A transitional 5-year adapted step could first be imposed with lower requirements.
- Applying incentives for code implementation for 3 to10 years (depending on pay-back period) before having the code completely mandatory with penalties for failed compliance.

One of the most relevant stakeholders that should be involved in the process of development and update of the codes is the project developers since they are responsible for the decision of implementation of EE measures in their constructed buildings (mainly in building design and envelope).

An example that could be taken is “Title 24 Compliance” in the U.S. which is a sort of an EE certificate for the building to be used as part of permits documents where inspection is then conducted to ensure compliance with the code for both the building envelope and systems (HVAC, Lighting, etc.).

2.1.3 *Capacity Building and Awareness Challenges*

According to the interviewed experts, the level of awareness tends to vary between different groups. Many large-scale developers (10-15% of the market) have this kind of awareness (backed up by awareness of their high-end clients) but the rest needs more awareness raising and capacity building on the multitude of benefits (financial in the form of savings, environmental, etc.). Raising awareness of the end users is very crucial since real estate marketing strategies also tend to be misleading when wrongly using terms such as “green” and “sustainable” capitalizing on the lack of awareness of most end-users.

Awareness of the industrial, commercial, and public building sectors of the importance of adopting energy saving methods and concepts is considered high, however; their awareness of the code is still on the lower end as mentioned by the experts.

When it comes to architects/engineers/construction professionals, awareness and knowledge of energy efficiency, thermal conductivity of different materials and other related

aspects should be embedded early on in engineering and architecture undergraduate programs. Training is also needed for the certifiers or assessors in the code enforcement entity. So far, it is the mandate of HBRC to conduct such capacity building and training programs. Mandating/implementation of the code should be supported by illustrating the benefits of implementing energy efficiency measures such as decreased electricity bills. This could be demonstrated by showcasing the payback of EE on real-life implemented case studies (pilot projects).

2.1.4 *Financial Challenges Related to the Implementation of EEBCs*

Many of the experts argue that with an experienced engineer/architect, the increased investment cost coupled with implementing some energy efficiency measures could be around 10-15% increase. The key issue in Egypt is that most buildings are constructed by developers where they usually are not interested in improving building efficiency as the reduction in consumption costs does not benefit them but benefits the end-users. Some of the end-users that build for themselves (residential buildings) are sometimes willing to increase the investment cost by implementing some energy efficiency measures when they're convinced with their payback and expected savings.

Facilitated local financing schemes should be made more available as international financing schemes tend to be very selective and targeting large scale commercial projects rather than residential buildings.

One of the experts divided the financial support into funding opportunities (e.g. for construction) whose target group could be the developers and incentives that can be useful for the owners who build their own units and achieve higher performance than required by the code. Other experts considered incentives to be suitable for the residential sector. While focus on having clear cost-benefit analysis to convince the industrial, commercial, and public building sectors who have showed preliminary interest, thus incentives and funds are not needed.

2.1.5 *Other relevant challenges and barriers*

Experts have confirmed that most of EE materials and systems are available in the Egyptian market except for some more advanced systems that are still emerging. However, the labels and specifications required by the code on the used materials and measures are not always available on products sold in the local market. The exclusivity of some accepted materials/measures to certain suppliers/manufacturers lead to relatively higher prices. Therefore, integration of industry and raising awareness on the codes requirements in terms of materials testing is crucial. In addition, more Laboratories (public or in universities) are needed for testing and labelling products.

Table 10 Summary of challenges of the implementation of EEBCs in Egypt

Aspects	Barriers/challenges
Technical	• Experts find the EEBCs in Egypt tend to be slightly complex specifically to engineers/architects who are not experienced in energy efficiency measures. • The lack of a simple calculation tool (software tool) for energy performance evaluation. • The lack of Measurement and Verification (M&V) during building operation.

Aspects	Barriers/challenges
Institutional and regulatory	• While the code has been prepared to be a mandatory code, so far, the ministerial decision to make it obligatory has not been issued. • The lack of a stand-alone neutral entity (or third party) that act as a referee and review the compliance with the EE code to issue the compliance certificate. • The lack of clear enforcement plan for the EEBCs.
Capacity Building and awareness	• The key barrier to enforcement is the lack of awareness of the benefits of EE measures among architects, owners, manufacturers, legislators etc. especially the financial benefits. • The lack of capacity building and training programs on the EEBCs. • The EEBCs are not considered in the curriculum of the relevant study programs.
Financial	• A limited number of facilitated local financing and incentives schemes. • The lack of awareness about the available financing schemes.

2.2 General Recommendations

Based on the analysis of the status quo and the experts' interviews, the suggested actions as main priorities to improve the EEBCs implementation and enforcement are the following:

2.2.1 *Technical Recommendations*

- Simplifying the EEBCs. Considering having a simplified 2-pager checklist of the minimum requirements to kick-start compliance with the codes.
- Integrating industry and manufacturers in the process and developing testing laboratories to fulfil the codes requirements regarding different materials and systems.
- Maintaining the balance between market readiness and newly introduced codes/requirements.
- Launching an online free digital code with an imbedded free tool.
- Having M&V requirements enforced as much as design requirements.

2.2.2 *Institutional and Regulatory Recommendations*

- Mandating the code and enforcing its implementation by including it as a prerequisite of the Building permits procedure.
- Establishing a stand-alone body/entity to issue the code compliance certificate for buildings and be responsible for the inspection after construction.

2.2.3 *Capacity Building and Awareness Recommendations*

- Awareness raising for the architects, engineers, owners, developers, manufacturers, and legislators is needed. More publicity on the code is needed.
- Showcasing the gains/paybacks of energy efficiency in real-life case studies (pilot projects) with accurate models and calculations.
- Support the implementation of showcase projects, especially in the industrial and commercial sectors.

2.2.4 *Financial Priority Recommendations*

- Providing financial incentives for those who comply with the EEBCs to speed the uptake of EE measures. Incentives should be two-fold (1. for code compliance, 2. for adopting new EE technologies).

The order of priorities differed among experts, but the above points covered all mentioned priority actions by the interviewees for achieving successful enforcement of energy efficiency building codes.

2.3 Prioritization of the Recommendations

The general recommendations concluded from the analysis and experts' interviews cover a wide range of technical, financial, institutional and regulatory, capacity building and awareness recommendations. Some of those recommendations fall beyond the scope of BUILD_ME and/or beyond BUILD_ME timeline. Nevertheless, most of those recommendations are relevant to accelerate the implementation and enforcement of EEBCs. In order to define the focus of the next steps of this study, two methodological steps have been prepared. The first step is the evaluation of the general recommendation summarized in Table 11 (evaluation is available in Annex 3) against the following criteria:

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

Table 11 Summary of general recommendations of the implementation of EEBCs in Egypt

Aspects	Recommendations
Technical	• Simplifying the EEBCs. Considering having a simplified 2-pager checklist of the minimum requirements to kick-start compliance with the codes. • Integrating industry and manufacturers in the process and developing testing laboratories to fulfil the codes requirements regarding different materials and systems. • Maintaining the balance between market readiness and newly introduced codes/requirements. • Launching an online free digital code with an imbedded free tool. • Having M&V requirements enforced as much as design requirements.
Institutional and regulatory	• Mandating the code and enforcing its implementation by including it as a prerequisite of the Building permits procedure. • Establishing a stand-alone body/entity to issue the code compliance certificate for buildings and be responsible for the inspection after construction.
Capacity Building and awareness	• Awareness raising for the architects, engineers, owners, developers, manufacturers, and legislators is needed. More publicity on the code is needed. • Showcasing the gains/paybacks of energy efficiency in real-life case studies (pilot projects) with accurate models and calculations. • Support the implementation of showcase projects especially in the industrial and commercial sectors.
Financial	• Providing financial incentives for those who comply with the EEBCs to speed the uptake of EE measures. Incentives should be two-fold (1. for code compliance, 2. for adopting new EE technologies).

The second step was to look on the experts' statements on the prepared set of recommendations. Therefore, a workshop has been held with representatives from Housing and Building Research Centre (HBRC) as the competent entity responsible of preparing the building codes in Egypt. The workshop aimed at periodizing the top recommendations using criteria that include:

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

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

a) A roadmap for continuous update of the code:

To prepare a roadmap for continuous update of the code in coordination with the relevant stakeholders this should include simplifying the EEBCs. Considering having a simplified checklist of the minimum requirements to start/enforce compliance with the codes.

b) EEBCs updating and simplifying to be included in national strategies

To include updating and simplifying the EEBCs in ongoing national strategies such as NEEAP 2 where NEEAP 1 supported the development of EEBCs in the first place.

c) Raising Awareness about the EE and EEBCs

To raise awareness about the EE and EEBCs for the architects, engineers, developers, manufacturers, legislators and construction professionals. This may include showcasing the gains/paybacks of energy efficiency in real-life case studies (pilot projects) with accurate models and calculations.

3. Priority Recommendations to improve the EEBCs in Egypt

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

A roadmap for the simplification of the code

3.1 A roadmap for the simplification of the code

A) Short summary

To prepare a roadmap for the simplification of the EEBCs in coordination with the relevant stakeholders, this should include simplifying the code as well. Considering having a simplified checklist of the minimum requirements to start/enforce compliance with the codes.

B) Goal(s) of action/recommendation

The main aim of this recommendation is to set a clear roadmap that guide the process of EEBCs simplification, necessary for actual compliance with the codes. This should cover the code simplification and devising a simple user-friendly supporting checklist for the minimum requirements to encourage increased rate of compliance by the current construction projects. The primary objective here is to simplify the EEBC so that it can be applied with simple procedures and with little funds required. Update will come onwards

The goals to be achieved out of this recommendation are as follows:

- Ensure a smooth effective update of the current version of the code. It is believed that simplification of the EEBCs with simple procedures and with little funds required will allow for its implementation
- To get collective viewpoints and feedbacks from the relevant stakeholders towards simplification of the EEBC and hence forth to make it achievable with simple procedures
- To support the ongoing activities and steps towards the simplification of the code to be clearer and easier for implementation.
- Support the creation of a simplified checklist of the code requirements that will be an integral part of the simplified version of the code. This will help to achieve stronger levels of enforcement and higher implementation rates in actual cases on-ground.
- The roadmap will also study and define best way to reach enforcement. This is anticipated to be formalized once the simplified version is ready and is accompanied with Cost Benefit Analysis CBA on the overall economic and environmental impacts.

C) Extended description of action/recommendation

The current version of the EEBCs for residential buildings was issued in 2005 and that for commercial buildings was issued in 2009. Both versions have not been updated since then which might render some of the requirements as obsolete and failing to keep track of the current advancements in the building sector. Furthermore, the EEBCs have been formulated in an academic way with very ambitious requirements that are not in line with the market status. A roadmap including specific milestones for the code update will provide the grounds to improve the code suitability to the current practices as well as boost its adoption rates in the Egyptian building stock. It is expected that the roadmap for simplification will pave the way to prepare a detailed action for simplification in a way that is suitable and easy to use.

