

Greening Building Codes in Egypt

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ABSTRACT: National sustainable development strategies are the normal mechanism for setting clear and verifiable goals at the national policy level. These goals may comprise broad qualitative objectives, quantifiable targets and include measurable indicators with which to judge performance (Sheate et al., 2001). These strategies are often reflected in building codes and legislations controlling the construction markets, and hence have a direct effect on decision making.

The aim of this work is to assess the main building code in Egypt -the Unified Building Law No.119/2008 with its executive appendix- from the green point of view, and to review the main concepts of the public review version of the Green Pyramid Rating System and the opportunities of enforcing it, as an approach for greening building codes in Egypt. The method for achieving this aim will be comparative analysis of the two codes, with more emphasis on the Unified Building Law since it is the one in effect. The study also analyses selected regulations from the International Green Construction Code (IGCC), the first international model code that includes sustainability measures for the entire construction project and its site from design through construction, certificate of occupancy and beyond, and the ASHRAE Standard for the Design of High-performance Green buildings - which is a compliance option of the IGCC- for adoption in the new building code of Egypt. Hence, the study leads to a better understanding of the possibility of greening building codes in Egypt and a good view of its penetration into the decision-making process.

Conference Theme: Sustainability and Urbanism

Keywords: building codes, green pyramid rating system, greening government, sustainable development.

INTRODUCTION

Spreading green architecture in Egypt requires reshaping the current legislations and codes. This starts by revising the existing local building laws and regulations. Numerous parts of the Unified Building Law no.119 released in 2008, and its executive appendix released by the Ministerial decree no. 144 in 2009, show negligence of important green concepts. However, many of these concepts were considered in the Green Pyramid Rating System (GPRS) public review edition released by the Egyptian Green Building Council (EGBC) –which was established the same year the Unified Building Law was released- and the Housing and Building Research Centre (HBRC) in April 2011, but with no specific schedule for releasing the final rating system or a timeline for enforcing it. This schism in building legislation policies makes it difficult to determine the right strategy for spreading green architecture in Egypt. By means of criticism of selected articles from the Unified Building Law and review of the GPRS and opportunities of enforcing it, together with analyses of selected portions of the IGCC and the ASHRAE Standard for the Design of High-performance Green buildings, a comprehensive approach for greening building codes in Egypt is presented.

1. THE UNIFIED BUILDING LAW NO. 119/2008 AND ITS EXECUTIVE APPENDIX MINISTERIAL DECREE NO.144/2009

1.1. Overview

The law no.119 for the year 2008, also known as the “*Unified Building Law*” was released by a presidential decree and ratified by the house of parliament on the 11th of May, 2008 in order to systemize and regulate the process of building in the whole republic. It was decreed in amendment and in integration with previous laws like the law no.10 for the year 1990, while it eliminates some other laws like the law no.106 for the year 1976 concerning construction works, except for article no.13-second version, the law no.78 for the year 1974 concerning elevators, the law no.3 for the year 1982 known as the Law of Urban Planning, part II of chapter II and part II of chapter IV of the law no. 49 for the year 1977 concerning selling real estate and the relationship between landlords and renters, article 9 of the law no.136 for the year 1981 concerning selling real estate and the relationship between landlords and renters, and any judgment concerning any previous laws that contradict with the current one.

It tackles a wide number of issues which includes regulations about national planning, regional planning, city planning, land divisions, unplanned zones, and special zones. They can be classified as the following;

- Civic development, which includes regulations about the coordination for civic development, zones with high value, and public advertising.
- Construction works, which include regulations about documentation, licensing, construction steps, responsibilities of the role-players, building readiness for use, and elevators.
- Keeping the built capital, which include regulations about apartment buildings benefactors unions, the maintenance of condominiums, and demolition of buildings.
- Punishments, which include fines and jailing for those who violate the regulations expressed in this law.
- General regulations which include the juridical frame and the implementation of this law with respect to previous laws.

The terms of the law are homogenous and cover a wide number of issues, though it was more focused on the administrative and juridical part of the process of construction rather than design or building determinants, which are discussed in more details in the executive appendix released later in April 2009 by a ministerial decree from the Minister of Housing, Utilities and Urban Development.