The roadmap comes as a response to the multiple requests for the update and simplification of the code by involved professionals and stakeholders to whom the adoption decision is left. It will aim at creating a simple process that ensures the update and simplification of the code. It must ensure clear manageable steps with clear assigned roles, milestones, timeframe following similar successful contextual experiences. The road map will also bring all stakeholders together to overcome organizational and procedural challenges.

The roadmap is developed along the following tentative steps (list in below is not exhaustive): further improvements on the list of activities, sequence and correlated time schedule to be elaborated by HBRC “the national entity responsible for the code preparation, update and simplification”:

- *Status-quo Definition:* Identify the status-quo of the existing EEBCs and the split of roles among the different entities/stakeholders who are responsible for devising and updating the codes *(supported by BUILD-ME II outputs).*
- *Participatory Approach:* Organise a stakeholder roundtable discussion for exchange on the organizational and procedural challenges facing the update and simplification of the code.
- *Create Knowledge Base:* Analyse best practices and similar experiences to define the lessons learned and set clear steps for the roadmap update.
- *Elaborate a clear target:* Define the targets and goals of the roadmap and the simplified checklist of the minimum requirements.
- *Define milestones:* Set specific intermediate steps for the update of the code based on the targeted adoption rate and rate of advancement in the construction practice.
- *Develop the Roadmap:* Devise clear and manageable steps of the road map for updating the code that should meet the targets/goals of all involved stakeholders and overcome the faced organizational and procedural challenges identified.
- *Feedback Round:* Have a second round of consultations with involved stakeholders after the development of the roadmap for feedback to ensure the uptake and adoption of the steps on ground. The outcome of these discussions is to be taken into consideration in the final version of the road map.
- *Evaluation:* Establish annual monitoring and reporting system on the progress achieved by involved entities and the status of the code adoption rate.

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

Assuming a core team of **3-4 members** with an approximate workload of **75 – 85 man-days** over a period of **5 months**, the estimated workload is as follows:

20 – 25 man-days for the status-quo analysis and for the organization of experts focus group discussion.

5 – 10 man-days for conducting the best practice examples mapping and analysis to draw links to this action.

30 man-days for the road map document development including internal review rounds.

15 man-days to organize the second experts focus group discussion for feedback on the developed road map and updating the road map towards the final version.

10 man-days for putting a monitoring and evaluation plan and attending the regular monitoring meetings.

E) Timeline and Milestones

Action Step	Estimated Duration	Workload
• **Task 1.1.**: Analyse the current status-quo of the existing EEBCs and map the stakeholders to be involved in the update	Starts in xxxx 1 month (Week 1 - 4)	**5 – 10** man-days
• **Task 1.2.**: Organize an experts' roundtable to identify the key challenges that hinders the code update and simplification	2 months (Week 3 -10)	**15** man-days
• **Task 1.3.**: Map and analyse the best practice examples in the field of code update and road map development	1 month (Week 5 - 8)	**5 – 10** man-days
• **Task 1.4.**: Set clear and measurable targets and milestones for the road map of the code update and simplified checklist creation	1 month (Week 7 -10)	**25** man-days
• **Task 1.5.**: Finalize the road map document to cover all the needed steps to achieve the goals	2 months (Week 9 -16)	**5** man-days
• **Task 1.6.**: Go through a second round of discussion with the experts and involved officials to ensure the developed road map satisfies all the needs and overcome all challenges. Fine tune the road map based on the feedback	1 month (Week 17 - 20)	**15** man-days
• **Task 1.7.**: Devise a monitoring, evaluation and reporting plan for reporting on the progress of this action	1 month (Week 1 - 4, 8, 12, 16, 20)	**10** man-days

Total = 80-90 man-days

Task No.	Month 1				Month 2				Month 3				Month 4				Month 5			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Task 1.1																				
Task 1.2																				
Task 1.3																				
Task 1.4																				
Task 1.5																				
Task 1.6																				
Task 1.7																				

F) Stakeholders and Roles

Leading Stakeholders:

- The Housing and Building National Research Centre (HBRC) that is affiliated to the Ministry of Housing, Utilities and Urban Communities (MoH). It is their mandate to devise, update or simplify the codes for the building sector.

Supporting Stakeholders:

- Previous members in the “Energy Efficiency Building Code” committee from inside and outside HBRC to share their experiences in the roundtable discussions.
- Other experts and professionals in the field who can reflect on the code development process, challenges facing the update and simplification processes in the discussions

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

- All professionals involved in the construction field who can be more encouraged to adopt the code due to its easier understanding, simplified requirements, and updated procedures.

G) Risks

- Risk: Lack of availability of the financial resources needed for devising this road map and putting it into action at a later stage.

  Mitigation: Searching for international donors and potential funds that could secure the needed resources for the road map devising and implementation.

- Risk: Low turnout at the organized events which will limit the identification of core barriers to overcome them in the developed road map.

  Mitigation: Following more of a top-down approach in ensuring the participation of the involved officials from the respective entities. Also relying on the strong network of HBRC to bring together experts who were involved in the code development committee for sharing their experiences.

  Note: If the first round of simplification of EEBC is (well prepared and announced)) and then the outcome to be materialized is enough to convince the market stakeholders to implement and use the EEBCs. This process will lead to get the EEBC application as a mandatory. From here, the required commitment to keep on updating the codes will be guaranteed and so mitigate any risks related to code’s activation and sustainability.

H) MRV

The senior in the core team can monitor the progress of the action and follow-up on the code update road map developed by the working group/team.

The team could have monthly meetings for following-up and reporting on the progress. Agenda and minutes of meetings shall be shared with all attendees for documentation and better reporting process. They shall submit a progress report every three months to the head of HBRC.

Another committee of experts to be formed to verify the quality of the developed road map and the existence of all circumstances, facilities and resources needed for putting it into action.

Having such an MRV plan is very important for the local and international recognition for the efforts done with regard to EEBCs update and simplification. In addition to ensuring the quality and sustainability of the efforts and progress.

Tracking the progress of the road map implementation and the code regular update needs another MRV plan that is beyond the scope of this action/recommendation.

HBRC shall handle these issues according to the local working experience taking into consideration the ultimate goal of simplification and update of the EEBC. Details of the MRV shall be darted and applied accordingly.

Good practice example

One of the unique systems followed for ensuring energy efficiency building sector is the Global Sustainability Assessment System (GSAS) released in **Qatar** in 2007. This system had four editions with the latest issued in 2019. The system is different from all the efficiency codes and regulations in the MENA region countries in that it does not rely on benchmarks for the passive parameter of the building envelope. It is rather a performance-based system that is the first of its kind in the MENA region. It assesses the efficiency and sustainability of the building through a performance analysis supported by a custom simulation system. Accordingly, GSAS evaluation is more accurate, and it ensures that the end goal of the building efficiency is achieved as measured by its actual performance.

Ref: Passerini, G. and Ricci, S., 2020. *The sustainable city XIV*. Southampton: WIT Press. https://books.google.com.eg/books?id=N_oOEAAAQBAJ&dq=best+practice+of+building+code+update+in+the+MENA+region&source=gbs_navlinks_s

Another good example of the update of practice in terms of code compliance and implementation is the model adopted by **Dubai**. In the UAE, there is not a federal building energy code and so each emirate issues its own codes. For Dubai, the Dubai Green Building Regulations and Specifications were issued in 2010 and were at first only mandatory for new government buildings. In 2014, the regulations became compulsory for all the Dubai buildings. In 2017, these regulations were relaunched by the Municipality as Al Sa'fat rating system. One of the five main categories of this system is "Resource Effectiveness-Energy" which covers all requirements for the high energy-efficient buildings including: the envelope, air conditioning, ventilation and renewables in buildings. The gradual mandating of the code in different sectors and the supporting regulations are lessons learned from Dubai experience.

Reference: Rodriguez-Ubinas, E., Alzarouni, S., Alhammadi, N., Alantali, M., Behzad, F., & Sgouridis, S. (2020). Sustainability through energy conservation building codes: Comparative analysis of green building regulations in the Middle east. *WIT Transactions on Ecology and the Environment*, *249*(December), 85–100. https://doi.org/10.2495/SC200081

Ref: Passerini, G. and Ricci, S., 2020. *The sustainable city XIV*. Southampton: WIT Press. https://books.google.com.eg/books?id=N_oOEAAAQBAJ&dq=best+practice+of+building+code+update+in+the+MENA+region&source=gbs_navlinks_s

The table below shows a compilation of Building code revision options in different countries which shows the different rates of update or revision ranging from every 3 to 5 years to being irregular. This could be helpful in identifying the most suitable rate of update for the case of Egypt to be included in the developed road map.

Ref: IPEEC. (2015). *Delivering Energy Savings in Buildings - International Collaboration on Building Energy*. https://tools.gbpn.org/sites/default/files/1448013016IPEEC_BEET3_Final_Report.pdf

Country	Schedule
Australia	Irregular
Canada	Every 5 years
China	Irregular but increasing in frequency, partial revisions of certain standards
France	Roughly every 6 years, in coordination with the EU
Germany	Ad hoc, in coordination with the EU
India	Irregular, next in 2017/18
Italy	Ad hoc, in coordination with the EU
South Korea	Every 4 years
Spain	Ad hoc, in coordination with the EU
Turkey	Yes, in the National Climate Change Action Plan
United Kingdom	Irregular, next in 2016
United States	Every 3 years

3.2 Raising Awareness about EE and EEBCs

A) Short summary

To raise awareness about EE and EEBCs for the different involved stakeholders: architects, engineers, developers, manufacturers, legislators and construction professionals. This shall include showcasing the gains/paybacks of energy efficiency in real-life case studies (pilot projects) with accurate models and calculations. It also includes a capacity building component through organizing thematic training sessions for targeted groups.
This is the most important issue in the process, to get CBA related to application of EEBC. HBRC shall handle this in accordance with priorities of construction, typologies to be applied on, and anticipated directions to get EE on the national level.

B) Goal(s) of action/recommendation

The main aim of this recommendation is to enhance the knowledge level of professionals involved in the field and raise their awareness on the EEBCs existence, sections and compliance procedures.
The goals to be achieved out of this recommendation are as follows:

- Raise awareness of architects, engineers, developers, manufacturers, legislators and construction professionals about the EEBCs details.
- Raise awareness of the involved stakeholders on the environmental and economic gains and benefits achieved from the implementation of EE measures in the building sector.
- Prove the applicability and effectiveness of the code by showcasing the gains/ paybacks of its implementation in actual cases by detailed models and calculations.
- Offer technical training and capacity building programs on the detailed code requirements, code application procedure, code compliance procedure, etc.
- Ensure increased readiness of the construction field professionals to support the compliance with the EEBC requirements.

C) Extended description of action/recommendation

Knowledge of the existence of the EEBCs and the buy-in of professionals is the foundation of the code adoption in the building sector. In many cases, the involved professionals are not updated by the available codes that are not mandated in the permit process. They also fall short on knowledge of the detailed sections of the code and the requirements for compliance. Accordingly, they cannot consult their clients on what measures to adopt to improve the energy efficiency of their building or how to meet the minimum requirements of the code. Organizing an awareness raising campaign for the involved professionals in the construction market is highly necessary, as well as raising awareness among the project developers to showcase the gains of implementing the code, which might lead to further awareness among the public. In addition, offering more advanced technical training to specific groups involved in the code application and compliance procedures is of great necessity. This has to be supported by all the needed information and databases to convince the experts of the multitude of environmental and economic benefits that could be achieved from the code adoption.
Awareness raising is developed along the following steps (list in below is not exhaustive):

- *Events Organization:* Organise workshops and meetings with the different target groups (Gr. 1: Architects, engineers and developers/ Gr.2: manufacturers/ Gr. 3: Legislators and government professionals) to increase the awareness of the code,

its detailed sections and compliance procedures.

- *Website Development:* Create an attractive and user-friendly website for sharing the code documents, compliance checklist, compliance procedure, training and workshops dates and create an online database of the available projects that complied with the code. If no cases exist, generic cases can be used for showcasing the code minimum requirements.
- *Marketing Investment Opportunities:* Showcasing the financial gains and paybacks by detailed models and calculations of actual real-world cases in the different awareness raising sessions.
- *Information Campaign:* Make use of different social media channels in spreading knowledge on the EEBCs, its gains and benefits (organise webinars and live events with renowned speakers and experts in the field).
- *Training and Capacity Building Program:* Offer technical training and capacity building programs to some targeted groups (Gr 1: Architects and engineers, to train them on fulfilling the detailed code requirements in their projects and on the code application procedure, Gr 2: Government officials and engineers involved in compliance checking, to train them on the details of the compliance procedure).
- *Consultation Department/Unit Establishment:* As part of the institutional set up development, a plan for establishing a consultation department or unit could be created to have the mandate of raising awareness and training later on.
- *Evaluation Process:* Establish annual progress monitoring and reporting system to identify the impact achieved by the awareness raising campaign.

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

Assuming a core team of **4 – 5 members** with an approximate workload of **150 – 165 man-days** over a period of **13 months**, the estimated workload is as follows:
5 – 10 man-days for the internal team coordination meetings over the whole period.
60 man-days for the organization of 4 events (1 event per quarter).
The development of the website will probably be outsourced.
10 man-days for the development of social media channels.
20 – 30 man-days for the organization and launching of Information campaign including the preparation of the needed documents and materials.
35 man-days for the preparation, organization and conducting of the training sessions.
15 man-days for putting a plan for the establishment of a consultancy unit/department as well as the establishment of the progress reporting system.
5 man-days for the monitoring and evaluation monthly meetings and reporting.

E) Timeline and Milestones

Action Step	Estimated Duration	Workload
• **Task 3.1.**: Internal Organizational Meetings for the core team	Starts in xxxx Over the whole period	**5 – 10** man-days
• **Task 3.2.**: Organize 4 events over a year. Each event is divided into 3 sessions for the 3 target groups	8 months (months 3,4,6,7,9,10,12,13)	**60** man-days
• **Task 3.3.**: Develop a website for sharing the code different documents	3 - 4 months (Week 1-16)	probably outsourced

and supporting databases		
• **Task 3.4.**: Develop social media channels/pages to support sharing the code and best practices	3 - 4 months (Week 1-16)	**10** man-days
• **Task 3.5.**: Organize and launch an Information Campaign using social media channels	9 months (Week 9 - 44)	**20 – 30** man-days
• **Task 3.6.**: Prepare and conduct a training and capacity building program for 2 target groups	3 months (Week 41-52)	**35** man-days
• **Task 3.7.**: Put a plan for establishing a consultation department/unit in the responsible entity	2 months (Week 33 - 40)	**10** man-days
• **Task 3.8.**: Establish annual progress monitoring and reporting system	1 month (Week 1 - 4)	**5** man-days
• **Task 3.9.**: Prepare annual progress reports and have monitoring and evaluation monthly meetings	1 month/year (Week 49-52)	**5** man-days
		Total = 150 – 165 man-days

Task No.	Month 1				Month 2				Month 3				Month 4				Month 5			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Task 3.1																				
Task 3.2																				
Task 3.3																				
Task 3.4																				
Task 3.5																				
Task 3.6																				
Task 3.7																				
Task 3.8																				
Task 3.9																				

Task No.	Month 6				Month 7				Month 8				Month 9				Month 10			
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Task 3.1																				
Task 3.2																				
Task 3.3																				
Task 3.4																				
Task 3.5																				
Task 3.6																				
Task 3.7																				
Task 3.8																				
Task 3.9																				

Task No.	Month 11				Month 12				Month 13			
	41	42	43	44	45	46	47	48	49	50	51	52
Task 3.1												
Task 3.2												
Task 3.3												
Task 3.4												
Task 3.5												
Task 3.6												
Task 3.7												
Task 3.8												
Task 3.9												

F) Stakeholders and Roles

Leading Stakeholders:

- The Housing and Building National Research Centre (HBRC) that is affiliated to the Ministry of Housing, Utilities and Urban Communities (MoH) and has the mandate of devising codes for the building sector.

Supporting Stakeholders:

- External experts (outsourced from HBRC) who might be consulted on the website and social media channels development or any other activities under this recommendation.

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

- All professionals involved in the construction field who can be divided into three target groups: Gr.1: Architects, engineers and developers/ Gr.2: manufacturers/ Gr.3: Legislators and government professionals.

G) Risks

- *Risk:* Low turnout at the organized events and lack of interest from the professionals to interact with the campaign and increase their knowledge about the EEBCs.

  Mitigation: Exerting effort in communicating the purpose of the events and training programs to potential participants using different needed material (brochures, flyers, etc.). Using different means of communication for announcing the event including website, social media accounts, phone calls, etc.

- *Risk:* Low outreach of the different digital campaigns (e.g., the information campaign) and not attracting enough followers from the field.

  Mitigation: Boosting the online visibility of the different campaigns through sharing with the extended network of all the involved entities and monitoring the interaction and Traffic on the different pages and websites. Making use of the different organized events in sharing the links and information about the campaign to attract more attention.

- *Risk:* Lack of sustainability of the awareness raising events and activities after the first year.

  Mitigation: Having a preliminary long-term plan for the awareness raising campaign and the frequency of events after the end of the first year is crucial. In addition, the establishment of a consultation department/unit in the responsible entity would

guarantee having a mandated entity that would take on the activities and ensure their sustainability on the long term.

H) MRV

The core team shall establish annual progress monitoring and reporting system to identify the impact achieved by the awareness raising campaign and to ensure its sustainability on the long term (beyond the first year). The team shall have monthly monitoring and evaluation meetings and submit 4 progress reports per year, one for each quarter submitted after the organization of the scheduled awareness raising events.

The impact of this action can be verified through tracking the number of architects, engineers, etc. who attend these events. A survey could be shared after some time from attending the event to check how many of the attendees got engaged in EE projects or related activities. Another means of ensuring the outreach of the campaign through different media, is checking the number of visits to the website and social media channels and the number of queries they receive which indicates people's interaction. In addition, verification of the impacts could be done through tracking the number of projects that start to comply with the code based on the awareness raising multiple measures.

Good practice example

Almost all EU member states have included plans for awareness raising and capacity buildings about the energy efficiency measures within their NEEAPs.

Based on Rivas, et.al. (2016), 100% of member states included information campaigns measures in their NEEAP, while only 42% included training campaigns since the former has a much wider audience with a broader impact.

In the conclusion, the report highlighted some key messages to take from this extensive analysis of EU member states experience about the effectiveness of awareness raising information campaigns:

- Such campaigns need to be built on emotions and rational arguments. Emotions are very important in getting people aware of the problem and connecting to it, while rational arguments will support the actual change in behaviour.
- The positive tone of the message is more impactful than the pessimistic and catastrophic messages.
- Getting people informed about the measures and their potentials is important but still they need to be able to adopt them. Accordingly, the feasibility of the measures is crucial to have increased adoption on ground after raising awareness.

This report is helpful in understanding the wide spectrum of different methods and tools used for raising awareness and training (listed in detail), in addition to identifying what could be learned and implemented in the case of Egypt.

Ref: Rivas, S., Cuniberti, B., & Bertoldi, P. (2016). *Effective information measures to promote energy use reduction in EU Member States. Analysis of information, empowerment and training measures in Member States National Energy Efficiency Action Plans*. https://doi.org/10.2790/360658

One successful example in Egypt of an awareness raising campaign was that held as part of the "The improving the energy efficiency of Lighting and other Building Appliances project (IEELA)" project that was implemented by UNDP and MoERE and funded by GEF. The project and campaign supported the shift towards an increased adoption of the more efficient LED lighting units. One of the most important components of the project was enhancing public awareness and capacity building of professionals. It organized a very creative awareness campaign titled "Watty El Watt" or "Reduce your Watts" that targeted promoting energy efficiency measures and shift the market to become an energy-efficient market through a Facebook page. In parallel, the campaign worked at the community level through social and sporting clubs, shopping malls, supermarkets, and places of worship. The capacity building component was focused on government employees who are dealing with EE auditing or standards and labels.

Ref: UNDP. 2021. *Improving Energy Efficiency of Lighting & Building Appliances | UNDP in Egypt*. [online] Available at: https://www.eg.undp.org/content/egypt/en/home/projects/improving-energy-efficiency-of-lighting---building-appliances.html [Accessed 25 June2021].

Ref: https://www.facebook.com/WattyElWatt/

3.3 Include/Synchronize the updated EEBCs in national climate and energy strategies

A) Short summary

To include updating and simplifying the EEBCs in ongoing national strategies such as NEEAP (National Energy Efficiency Action Plan).

B) Goal(s) of action/recommendation

The main aim of this recommendation is to support the inclusion of the plan and road map of updating and simplifying the current version of the EEBCs for different types of buildings in NEEAP II as one of the key national strategies that support EE transformation in Egypt.
The goals to be achieved out of this recommendation are as follows:

- Investigating the suitability of including the plan of updating and simplifying the code in NEEAP II targets and time frame.
- Pave the way for the inclusion of this plan in the strategy through discussions with the involved governmental entities.
- Ensure the sustainability of the code update implementation as it is going to be an integral part of the National Energy Efficiency Action Plan NEEAP II.

C) Extended description of action/recommendation

The development of the Energy Efficiency code for the residential and commercial buildings was evaluated and reported on in the National Energy Efficiency Action Plan (NEEAP I) of Egypt that extended from 2012 to 2015. Accordingly, the recommended update and simplification of that version of the code has to be supported and embedded in the key targets of NEEAP II (2018-2019 and 2021-2022) as well. This recommendation strongly backs up the current actions included in the first version of NEEAP II document that focuses on enforcing the code and activating its application on a wider scale.

- *Status-Quo Analysis of the Strategy:* Analyse the current NEEAP II targets and aims regarding the component of “Energy Efficiency Procedures in the Buildings Sector”.
- *Document Preparation:* Prepare a brief description of the update and simplification plan of the code that covers some key points (Objective, description, implementing agency, focal point, stakeholders, evaluation and monitoring, calculation of savings, targeted results, etc.).
- *Discussions:* Conduct meetings with the entities responsible for the development of NEEAP II in Egypt to present the plan, brief and discuss its inclusion in NEEAP II targets for EE in the building sector.
- *Implementation:* Reaching agreement with the respective entity on the incorporation of the plan in NEEAP II strategy.
- *Reporting System:* Establish a monitoring, evaluation and reporting plan that facilitates the regular reporting on this action and the achievements in its implementation in NEEAP II document/report.