1.2. How green is the Unified Building Law?

There are some points that are crucial for this code to be truly green. Herein some of the terms of the law will be listed and analysed from a green perspective. The selection of these parts is based on their contradiction with green concepts. The order of the articles is the same order of their occurrence in the text of the law.

Article 2

...Strategic plan: it is the plan that determines the future vision of urban development and could be on the level of the nation, a region, a governorate, a city or a village. It includes goals, policies, and plans for economic and social development and the built environment that is essential for sustainable development. It also states the future needs for urban expansion, land use, and the programs, priorities, mechanisms, and financing sources on the planning level.

(People's Assembly 2008:2)

The article is concerned by the formulation of strategic plans for the different planning levels, in order to achieve a 'sustainable development' for a developing country like Egypt. However, it does not represent a whole framework for the whole country that states the overall sustainable vision for the next decade or so. There must have been a unified development goal such as transformation the society from being agriculture-based to being industrial-based, or stating that the unified goal for the nation is to develop a balance between agriculture, services and industry.

Article 15

...and the national planning and urban development authority puts down temporary building requirements for the existing areas which have no building regulations, especially those concerning street networks and building heights that fulfil the requirements of natural lighting, ventilation, architectural and urban character, safety, and the environmental requirements according to the density described by the executive appendix for this law. It is prohibited to increase a building height to more than 1.5 times the width of the street on which it lies, with a maximum height of 36 meters. These temporary regulations are effective until the aforementioned strategic and detailed plans are prepared and ratified.

(People's Assembly 2008:5)

The article –accidentally– follows one of the green concepts by emphasizing that each region must have its own strategic and detailed plan from which its own regulations evolve. However, it hasn't mentioned that each local set of regulations or strategic plans should be based on local climatic and cultural research that analyses the local natural and societal context. It has also emphasized on the importance of achieving natural lighting, ventilation and keeping the architectural and urban character. But it has put a superficial temporary regulation limiting the height to 1.5 times the width of the street with a maximum of 36 meters, disregarding whether this would satisfy the aforementioned health and environmental concerns.

The executive appendix for the Unified Building Law (ministerial decree no.114 year 2009), published in Al-Wakaea Newspaper issue no.11-A released 8th of April, 2009, is an explanatory appendix for the Unified Building Law. It describes the detailed regulations of the articles in the main law. As a general note, the regulations inscribed in the appendix do not differentiate between the different regions and their respective climates and natural settings. Herein, some of the articles in the appendix are quoted and discussed.

Article 93

The clear height from the floor finishing surface to the bottom of the ceiling must not be less than 2.7 meter. However it can diminish down to 2.3 meter in entrances, toilets, corridors, laundry rooms, guard rooms and the likes in a range that does not exceed 25% of the floor area of the room.

(Ministry of Housing, Utilities and Urban Development 2009:78)

The lawmaker has put a minimum for clear height that only spatial causes like furniture, chandeliers, and the passage of users. From the environmental point of view, such a height is not adequate for cross ventilation and natural light to penetrate the depth of the architectural spaces. Contractors always stick to minimum as it comes to dimensions, except for total building height of course, in order to save money and create more selling opportunities.

Article 94

The internal floor areas and the shorter dimension of any of the building's rooms must not be less than the following:

Use	Minimum Area (sq.m.)	Minimum dimension (m.)
Dwelling Rooms	7.5	2.5
Toilets	0.80	0.80
Kitchens	3.00	1.50
Bathrooms	1.50	1.20
Guard rooms	5.00	2.00

Table 1: Minimum floor areas and dimensions for room types in residential buildings.

Source: (Ministry of Housing, Utilities and Urban Development 2009)

The article suggests that a space with dimensions 2.5x3.0m is adequate for a bedroom or a living room, a space 0.80x1.0m is adequate for a toilet, a space 1.50x2.00m is adequate for a kitchen and a space 2.00x2.50 is adequate for a guardroom. Such room sizes are already implemented in many housing projects, all by the government of course, known as "Youth housing projects" that spread in a wide number of new cities. Many of these projects provide dwellings as small as 48sq.m and 63sq.m in total. Ironically, the same government provides graveyards up to 75sq.m in area, in the outskirts of 6th of October city. Such spaces have nothing to do with any environmental or health concerns and do not provide users with any functional or even psychological satisfaction.