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

Assuming a core team of **3 members** with an approximate workload of **35 – 50 man-days** over a period of **4 months**, the estimated workload is as follows:

20 – 30 man-days for analysing the current version of NEEAP II document and preparing the draft for the plan of updating and simplifying the code to be included in NEEAP II strategy and final document.

15 – 20 man-days for organizing and attending the meetings and for putting a clear monitoring, evaluation and reporting plan for reporting back to NEEAP II on progress in this action by the responsible entities.

HBRC shall develop the required workload distribution in relation to the needed activities in view of local experiences and needs.

E) Timeline and Milestones

Action Step	Estimated Duration	Workload
• **Task 2.1.**: Analyse the current NEEAP II targets for the building sector	Starts in xxxx 1 month (Week 1 - 4)	**5 – 10** man-days
• **Task 2.2.**: Prepare the update and simplification plan detailed proposal document	2 months (Week 5 - 12)	**15 – 20** man-days
• **Task 2.3.**: Conduct meetings with the responsible entities and individuals for NEEAP II development	2 months (Week 7 - 14)	**5 – 10** man-days
• **Task 2.4.**: Ensure the inclusion of the plan in NEEAP II document	1 month (Week 13 - 16)	**5** man-days
• **Task 2.5.**: Devise a monitoring, evaluation and reporting plan for reporting on the progress of this action in NEEAP II	1 month (Week 9 - 12)	**5** man-days
		Total = 35 – 50 man-days

Task No.	Month 1				Month 2				Month 3				Month 4			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Task 2.1																
Task 2.2																
Task 2.3																
Task 2.4																
Task 2.5																

F) Stakeholders and Roles

Leading Stakeholders:

- The Ministry of Housing, Utilities and Urban Communities (MoH), the Ministry of Electricity and Renewable Energy (MoERE), the Housing and Building National

Research Centre (HBRC)

Supporting Stakeholders:

- Regional Centre for Renewable Energy and Energy Efficiency (RCREEE)

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

- New Urban Communities Authority (NUCA)
- Housing sector

G) Risks

- *Risk:* Facing procedural barriers in the implementation of the update road map due to the inclusion in the strategy.

  Mitigation: Ensuring the full support and buy-in of NEEAP responsible entities for the code update and simplification. Having a key contact person, from the entity, responsible for handling all the communication with the code update team to facilitate the process of synchronization and inclusion within the strategy.

- *Risk:* Prioritizing the activation of the current code before updating it.

  Mitigation: Outlining a reasonable and realistic time plan for the code update and simplification that adds only few months to the code activation plan. Demonstrating the urgent need for the code update during the discussions with the responsible entities by showcasing the results of the conducted analysis and sharing the outcomes of the best practice examples.

H) MRV

The team responsible for this action shall devise a monitoring, evaluation and reporting plan that facilitates the regular reporting on this action and the achievements in its implementation in NEEAP II document/report. They shall submit one progress report towards the mid-period assigned for this action in addition to one final progress report at the end of implementation to be incorporated in NEEAP II final document, in preparation for NEEAP III actions.

Good practice example

One example of including the energy efficiency code review in NEEAP was the Tunisian Case. In recent years, Tunisia has made visible efforts to support the deployment of renewable and energy efficiency projects. Those efforts are aligned with the ambition revealed on the national strategy to get 30% of energy generate by renewable and 30% reduction of the primary energy consumption by 2030 as part of their NEEAP. Another part of Tunisia's 2011 NEEAP was to review their Energy Efficiency Building Codes for Residential Buildings, Office Buildings and Collective Housing with the aim of making some elements of the code mandatory.

Tunisia's 2011 NEEAP also resulted in the production of technical guides for energy efficiency in residential buildings, office buildings, educational buildings, commercial buildings, healthcare facilities and hospitality buildings, as well as a technical guide for heat rationing in new construction.

Ref: Detoc, L. (2016). *Country Profiles. Tunisia*. *November*, 43. https://www.res4med.org/wp-content/uploads/2017/11/Country-Profile-Tunisia-Report_05.12.2016.pdf

Ref: Jensen, E. (2007). Energy Efficiency: Energy Efficiency: *Ashrae Standard*, *1*(December 2012), 1–12.

Ref: Slideshare.net. 2021. *Session 2 Tunisia NEEAP*. [online] Available at: https://www.slideshare.net/rcreee/session-2-tunisia-neeap [Accessed 28 June 2021].

References

CES-MED, C. E. (2016). *Recommended National Sustainable Urban and Energy Savings Actions for Egypt.* Hulla & Co. Human Dynamics KG.

Hanna, D. G. (2011). *EE BUILDING CODE Report Egypt.* Cairo: MED-ENEC “Energy Efficiency in the Construction Sector in the Mediterranean".

Hanna, G. B. (2011). *EE BUILDING CODE Report Egypt .* Cairo: MED-ENEC, Project funded by the European Union.

HBRC, E. H., & The Organization for Energy Planning, PA Consultin. (2006). *Egyptian Energy Efficiency Commercial Building Draft Code (EEECBC).* Cairo.

HBRC, E. H., Planning, T. O., & PA Consulting Group, D. U. (2005). *Egypt Energy Efficiency Residential Building Code EERBC.* Cairo: HBRC EGYPT Housing & Building National Research Centre.

UN-Habitat. (23. May 2019). *UN-Habitat supports Egypt on standards for creating smart cities*. Von UN-Habitat : https://unhabitat.org/un-habitat-supports-egypt-on-standards-for-creating-smart-cities/ abgerufen

Appendix A: Examples of Compliance and Requirements from the EEBCs in Egypt

An example of compliance paths in Egypt EEBCs: HVAC Compliance Paths

Egyptian commercial Energy Code *Chapter 3: Building Envelope*

Table 3.1

Building Envelope Requirments — **Non-conditioned Buildings in Cairo**

CDD 10= 4438 HDD18.5 = 424

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Orientation		Opaque			Fenestration														
		Surface Color	Min. Required R values (m^2°C/W)		WWR %														
					10-<20	20-<30	30-<40	40-<50	>50%	10-<20	20-<30	30-<40	40-<50	>50%	10-<20	20-<30	30-<40	40-<50	>50%
			Mass.	Light	Min. R Value					Max. SHGC*					Min. SGR* (%)				
Roof		Dark	2.2	2.7															
Walls	N	Dark	0.5	1.0	NR	NR	NR	NR	NA	NR	NR	NR	0.7	NA	NR	NR	NR	70%	NA
		Bright	0.4	0.9															
	NE/NW	Dark	0.7	1.0	NR	NR	NR	NA	NA	NR	NR	0.5	NA	NA	NR	NR	70%	NA	NA
		Bright	0.5	0.9															
	E/w	Dark	0.9	2.0	NR	NR	NA	NA	NA	0.5	0.5	NA	NA	NA	70%	70%	NA	NA	NA
		Bright	0.6	1.6															
	SE/SW	Dark	0.8	2.0	NR	NR	NA	NA	NA	0.5	0.5	NA	NA	NA	70%	70%	NA	NA	NA
		Bright	0.6	1.6															
	S	Dark	0.6	1.4	NR	NR	NA	NA	NA	0.7	0.7	NA	NA	NA	60%	60%	NA	NA	NA
		Bright	0.5	1.2															

Wall and Roof Color

Dark Absorbtivity ≥ 0.5

Bright Absorbtivity < 0.5

Wall Assembly Mass

Massive: is 450 kg/m^2 or more

light Less than 450 kg/m^2

If WWR is <10% there is no requirmernt for R,SHGC,SGR

Windows with shutters have no requirment for neither SHGC nor SGR.

For exposed glass windows should meet the min SHGC

*Shaded windows should meet the min SGR in 21 Sept.

If they don't, the glazing shall meet the SHGC requirement.

NA Not allowed

NR Not Required

SHGC Values for some common Glazing types

0.27 = Double glazing Ref.-Tin M

0.75 = Single glazing Clear Glass

R-Values for some typical Roof constructions

0.3 =12 cm Concrete, 6cm of sand, 2 cm of mortar, 2 cm of tiles

0.4 =12 cm Concrete, 8 cm slope concrete, 6cm sand, 2 cm mortar, 2 cm tiles

0.6 =30cm Hollow Blocks,8cm slope conc.,6cm sand,2cm mortar,2cm tiles

R-Values for some typical Wall constructions

0.4 =12 cm clay brick 2cm of Plaster on both sides

0.6 =25 cm clay brick 2cm of Plaster on both sides

0.8 =38 cm clay brick 2cm of Plaster on both sides

R-Value of Common Insulation

R value 0.51 = 2 cm Insulation

R value 1.01 = 3 cm Insulation

R value 01.51 = 6 cm Insulation

if insulation is placed inside the wall the R value is reduced by 30%

R value of non vented Cavities in the wall is considered 0.11

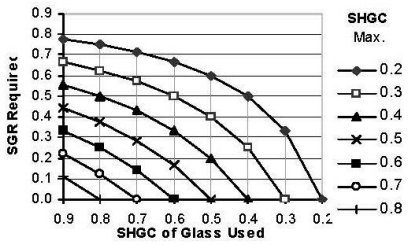
Outdoor surface risistance = 0.055

Indoor surface risistance = 0.123

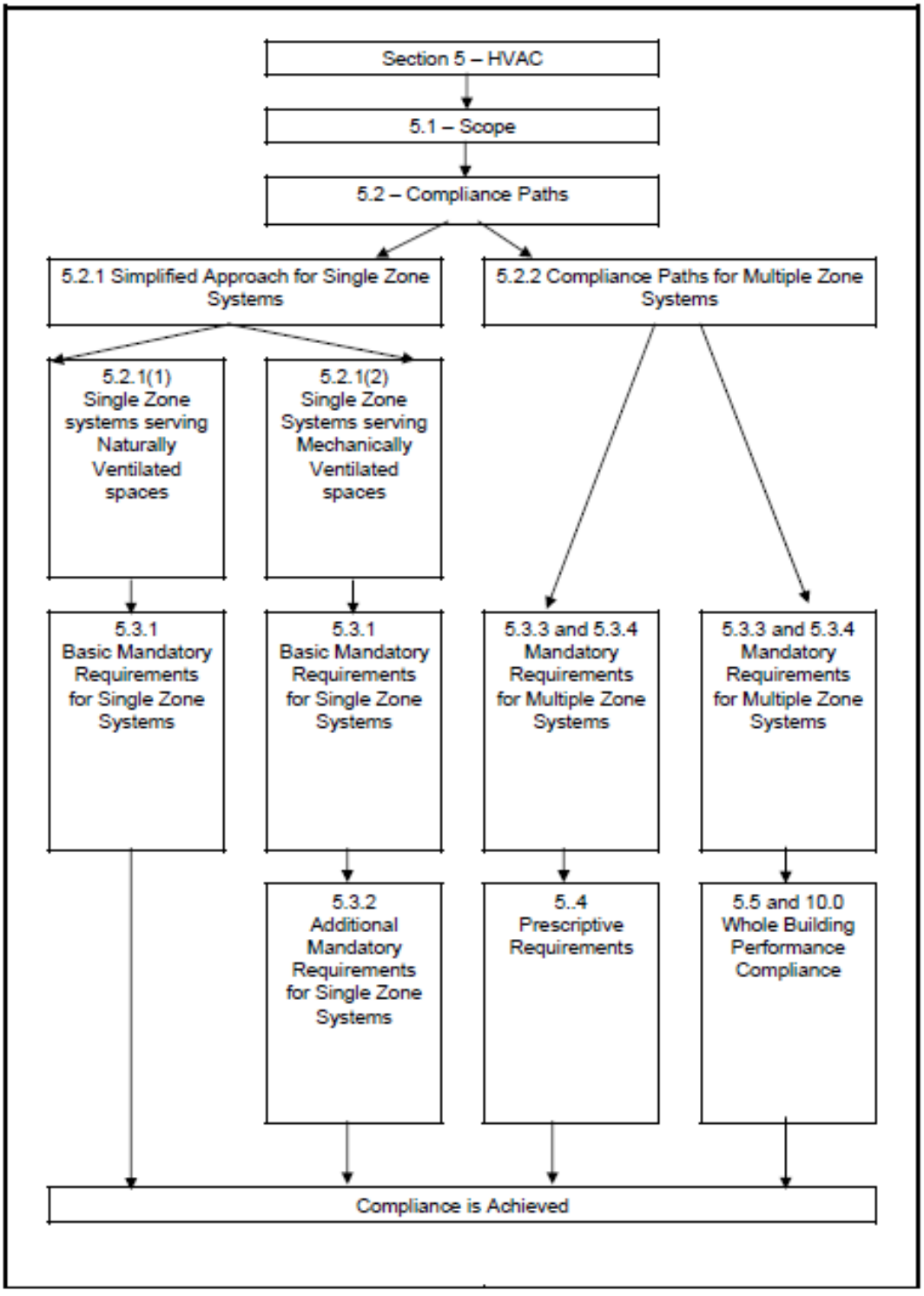
SGR Value and Adjusted SHGC Values

SHGC Max Allowed	SHGC of Glazing Used 0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2
0.2	0.78	0.75	0.71	0.67	0.60	0.50	0.33	0.00
0.3	0.67	0.63	0.57	0.50	0.40	0.25	0.00	
0.4	0.56	0.50	0.43	0.33	0.20	0.00		
0.5	0.44	0.38	0.29	0.17	0.00			
0.6	0.33	0.25	0.14	0.00				
0.7	0.22	0.13	0.00					
0.8	0.11	0.00						

SGR Value for shading device required to reduce SHGC of the Fenestration if Glazing of Higher SHGC value is Used



An example of compliance paths in Egypt EEBCs: HVAC Compliance Paths



Appendix B: Documentation of Expert Interviews and Statements on EEBCs in Egypt

George Bassily (deceased) **HBRC** **Contact Information**	
Country:	Egypt
Interviewee's Name (Respondent):	George Bassily (deceased)
Affiliation:	HBRC
Position:	Emeritus Professor, (Former Professor)
Years of experience:	50+
E-mail:	-
Telephone no.:	-
Date of filling in the questionnaire and/or the interview:	05-07-2020
Short Bio (100 – 150 words):	George Bassili Hanna, Egyptian physicist, educator, is the recipient of Egyptian Encouragement State prize for engineering science, 1992, Pendant of First Class with certified Higher Education, 1995. He is a Member of International Solar Energy Society, American Society Heating, Refrigerating and Air Conditioning, Egyptian Engineering Syndicate - Science Profession. He filled the following positions in HBRC: Assistant researcher - 1966-1971, researcher 1974-1977, assistant professor 1980-1984. Assistant professor Riyadh University, Saudi Arabia, 1977-1980. Professor, head building physics department General Organization for Housing Building and Planning Research, Cairo, since 1984. He is also a Professor at Faculty of Science, physics department Cairo University, since 1984.

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?

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

Code was first issued in English and then the Arabic version was issued for residential and commercial buildings. As it was not published recently, it requires updates.

For this code to be mandated/implemented, concerned parties such as code enforcing agencies and engineers have to understand its essence which is not the case currently.

Many engineers/suppliers tend to be not aware of technical specs of building elements. HBRC have specialized labs that could test building material/component and issue certificates.

Availability of technical compliance manuals and/or procedures

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

No compliance manuals are currently available.

HBRC conducted some capacity building activities such as training sessions/workshops and prepared some printed material explaining how the building performance is changed according to different materials, walls sections, windows and other elements, however this was done before the issuance of the EE codes.

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

During the preparation of the EE codes, experts were divided into several working groups where Dr. George Bassily was responsible for the simulation team. The most crucial element needed was the data of real-life case studies to run simulation which was not highly available. The simulation group worked extensively on many case studies to be able to come up with the values included in the EE codes.

Any implemented energy efficiency measures should also have a clear plan/manual for the operation and maintenance phase to ensure no challenges will appear after implementation such as the case of solar water heaters in some areas in Egypt.

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 idea of having a simple tool to calculate different scenarios for the same building is important however the user of such tool should also be technically equipped

Having a scheme to certify assessors for the EE codes could be done through HBRC to equip a number of professionals with the needed tools and knowledge.

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.

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

Raising awareness and mandating energy efficiency codes should be both done parallelly to ensure uptake of the implementation.

The focus should be shed first on residential buildings.

Given the fact that the EE code requirements are very high, a transitional 5-year adapted step could be first imposed with lower requirements.

Developers might not be willing to implement the code due to the increase in construction cost caused by the upgrading/change of some building elements such as windows, insulation and others.

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?

Coordination

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

The coordination between different entities needs to be stronger to ensure the implementation can be done.

Participation

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

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

The EE codes should be updated according to the current market developments.

Do you think the compliance manuals and guidelines 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?

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

What are the other potential institutional issues and challenges?

The government is already carrying a huge burden due to the subsidies on electricity in terms of covering the actual electricity production cost while most imposed solutions/strategies mainly target solving a current pressing issue rather than achieving long term goals.

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

One of the recent success stories was the uptake of LED lighting in Egypt because of the successful coordination between different sectors (industry, housing etc.)

Australia imposed a law in 2013, that any development plan should be done in compliance with LEED Neighbourhood certification which in return raised the awareness and uptake of sustainable development.

Capacity Building and awareness challenges

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

It's very apparent that there's a lack of general awareness of the importance of energy efficiency. There should be public awareness campaigns by the government targeting the raise of awareness of the importance of resource efficiency including energy and water.

What are the challenges related to the capacity building programs?

Developers should communicate to the end users that any additional cost implicated by the implementation of any energy efficiency measure will have a direct payback in the near future such as decreased electricity bills.

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

Some individual cases might be willing to take some of the EE codes aspects into consideration when introduced to these measures' payback in terms of electricity savings. An example of this might be the interest of some end-users to implement some solutions on roofs that are highly exposed to sunlight and heat. Some of these measures are adding shading elements and PVs given that recently the prices of PVs are slightly lower.

From your perspective, what are the main barriers to the enforcement of the EEBCs?
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)
Such Financial calculation was not conducted at the time of the code development.
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?
How do you asses the availability of funds and financing options available when building comply with the EEBCs?
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.
Mandating/implementation of the code should be supported by illustrating the benefits of implementing energy efficiency such as decreased electricity bills. This could be demonstrated by showcasing the payback of EE on real-life implemented case studies (pilot projects).
Other challenges and barriers
How do you evaluate the availability of EE construction materials in the local market? (please provide examples)
How do you evaluate the availability of the data and info of EE construction materials in the local market?

Other points:
One of the most important measures related to energy efficiency is the u-vales of external walls. Buildings should be designed based on specific u-values that focuses on both the thicknesses of different layers used such as insultation or airgaps and also the type of materials used such as different types of bricks. The u-values of different building elements should be calculated, added in worksheets and approved before construction. Another important aspect to focus on is the ratio of openings and emphasizing the importance of building orientation, bearing in mind that in Egypt, the southwest orientation is the worst in terms of sunlight exposure.

From your perspective, what do you think of the following recommendations? please provide explanation, information, sources, …etc.		
To update the code in coordination with the Relevant Stakeholders	**Strongly recommended**	please provide explanation and recommendations
To include the Minimal Energy Performance Standards MEPS in the code	**Recommended**	please provide explanation and recommendations
To update and/or include the methodology for calculating the energy performance and/or energy demand	**Strongly recommended**	please provide explanation and recommendations
To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	**Recommended**	please provide explanation and recommendations
To include the compliance with EEBCs in the Building Permit Procedure	**Recommended**	please provide explanation and recommendations
To consider the EEBCs in the national strategies e.g. NEEAP, NDC	**Choose an item.**	please provide explanation and recommendations
To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	**Strongly recommended**	please provide explanation and recommendations
To provide training and awareness programs on the EEBCs for the municipalities and/or departments responsible of the issuing of building permits.	**Recommended**	please provide explanation and recommendations
To establish funds and provide incentives for compliance with the EEBCs	**Choose an item.**	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 Importance of showcasing the gains/paybacks of energy efficiency in real-life case studies (pilot projects)
Priority two Raising awareness and mandating energy efficiency codes should be both done parallelly to ensure uptake of the implementation.

Dr. Samir Saad – Dr. Mohamed Ezzat – Dr. Ashraf Kamal HBRC – Electromechanical Department Contact Information	
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Years of experience	-
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Telephone no.:	-
Date of filling in the questionnaire and/or the interview	16-09-2020
Short Bio (100 – 150 words)	

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?

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

The code is complex, and it is not easily understandable for most architects and engineers in the field, as it is not mandated so not applied or practiced. They are more aware of other building codes and firefighting code since they are mandated and enforced.

Availability of technical compliance manuals and/or procedures

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

There are no issued manuals or guidelines.

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

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.

Many of the neighbouring countries (Jordan, Palestine, Syria, etc.) adopts construction practices that could be considered as best practices, where local materials are used (stone, mudbricks, etc.), they apply the cavity wall concepts and adjust minimum ceiling heights for better indoor environment. UAE is more on the high-tech side of the measures and they enforce codes and laws strictly as they are sure it can be afforded by developers, etc.

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.

All codes issued by HBRC are considered as indicative/voluntary codes until the respective Minister issues a decree/decision to mandate it. The EEBC issuance was never followed by this decree to be mandatory or enforced.

For the code to be mandatory, a cost benefit analysis is needed first to showcase the financial benefits of applying the code to convince the decision makers.

Also, following the American model, the code has to be mandatory starting from the date of issuance of this decree to be applied on new buildings constructed afterwards.

We cannot impose penalties for not applying the code at the beginning. It has to be mandated gradually through applying incentives first for 3 to 10 years for example (depending on cost-benefit analysis), afterwards penalties could be applied.

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?

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

HBRC should be responsible for the implementation and enforcement of the code. By law, it is the mandate of the entity that issues the code to ensure its implementation. This is usually done through creating a committee from the entity's experts to evaluate the applying projects. External experts could join the committee upon request. The same applies to the firefighting code, experts from Civil Defence Authority are involved in a committee within HBRC but the final decision cannot be taken by the Civil Defence Authority only. There are usually multiple committees; technical committee, reviewing committee, etc. there is always a multi-layered reviewing and cross-checking to avoid biases.