Article 96

Each room in residential buildings must have one or more openings to a street or an inner court, that satisfies the conditions described in this appendix, in order to provide natural lighting and ventilation. The total areas of the openings should not be less than the following: 8% of floor area, in case of dwelling rooms, 10% of the floor area, in case of service spaces such as toilets, kitchens, bathrooms, stairwell or the likes.

(Ministry of Housing, Utilities and Urban Development 2009:79)

It goes without saying that every room should have a window. But fixing a minimum of 8% of the floor area, and 10% in case of service areas, regardless the orientation of the room, let alone the location of the whole building, makes the article very superficial. The same article mentions the following;

...Except for kitchens of residential units, it is allowed to ventilate and light offices and service spaces artificially. However in the cases of the hotels, hospitals and public spaces where artificial ventilation is not available, it is allowed to use a courtyard to ventilate and light the bathrooms and kitchens appended to the rooms. The specified courtyard must not be less than 1.5 square meters in area and the smallest dimension must not be less than 1 meter.

(Ministry of Housing, Utilities and Urban Development 2009:79)

This part shows the complete negligence of environmental concerns. The first priority is given to artificial lighting and air conditioning rather. No reference has been given to keeping natural ventilation even as an option. Even when presenting natural ventilation and lighting as a replacement for the artificial ones, the suggested solution is a 1.5sq.m court, which is basically a duct.

The openings in office buildings are not bound by the floor area/opening area percentages described in this executive appendix.

(Ibid.)

Controversially, the law excludes office buildings from abiding to the regulations it has specified for other types of buildings, although office buildings are used for long hours and must provide the same safety and health

conditions for employees. Hence, the law represents HVAC systems and artificial lighting as the only ventilation and lighting solutions for office buildings.

Article 99

In the case of rooms or service areas where it's impossible to open up windows that overlook courtyards or streets, it is allowed to make recessions (pocket court) in order to allow an opening. The depth of the recession must not exceed half its width and the window must be directly in the face of the recession. It is also allowed to build balconies in recessions, with a maximum width equal to half that of the recession.

(Ibid.:81)

This article suggests that buildings could be attached to each other, and that the rooms which face the wall of the adjacent building may be ventilated and lighted by a pocket court which depth is at most half its width. Such pocket courts are usually 1.0x1.0m ducts that do provide neither healthy ventilation nor adequate lighting.

Hence, it is noticeable that the Unified Building Law and its executive appendix did not take green architectural concepts and many contextual and health concerns into consideration. Hence, the Unified Building Law needs reformation at large scale in order to catch up with universal green standards.

2. GREEN PYRAMID RATING SYSTEM PUBLIC REVIEW VERSION

2.1. Overview

The Green Pyramid Rating System (GPRS) is a national environmental rating system for buildings. It provides definitive criteria by which the environmental credentials of buildings can be evaluated, and the buildings themselves can be rated (*The Green Pyramid Rating System, First Edition 2011*). It was drafted by the Housing and Building Research Centre (HBRC) in conjunction with the Egyptian Green Building Council (EGBC) in 2010, and the first edition was made available for public review in April 2011. The GPRS provides 4 levels of certification depending on score of the project in the weighted factors; 'Certified', 'Silver Pyramid', 'Gold Pyramid' and 'green pyramid'.

Please note that this is only applicable for new projects, as the code for greening existing buildings is still under development by the EGBC and the HBRC (*The Green Pyramid Rating System, First Edition 2011*).

2.2. Enforcement of the rating system

GPRS documentation does not specify any timeline for its enforcement although it described itself as legislation and although it describes the application of its contents as urgent.

These negative aspects are mainly because the GPRS was made as a project for a legislation that is still under analysis and public review. However, the seriousness of the issue it addresses should have motivated the law and code makers to refer to it and give incentives for its application.