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 related entities is more on the low side. Coordination is needed between Ministry of Housing, Utilities and Urban Communities, Ministry of Electricity and Renewable Energy and Ministry of Environment for the successful implementation of the code.

Participation

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

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

Do you think the compliance manuals and guidelines 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?

What are the other potential institutional issues and challenges?

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

The vast adoption of LED lights in Egypt can be considered as best practice in this aspect. An incentive was offered (lowering price of LED lamps) and closing the factories that produce conventional ones helped create a successful market for LED lights penetration.

Capacity Building and awareness challenges

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

The level of awareness of the EEBC itself is low among most of the involved stakeholders.

However, awareness of the importance of adopting energy saving methods is there especially among large-scale manufacturers in the industry who search for international codes and manuals to reduce their energy consumption with the help of local engineers. Also, in the commercial sector (malls and large-scale retail buildings), the developers/investors search for energy saving alternatives for their buildings. Another successful example is the petroleum companies' sector. But all this is done on individual basis and not related to the code.

What are the challenges related to the capacity building programs?

There were training programs conducted at the time of EEBCs issuance for interested architects and engineers who want to learn more about the code. However, the problem was that no certification or training programs were carried out for having certifiers/assessors that can assess the code compliance for issuing a certificate.

It is the mandate of HBRC to conduct such capacity building and training programs. In addition, it is HBRC authority to approve the certification after confirmation from the committees created inside the entity (the code permanent committee, or sub committees, etc.). The committee could request involving external experts if needed.

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

LEED certifiers and LEED training programs can be considered as a best practice for having accredited certifiers/assessors in all countries.

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 additional costs were not identified, and they need to be. The additional investment costs of adopting the code are considered high by developers and investors thus there is no willingness for applying it. Unfortunately, so far there are no conducted studies or calculations that counteract these claims.

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?

From your perspective, what are the main barriers to the enforcement of the EEBCs?
No incentives are applied so far. It is important to offer incentives, especially for the residential sector to convince owners/developers for the implementation. The pay back is not sensed by small-scale developers as the savings benefit the owners only, thus an incentive is needed. For large-scale developers, energy savings are more meaningful. For the industrial, commercial, and public building sectors, incentives are not the key but having a clear cost-benefit analysis (pay back calculation) that convinces them of the prospected savings is more important. Their interest in energy saving concepts is further maximized after the subsidy removal plan and the increase in energy prices.
How do you asses the availability of funds and financing options available when building comply with the EEBCs?
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

Other challenges and barriers
How do you evaluate the availability of EE construction materials in the local market? (please provide examples)
It is available in the market but not on a large scale as the demand is still limited and only confined to large-scale entities and projects that can afford the EE equipment (especially for MEP systems). The leading company in this is Schneider Electric which can cover the limited demand in the market. But once the market expands, more companies are expected to be available easily. Military production is now leading in manufacturing LED lights.
How do you evaluate the availability of the data and info of EE construction materials in the local market?

From your perspective, what do you think of the following recommendations? please provide explanation, information, sources, …etc.		
To update the code in coordination with the Relevant Stakeholders	**Recommended**	It is important to include all relevant stakeholders in the process.
To include the Minimal Energy Performance Standards MEPS in the code	**Choose an item.**	please provide explanation and recommendations
To update and/or include the methodology for calculating the energy performance and/or energy demand	**Strongly recommended**	It is important to include a software tool for the energy performance calculations.

From your perspective, what do you think of the following recommendations? please provide explanation, information, sources, …etc.		
To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	**Recommended**	please provide explanation and recommendations
To include the compliance with EEBCs in the Building Permit Procedure	**Strongly recommended**	please provide explanation and recommendations
To consider the EEBCs in the national strategies e.g. NEEAP, NDC	**Not relevant**	The more important is developing action plans and road maps for on-ground implementation rather than having EEBCs included in national strategies that fall short on implementation.
To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	**Recommended**	please provide explanation and recommendations
To provide training and awareness programs on the EEBCs for the municipalities and/or departments responsible of the issuing of building permits.	**Recommended**	please provide explanation and recommendations
To establish funds and provide incentives for compliance with the EEBCs	**Recommended**	Recommended but depending on the sector. Incentives are needed more for the residential sector. Other sectors need cost-benefit analysis.

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 Creating accurate models for the cost-benefit analysis to identify the energy saving potential for the local (owners, etc.) and national levels (for the whole country). Conduct the analysis on existing case studies.
Priority two Support the implementation of showcase projects especially in the industrial and commercial sectors. Can organize workshops and meetings with these stakeholders to inform them of the cost-benefit results. The involvement of the industrial sector is crucial to offer products that fulfil the code in the market.
Priority three Having the code as mandatory and linked to the Building permits procedure.

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.

Other Points from the Discussion:

- The key for residential buildings is having the code as mandatory and to offer incentives for the owners and developers.
- For the industrial, commercial, public buildings sectors, incentives are not needed. The key is having a clear cost-benefit analysis that identify the payback period of the EE systems plus having the code mandatory as well.
- Simple measures could have huge impact on savings such as motion sensors that are not expensive and can be used in different spaces to reduce the consumption patterns.

Moemen Afify **Cairo University - MA Consultants** **Contact Information**	
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Short Bio (100 – 150 words)	Prof. Dr. Mohamed Moemen Afify is a Full-time Professor at the Department of Architecture, Faculty of Engineering, Cairo University. He taught several courses in both undergraduate and post-graduate studies in several other universities as well, such as architectural design, environmental design and control systems, renewable energy sources, shade and shadow., Dr. Afify is specialized in environmental design and planning as well as energy conservation in buildings. He worked as the Environmental Optimization Coordinator for the new American University in Cairo Project through Sasaki/CDC. Dr. Afify worked in several projects related to environmental studies such as in the cities of Cairo, Aswan and other similar projects. He also developed the environmental strategies for several projects in Egypt and Saudi Arabia. Being an architect, Dr. Afify designed several projects taking into account environmental optimization processes. He was also the member of the committee for the Egyptian Code for Energy Conservation.

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 complex, and its schedules are not easily understandable especially for unspecialized architects or engineers who are not involved in environmental design. The code needs simplification following ideas like the “take-off” in the U.S. which is a simple 2-pager checklist of the minimum requirements to be achieved in the building. Such simplicity allows any architect or engineer to easily check the compliance of the building at least with the minimum standards then they can take it from there and improve.
Availability of technical compliance manuals and/or procedures If such manuals or guidelines are available, how implementable are they? Does the code(s) provide clear steps and procedures for designers, engineers and for the local authority responsible for issuing the building permits and/or occupancy permits.
From your perspective, what are the other technical challenges? Please elaborate here.
The code does not cover all regions, mainly Cairo and Alexandria.
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 sure about the status in the MENA region countries when it comes to the codes. But Egypt has special dynamics since there is a large percent of informal areas and so the target group of the code compliance has to be clearly identified (does it include the informal buildings or not).
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.
All issued codes are mandatory, however; the problem is there is no entity to enforce it. There are only 2 codes that are being enforced in Egypt, the Egyptian firefighting code (enforced by the Civil Defence Authority) and the structural code (enforced by insurance collaborative). These 2 compliance certificates are obligatory to receive the building permit. Therefore, they are followed and implemented.

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

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?

Yes. There should be a separate stand-alone entity responsible for the code enforcement and not HBRC or permits entities. This entity should be responsible for the inspection of the code compliance as well. The issued code compliance certificate can then be used for obtaining permits and be linked to this process.

Coordination

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

A separate entity needs to be established for enforcing the code and for the inspection. It could be affiliated to the Ministry of Electricity and Renewable Energy. It should not be related to the permit's authorities or HBRC. Having a separate entity would ensure a clear mandate and having the specialized assessors for this purpose.

Participation

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

The most relevant stakeholder that should be involved in the process of development and update is the project developers since they are responsible for the decision of implementation of EE in their constructed buildings (mainly in building design and envelope). The code development should not only be based on points of view of academics and researchers.

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

Do you think the compliance manuals and guidelines 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?

What are the other potential institutional issues and challenges?

From your perspective, what are the main barriers to the enforcement of the EEBCs?
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
A similar process to what is proposed is “Title 24 Compliance” in the U.S. that is a sort of an EE certificate for the building to be used as part of permits documents. Inspection is then conducted to ensure compliance with the code for both the building envelope and systems (HVAC, Lighting, etc.)
Capacity Building and awareness challenges
What is the level of awareness/interest among the relevant/involved stakeholders about the EEBCs?
Awareness of the code among specialized architects and engineers exist. But it should actually start from the undergraduate level in education to ensure having a generation of architects and engineers who might implement the code even if it is not obligatory.
What are the challenges related to the capacity building programs?
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.
Awareness and knowledge gain can be through practical experience. This experience needs to be fostered not only by awareness of codes but also by practice, and so it is important to include this in education curricula.
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)
Usually, it is not less than 10%. It could reach 5% if only simple measures were implemented such as double wall with cavity and not insulation. The key issue in Egypt is that most buildings are constructed by developers. Usually the developer will not care about improving building efficiency as the reduction in consumption costs do not benefit him but benefit the owner. Owners who build for themselves (residential units) are those who have a high level of awareness of the importance of applying EEBC in their buildings and so are willing to pay the extra investment costs. That is why having a mandatory code is needed to ensure implementation by developers.
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?

From your perspective, what are the main barriers to the enforcement of the EEBCs?
Incentives are not needed and will not be successful. The code (considered as the baseline and minimum requirement) should be mandatory with a fine in case of no compliance. Funding construction would be more useful than incentives especially for developers. Incentives can be useful for the owners who build their own units and go beyond the code.
How do you asses the availability of funds and financing options available when building comply with the EEBCs?
Currently there are no available funds. Funding construction would be more useful than incentives especially for developers.
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.
Other challenges and barriers
How do you evaluate the availability of EE construction materials in the local market? (please provide examples)
Most of EE materials and systems are available in the Egyptian market. But still some specific systems and materials are not available yet in Egypt or slowly appearing. Thermal break windows for example are not available except by one supplier only. Insulation is available in the market.
How do you evaluate the availability of the data and info of EE construction materials 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**	The most relevant stakeholder is the developers since they are the on-ground implementers of the code requirements. Academics and researchers are not the most relevant.
2. To include the Minimal Energy Performance Standards MEPS in the code	**Strongly recommended**	Can include “take-off” checklist to represent the minimum requirements and then any additions could be done.
3. To update and/or include the methodology for calculating the energy performance and/or energy demand	**Not relevant**	There should be certified bodies or individuals who are responsible for calculating the energy performance. It is complex to be left for any architect or engineer to conduct as per the code. Such experts are available in the market (for LEED)
4. To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	**Recommended**	please provide explanation and recommendations

From your perspective, what do you think of the following recommendations? please provide explanation, information, sources, …etc.		
5. To include the compliance with EEBCs in the Building Permit Procedure	**Strongly recommended**	We should not mandate the permits responsible authorities to issue the code compliance certificates. But we need to establish a separate entity to be responsible for enforcing the code compliance and to issue the certificate. It should also be responsible for the inspection of the building after construction (3 visits or write a report like what happens with the 2 enforced codes). This certificate should be obligatory for obtaining the permits.
6. To consider the EEBCs in the national strategies e.g. NEEAP, NDC	**Recommended**	It must be included in these strategies; buildings should be taken into consideration since they represent 45% of consumed energy in Egypt.
7. To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	**Recommended**	But this awareness raising should start earlier on from the undergraduate studies of architects and engineers.
8. To provide training and awareness programs on the EEBCs for the municipalities and/or departments responsible of the issuing of building permits.	**Not relevant**	Municipalities and permits departments should not be involved in this process at all. It should be the newly established entity's responsibility.
9. To establish funds and provide incentives for compliance with the EEBCs	**Not relevant**	Having it as a mandatory code is more important than the incentives and 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

Establishing a body/entity to issue the code compliance certificate for buildings. Same body should be responsible for the inspection after construction. It should run as a stand-alone entity and could be affiliated to the Ministry of Electricity and Renewable Energy.

Priority two

Code simplification is crucial to be easily understood by any architect or engineer and they do not have to specialized in the field. Also think of the option of having a simplified 2 pager checklist of the minimum requirements as a start of compliance with the code.

Other Points from the Discussion:

The energy code is focused on energy conservation. It should be concerned with the implementation of the minimum standards (base case) suitable for the local context. Rating systems as GPRS, TARSHEED, LEED, etc. usually target higher standards compared to codes such.

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 four

Ahmed Abdin Cairo University Contact Information	
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Short Bio (100 – 150 words)	Prof. Dr. Ahmed Abdin is a Full-time Professor of Architectural Design and Environmental Control at the Department of Architecture, Faculty of Engineering, Cairo University. He is an Egyptian Architect who devoted himself to Environmental Architecture. due to his unbelievable enthusiasm and hardworking, he succeeded to challenge all the barriers facing Environmental Design in Egypt, and to cross them. His buildings have a great climatic design based on deep scientific understanding of thermal behaviour of buildings, achieving air movement with wind catches and suction chimneys, without even using a fan, let alone an air conditioner. Building form is directly driven from the building envelope's function as a regulator and controller of heat and light, giving it a unique form and style. He was also the member of the Energy Efficiency code 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?

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

There is some complexity in energy calculation. However, for the rest of the calculations, it is flexible enough for architects as they only identify values from given data tables. It is easy to identify the effectiveness of shading devices, the suitable window openings and the type of glazing using tables provided by the code. The code requirements are easy to fulfil, and not highly demanding, it just needs more publicity and more enforcement.

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 guidebook was being developed for the code by HBRC, but it was not published. It guides the code compliance and check methods. The code provides clear steps but only for new buildings, another version needs to be developed for retrofitting of buildings.

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

The technical knowledge of different EE measures among architects and engineers exists. However, their recommendations and what they learn at school is not implemented on ground as the construction decision in many cases is controlled by contractors who only focus on cost not taking many technical considerations and environmental aspects into account.

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.

Tunisia and Lebanon have good experience regarding similar codes. In addition to the nZEBs action plan applied in all European countries.

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.

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

The code must be mandatory. If this code is mandated and EE measures and concepts were applied to the building envelope only, energy consumption will be reduced by 8-10% on the national level and by 30-40% in the building sector (according to studies conducted in Cairo University).

The key barrier to being mandatory is the lack of awareness of the benefits of EE measures among architects, owners, manufacturer, legislator etc. In addition, there has to be full integration of industry to ensure the availability of the needed materials and systems in the market with specifications that fulfil the code requirements. Also, incentives should be employed to encourage code compliance as it is going to be mandatory.

According to law 119, all issued codes are mandatory. This is only applied for safety codes, such as the Egyptian firefighting code (enforced by the Civil Defence Authority) and the structural safety code (enforced by insurance collaborative). However, this is not applied for the EE code as there is no neutral entity responsible for the enforcement.

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?

There is need for a neutral entity to be responsible for the enforcement of EEBC like the Civil Defence Authority and Insurance collaborative that ensure the compliance with the firefighting and structural safety codes respectively.

Coordination

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

Participation

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

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

From your perspective, what are the main barriers to the enforcement of the EEBCs?
Yes, the code needs to be updated regularly (every 5 years) as there are multiple changes happening like the energy subsidy removal for example, which was one of the recommendations of the EE code committee.
Do you think the compliance manuals and guidelines should be updated?
Yes definitely.
In case of the lack of compliance manuals and guidelines, how could they be developed? What are the entities and stakeholders to be involved?
What are the other potential institutional issues and challenges?
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
Capacity Building and awareness challenges
What is the level of awareness/interest among the relevant/involved stakeholders about the EEBCs?
The technical know-how of architects and engineers exists. In fact, EE code requirements are being taught in the Departments of Architecture in the different Egyptian Universities. Raising awareness for the developers is needed to understand the benefits of applying EE measures not only in the commercial buildings but also in the residential buildings. Many large-scale developers (10-15% of the market) have this kind of awareness (backed up by awareness of their high-end clients) but the rest needs more awareness raising and capacity building on the multitude of benefits.
What are the challenges related to the capacity building programs?
Aspects related to thermal conductivity and the knowledge of R-value and U-value of different materials needs to be highlighted more in the curricula of higher education. This know-how is still missing in the current programs. In addition, the architectural design course needs to focus more on building technology aspects (combine design, working drawings and environmental control in the offered studios).
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

From your perspective, what are the main barriers to the enforcement of the EEBCs?
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 additional costs are not much, the key is in the passive design and ensuring the best design of the building envelope that achieves minimal lighting, heating and cooling loads. The main aspects to be considered are the wall insulation, window to wall ratio, window openings area and orientation and type of glazing. These measures do not add much to the initial cost and ensure a fast payback period as a result of energy consumption reduction.
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?
Banks need to facilitate funding and financing the implementation of different measures. The rebate system and the replacement of old lighting units or other systems could be a good option as an incentive (applied before for the promotion of LED lights). Other facilitation is needed for the developers as well.
How do you asses the availability of funds and financing options available when building comply with the EEBCs?
There are multiple issues in the current funds given for EE and RE measure. For example, the FIT applied by the Ministry of Electricity and Energy for PV panels has a very long payback period (over 10-12 years) and so its return is much lower than the interest rate of the bank which is not promoting energy generation compared to depositing money in the bank. Such percentages need to be defined after deep analysis of the market to be feasible.
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.
Other challenges and barriers
How do you evaluate the availability of EE construction materials in the local market? (please provide examples)
Most of the measures and materials are not available in the market. Because most manufacturers do not offer the option of testing the energy efficiency of the systems. Laboratories (public or in universities) are needed for testing the products and for labelling them.
How do you evaluate the availability of the data and info of EE construction materials in the local market?

From your perspective, what are the main barriers to the enforcement of the EEBCs?
The code requires certain labels on the used materials and measures that specify key specifications. Such labels are not always available on products sold in the local market. Therefore, integration of industry and raising awareness on these needs is crucial.

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**	It is a must and it is the responsibility of the permanent committee for EE code. It should be updated every 5 years.
2. To include the Minimal Energy Performance Standards MEPS in the code	**Strongly recommended**	It is already included. It is defined as the energy consumed by each square meter of the building. Assigning labels for the building could be done through GPRS.
3. To update and/or include the methodology for calculating the energy performance and/or energy demand	**Recommended**	It is imbedded in the basic requirement of the code. The calculation of energy performance is included in chapter 10 of the code. It was recommended to add a calculation method (software tool) for the complex building forms to compare the energy consumption of similar buildings to it.
4. To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	**Recommended**	Developed but not published yet. The governmental buildings will be included in the 3rd issue of the code to act as showcases of the implementation of such measures.
5. To include the compliance with EEBCs in the Building Permit Procedure	**Recommended**	There must be a neutral entity (consultants and experts) who act as a referee and review the compliance with the EE code likewise the firefighting code and structural safety codes. It then should be included in the permits procedures but decided upon by the certification bodies.
6. To consider the EEBCs in the national strategies e.g. NEEAP, NDC	**Recommended**	The EEBC should be included in all national strategies even the development of curricula in higher education.
7. To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	**Recommended**	Awareness is highly needed. Training is also needed for each sector (design, execution, certification, etc.).

From your perspective, what do you think of the following recommendations? please provide explanation, information, sources, …etc.		
8. To provide training and awareness programs on the EEBCs for the municipalities and/or departments responsible of the issuing of building permits.	**Recommended**	Awareness is highly needed. Training is also needed either for the engineers who issue the permits or the experts in the certification bodies.
9. To establish funds and provide incentives for compliance with the EEBCs	**Strongly recommended**	Explained earlier

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

Awareness raising for the architects, engineers, owners, developers, manufacturers, and legislators is needed. More publicity on the code is needed.

Priority two

Devising an enforcement plan for the code is extremely crucial.

Priority three

Integrating industry and manufacturers in the process and developing the testing laboratories to fulfil the codes requirements in different materials and systems.

Priority four

Providing incentives for those who comply with the code.

Other Points from the Discussion:

- The EE code is taken as the basis for GPRS Energy Efficiency Category (which makes up 32% of the GPRS points). The code is the minimum requirement for the Egyptian rating system. The more efficient the building, the more points it gets.
- Building walls of 12 cm thickness instead of 25 cm thickness does not have significant impact on construction costs. It only reduces around 30% of the wall cost which is minimal compared to the whole building costs but has a huge impact on energy efficiency.
- Adding an insulation layer to the wall can secure a payback of the insulation layer costs from the energy consumption reduction within only 2 years.
- According to conducted studies, 70% of the energy consumed by office buildings can be satisfied by PVs energy generation.

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Short Bio (100 – 150 words):	▪ Engineering Consultant, Egyptian Syndicate of Engineers, since 1994. ▪ LEED AP, US Green Building Council, since 2007 (First LEED AP in Egypt) ▪ LEED® Faculty™, US Green Building Council, since 2009 ▪ LEED AP BD+C, GBCI, since 2012 ▪ LEED AP O+M, GBCI, since 2014. ▪ Estidama Pearl Qualified Professional (PQP) for Building and Community, since 2011. ▪ GSAS-Certified Green Professional, (GORD), since 2011. Senior Architect/Project Manager/Sustainability Consultant/LEED Specialist with an overall experience of 25 years in the design and execution of various types of Building projects. Vice President of Egypt Green Building Council, prospective member of the World GBC, a non-profit NGO with the objective of promoting Green Building in Egypt. Head of the technical Committee responsible for the development of TARSHEED Residential, Commercial and Community, the Green Building Rating System developed specially for Egypt and developing countries

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?

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

Availability of technical compliance manuals and/or procedures

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

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

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.

Green building rating systems – plausible certification systems – also used for marketing

financial incentives by the gov, such as renewable energy subsidies

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 government can’t take huge steps regarding mandating such codes due to the low market readiness. If such codes were mandated without preparing the market will lead to sudden price increases.

The balance should be always maintained between market readiness and introduction of new codes or requirements.