3. INTEGRATION BETWEEN THE UNIFIED BUILDING LAW AND THE GPRS

3.1. Current Situation

By comparing the building codes included in the Unified Building Law No.119 for year 2008, and its executive appendix released in April 2009 by the Minister of Housing, law No. 114 for the year 2009 on one hand, and the GPRS document released by the EGBC/HBRC, Ministry of Housing committee that was formed the same year, astonishing results reveal. There are serious contradictions between both documents, as the Unified Building Law and its appendix allow building designs and procedures that do not comply with to the GPRS.

Moreover, there is no reference in the Unified Building Law for the GPRS or green building in general, nor there is any reference for the Unified Building Law in the GPRS documentation released by the Ministry of Housing, Utilities and Urban Development. Thus, it is clear that the GPRS is an isolated document that does not fit into the current legislations, nor represent a binding legislation on its own.

3.2. Integration opportunities

This gap between a fully-enforced non-green building law and an unendorsed green building law must be filled. This is basically doable by greening some of the regulations of the Unified Building Law and also by putting a timeline for the enforcement of the GPRS that starts by giving incentives to projects that apply it, then imposing fines on those which do not, and ends by requiring the achievement of at least a 'GPRS-certified' standard for gaining a license.

4. ENACTING THE INTERNATIONAL GREEN CONSTRUCTION CODE IN EGYPT

The IGCC is not a building code that fits any nation, as this is the complete opposite to green principles. It is an international guide that represents a jurisdictional framework for creating local codes which shall be tailored to the local status of each country/municipality/governing body. The IGCC offers flexibility to jurisdictions which adopt the code by establishing several levels of compliance, starting with the core provisions of the code, and then

offering "jurisdictional requirement" options that can be customized to fit the needs of a local community. Thus, it can be used to enhance the Unified Building Law of Egypt, bearing in mind local environment and determinants.

At the time of adoption, jurisdictions should insert the appropriate information in provisions requiring specific local information (International Code Council 2010). This can be done by the Housing and Building Research Centre (HBRC) in conjunction with the Egyptian Green Building Council (EGBC). It is also important to note that the ASHRAE Standard for the Design of High-performance Green Buildings is the jurisdictional compliance option of the IGCC that contains guiding for design processes.

The IGCC Public Version 2.0 was produced by the International Code Council (ICC) in November 2010 after the public comments from around the globe submitted to Public Version 1.0 were considered by the IGCC Public Comment Committee at the Public Hearings held in Rosemont, IL, US, August 14 – 21, 2010 (International Code Council 2010). The hearing committee consisted of representatives from USGBC, AIA, ASHRAE, ASTM (The American Society for Testing and Materials), EPA and selected architects. Public Version 2.0 contains the changes to Public Version 1.0 suggested in the Public Comments that were approved or approved with modifications by the Committee (Ibid.). The original base of IGCC Public Version 1.0 was compiled by the Sustainable Building Technology Committee (SBTC) appointed by the ICC Board of Directors, with the American Institute of Architects and ASTM International as cooperating sponsors (Ibid.).

Here are the main five scopes of the IGCC and comments about their applicability in Egypt;

4.1. Site development and land use

Within this section, the IGCC focused on the following regulations:

- Prohibition of importing soil for tapping on site from farmlands or greenfield lands.
- Buildings with area 929sq.m. or more must have a changing room, a shower and a bicycle parking site.
- Where trees are used, they should be selected to be native to, or non-invasive and adaptive to, the region and climate zone in which the project site is located.
- Not less than 75% of the roof surfaces of *buildings* located in climate zones 1 through 3, as established in the *International Energy Conservation Code*, shall be covered either with solar photovoltaic cells panels or vegetation.

(Ibid.:35-56)

4.2. Material resource conservation and efficiency

Within this section, the IGCC focused on the following regulations;

- A construction material and waste management plan shall be developed and implemented to recycle or salvage construction materials and waste.
- Not less than 55% of the total building materials used in the project, based on mass or cost, shall be used, recycled, or recyclable.
- Fluorescent lamps should not contain more than 5-8 milligrams of mercury (varies according to their lifetime).
- A building service life plan (BSLP) in accordance with this section shall be included in the construction documents. The design service life shall be not less than 60 years and the BSLP shall indicate the design service life selected for the building.