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 codes tend to be more theoretical and generally fall short regarding practicality or ability of implementation.

Coordination

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

From your perspective, what are the main barriers to the enforcement of the EEBCs?
Participation How do you assess the effectiveness and involvement of relevant stakeholders in the development and implementation of the code?
Do you think the code should be updated? If yes, what are the entities that should be involved in the updating processes?
Do you think the compliance manuals and guidelines 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?
What are the other potential institutional issues and challenges?
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
International certifications tend to be more successful in Egypt more than locally developed ones. (LEED is the most successful and Edge is becoming more ready for implementation. Edge certification conducted some studies on baseline case in Egypt.
Capacity Building and awareness challenges
What is the level of awareness/interest among the relevant/involved stakeholders about the EEBCs?
What are the challenges related to the capacity building programs?

From your perspective, what are the main barriers to the enforcement of the EEBCs?
Removing electricity subsidies was the most important step to encourage energy saving in buildings. Covid-19 might have a positive impact on the green building trends (relating to increased interest in addressing the health and environmental issues) Most important step is for the government to offer incentives; it seems there might be upcoming projects/initiatives by the government such as “Get ready for the Green” initiative. Marketing tend to be misleading using terms such as green. Awareness of end user is also an issue, as green buildings is not highly valued. Mainstreaming some energy efficiency minimum requirements for privately owned compounds could be a starting step. Buildings in private compounds are being built better than baseline buildings.
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.
The mandating of green buildings certification in Dubai since 2007 had a major effect on the green building sector in Dubai and the domino effect of this was witnessed in other Gulf countries as well.
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)
Baseline differs according to developer, area, type of building. Additional cost also depends heavily on the experience of green building consultant. In a case of an advanced baseline office building in a New city in Egypt, the additional cost could be around 5% if the green consultant is experienced.
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 aren’t any incentives for EE buildings currently in place.
How do you asses the availability of funds and financing options available when building comply with the EEBCs?
International funds seem to be selective and offering fund for a small no. of projects, however the financing schemes/funding should be accessible and available for all projects on a national level.
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.

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

Other challenges and barriers
How do you evaluate the availability of EE construction materials in the local market? (please provide examples)
An increased number of suppliers/manufacturers are working towards getting their materials/buildings elements certified to be compatible for LEED certified buildings. This is mainly due to the slight increase in LEED certified buildings in Egypt.
How do you evaluate the availability of the data and info of EE construction materials in the local market?
Materials that are accepted for LEED certified buildings are generally available in Egypt but not in abundance and their prices tend to be relatively high due to their exclusivity to certain suppliers.

From your perspective, what do you think of the following recommendations? please provide explanation, information, sources, …etc.		
To update the code in coordination with the Relevant Stakeholders	**Choose an item.**	please provide explanation and recommendations
To include the Minimal Energy Performance Standards MEPS in the code	**Choose an item.**	please provide explanation and recommendations
To update and/or include the methodology for calculating the energy performance and/or energy demand	**Choose an item.**	please provide explanation and recommendations
To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	**Choose an item.**	please provide explanation and recommendations
To include the compliance with EEBCs in the Building Permit Procedure	**Choose an item.**	please provide explanation and recommendations
To consider the EEBCs in the national strategies e.g. NEEAP, NDC	**Recommended**	please provide explanation and recommendations
To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	**Recommended**	please provide explanation and recommendations
To provide training and awareness programs on the EEBCs for the municipalities and/or departments responsible of the issuing of building permits.	**Choose an item.**	please provide explanation and recommendations

From your perspective, what do you think of the following recommendations? please provide explanation, information, sources, …etc.		
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: Incentives should be provided by the government to speed the uptake of EE measures
Priority two: Maintaining the balance between market readiness and newly introduced codes/requirements
Priority three: Mainstreaming some energy efficiency minimum requirements for privately owned compounds could be a starting step.

Omar El-Rawy **Green Building Consultant and Researcher** **Contact Information**	
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Short Bio (100 – 150 words):	

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.**

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

1. Lack of incentive
2. Project teams not willing to invest in EE studies, compliance, and simulation.

I don't believe there are much technical barriers in EEBCs related to design phase, rather, most are managerial and process barriers. If we split EEBCs requirements into prescriptive and/or simulation requirements, we can admit that both are attainable by wide range of AEC professionals and consulting firms, so no technical barriers to comply with EEBC in terms of building design.

The technical barrier actually comes whenever the EEBC requires Measurement and Verification (M&V) during building operation, in such case we can admit that we might face some technical barriers, for example, in setting a correct M&V plan, defining Measurement points, intervals, devices, as well as roles and responsibilities.

Code complexity

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

Well, comparing to other building engineering codes (for ventilation, lighting, thermal comfort, Fire Fighting, etc.), I consider that EEBC is the most complex. The fact that EEBC addresses all building disciplines, and address so much dependant and independent variables, in addition to involving BAS, makes it very complex indeed.

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.

I don't think so, codes already involve the needed manuals, additionally, renowned codes are already integrating within BESTs (Building Energy Simulation Tools).

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

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.

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

I see the best practice is always in digitization. It's a successful practice already which is being followed by the simplest to the most complex certification systems. Simple codes like IFC EDGE for example is a 100% digital EEBC. Also, for Detailed simulations, codes like ASHRAE 90.1 and NECB are also integrated in BESTs like IESVE.

This practice of digitization facilitates codes release, understanding, implementation, as well as codes versions' development.

In general, I see the concept of EDGE online code and certification system is the best tailored for developing countries. The main reason is that: The market capacity doesn't afford detailed code compliance and energy simulation incorporation into new buildings

Online tools also have a relatively high error, for Edge it's around 12% error factor. However, if online tools would accelerate the uptake of energy efficiency regardless the accuracy of calculations this would have a better impact than having very few EE buildings having to go through complicated procedures to ensure accuracy of calculations.

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 main barrier is to verify that a certain project did well implement the code requirements during design and construction of the project.

TO make it mandatory there must be audit sessions between the authorities and project teams. This is already the case in many countries to successfully achieve the aim behind the mandatory code.

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?

Yes, authorities' structure is already bureaucratic, which doesn't cope with the fast pace of the design and construction timelines.

Coordination

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

Participation

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

It's very essential to involve all related stakeholders.

From your perspective, what are the main barriers to the enforcement of the EEBCs?
Do you think the code should be updated? If yes, what are the entities that should be involved in the updating processes?
Yes, Codes development / updating should involve these main entities: Authorities Researchers Practitioners Manufacturers
Do you think the compliance manuals and guidelines 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?
What are the other potential institutional issues and challenges?
Bureaucracy.
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
Code can be mandatory only for large scale projects (determined by projects GFA / expected energy use), to facilitate and streamline being really mandatory. For such projects it will be feasible to monitor and ensure that codes are being followed.
Capacity Building and awareness challenges
What is the level of awareness/interest among the relevant/involved stakeholders about the EEBCs?
Among building design teams I've noticed relatively high awareness and low interest actually. While building operators and facility managers showed lower awareness but higher interest in implementing EEBCs in their buildings when understanding the coupled paybacks.
What are the challenges related to the capacity building programs?

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

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)
Additional cost is mostly the cost for the energy analysis / simulation team.
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 incentive is mostly to achieve a green building certification, locally, there seems not to be any additional incentives.
How do you asses the availability of funds and financing options available when building comply with the EEBCs?
Almost no fund.
What are the best practices to cope with the challenges/barriers discussed above? Preferably referring to local practices, MENA and/or developing countries.
Referring to MENA and developing countries, I think that utilizing a digital approach, instead of writing book codes would be the best practice to promote energy efficiency in the building sector, such digital codes can also close the gap between design assumptions and actual building operation by having M&V requirements being embedded. Such framework will also allow having a governmental funding body which can fund EE technologies being implemented in high performance buildings and can also provide direct incentives based on the building's online monitored performance. Several successful international governmental case studies can be followed to successfully implement such framework.

Other challenges and barriers
How do you evaluate the availability of EE construction materials in the local market? (please provide examples)
Materials, Equipment, and Technologies are available, the challenge is mainly with the process. Project teams' culture doesn't support holding technical meetings / workshops to best utilize such materials and equipment towards EE.

From your perspective, what are the main barriers to the enforcement of the EEBCs?
How do you evaluate the availability of the data and info of EE construction materials in the local market?

From your perspective, what do you think of the following recommendations? please provide explanation, information, sources, …etc.		
To update the code in coordination with the Relevant Stakeholders	**Strongly recommended**	Stakeholders must involve (Building Authorities, Practitioners, Researchers, and Manufacturers)
To include the Minimal Energy Performance Standards MEPS in the code	**Recommended**	This is essential to have incentives to go for higher savings.
To update and/or include the methodology for calculating the energy performance and/or energy demand	**Strongly recommended**	It's sufficient to regulate demand and EUI only.
To develop an EEBC compliance manual with clear technical requirements, procedures and assigned responsibilities	**Not important**	
To include the compliance with EEBCs in the Building Permit Procedure	**Not important**	Not all investors will afford compliance.
To consider the EEBCs in the national strategies e.g. NEEAP, NDC	**Not important**	
To provide training and awareness programs on the EEBCs for architects, engineers and construction professionals	**Strongly recommended**	
To provide training and awareness programs on the EEBCs for the municipalities and/or departments responsible of the issuing of building permits.	**Recommended**	
To establish funds and provide incentives for compliance with the EEBCs	**Strongly recommended**	This is the most significant incentive.

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: Launch an online free digital code with an imbedded free tool.
Priority two: Have M&V requirements enforced as much as design requirements.

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 three: Provide two-fold incentive (1. for code compliance, 2. For adopting new EE technologies)
Priority four: have minimum prerequisite EE target for building permit.

Appendix C: Evaluation of the General Recommendations

Aspects	Recommendations	Evaluation criteria			
		Highest potential to achieve BUILD_ME objectives	Governmental and political support to the recommendations	Relevant stakeholders' interest and support	Timeframe of implementing the recommendations
Technical	Simplifying the EEBCs. Considering having a simplified 2-pager checklist of the minimum requirements to kick-start compliance with the codes.				
	Integrating industry and manufacturers in the process and developing testing laboratories to fulfil the codes requirements regarding different materials and systems.				
	Maintaining the balance between market readiness and newly introduced codes/requirements.				
	Launching an online free digital code with an imbedded free tool.				
	Having M&V requirements enforced as much as design requirements.				
Institutional and regulatory	Mandating the code and enforcing its implementation by including it as a prerequisite of the Building permits procedure.				
	Establishing a stand-alone body/entity to issue the code compliance certificate for buildings and be responsible for the inspection after construction.				
Capacity Building and awareness	Awareness raising for the architects, engineers, owners, developers, manufacturers, and legislators is needed. More publicity on the code is needed.				
	Showcasing the gains/paybacks of energy efficiency in real-life case studies (pilot projects) with accurate models and calculations.				
	Support the implementation of showcase projects especially in the industrial and commercial sectors.				
Financial	Providing financial incentives for those who comply with the EEBCs to speed the uptake of EE measures. Incentives should be two-fold (1. for code compliance, 2. For adopting new EE technologies).				

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