(Ibid.:57-74)

4.3. Energy conservation and efficiency

Within this section, the IGCC focused on the following regulations;

- All building types and sizes must score that is not greater than 51 (or less according to the governing jurisdiction decision) on the Zero Energy Performance Index (zEPI). $zEPI = 57 \times (PD-RE-WE)/RD$, where: PD = Total annual energy delivered to the *proposed* design and consumed on site RE = Total annual energy savings from renewable energy derived on site, RD = Total annual energy used by a *standard reference design*, and WE = Total annual energy savings from *waste energy recovery*.
- Buildings that contain HVAC or lighting systems shall comply with this section. A building energy management and control system (EMCS) shall be provided and integrated with building HVAC systems controls and lighting systems controls to receive an open and interoperable automated demand response (Auto-DR) relay or internet signal.

- The building thermal envelope shall be durably sealed to limit infiltration.
- Occupant sensor controls shall be provided to automatically reduce connected lighting power by not less than 45% during periods when occupants are not present in corridors, enclosed stairwells, storage and stack areas not open to the public, and parking garages.
- Solar photovoltaic systems or wind energy systems shall be designed, constructed and sized to provide not less than 2% of the total estimated annual electric energy consumption of the building, or collective buildings on the building site.
- A Systems Manual shall be provided and shall include HVAC controls system maintenance and calibration information, control sequence descriptions, a complete narrative of how each system is intended to operate including recommended set-points, seasonal change-over information and emergency shutdown operation, control sequence descriptions for lighting, domestic hot water heating and all renewable energy systems with a description of how these systems connect to, and are controlled in conjunction with, the overall building system.

(Ibid.:75-113)

4.4. Water resource conservation and efficiency

Within this section, the IGCC concentrates on the efficiency of use of water as a scarce resource. Some of the regulations indicated in this section are;

- Prohibition of using potable water in landscape irrigation except in new projects up to 3 years
- The maximum water consumption for the different water fixtures are 2.0 gpm (gallon per minute) for showerheads, 0.5 gpf (gallon per flush) for urinals, 1.6 gpf for water closets, and 0.7 gpm for manual drinking fountains.
- Appliances using water like dishwashers, clothes washers and ice makers should be Energy Star labelled.
- For automated car-wash facilities, at least 50% of used water should be collected and reused for next washes.
- Swimming pools shall be provided with vapour-retardant covers.

(Ibid.:119-146)

4.5. Indoor environmental quality and comfort

Within this section, the IGCC focuses on the design and regulations for the indoor environmental quality and comfort in buildings. Some of the regulations indicated in this section are;

- Buildings shall be designed in compliance with ASHRAE 55 –04 (according to thermal comfort specifications of the climatic zone), except spaces with special requirements for processes, activities, or contents that require a thermal environment outside of that which humans find thermally acceptable, such as food storage, natatoriums, shower rooms, saunas, and drying rooms.
- Smoking shall not be allowed inside of buildings. Signage stating such shall be posted within 10 ft (3 m) of each building entrance.
- Fireplaces and fuel-burning appliances shall be vented to the outdoors and shall be provided with combustion air in accordance with the *International Mechanical Code and the International Fuel Gas Code*.
- Not less than 50% of the total floor area in *regularly occupied spaces* shall be located within a *day-lit area*.

(Ibid.:147-170)

As seen in Section 1.2, the legislative system represented in the Unified Building Law No.119 for the year 2008 and its administrative appendix by ministerial decision No.114 for the year 2009 have very little to share with the regulations listed above. The main regulations of the IGCC that Egypt is in need for enacting are;

- Covering a minimum percentage (that can be decided by means of a specific study) of the surfaces of building roofs with vegetation or photovoltaic cells panels.
- The use of recycled, recyclable or reused materials in building with a minimum of a certain percentage (that can be decided by means of a specific study) of building materials used in construction.

- Enforcement of the Zero Energy Performance Index (zEPI) calculation and abiding to its limit as part of licensing requirements.
- Enforcement of the use of sensor controls to reduce energy waste in unoccupied spaces and public areas.
- Enforcing water consumption rates for electric fixtures and encouraging water sensors.
- A certain percentage (that can be decided by means of a specific study) of space inside any given building shall be located within a day-lit area.

Enacting these regulations from the IGCC, especially that Egypt is trying to get membership in the WGBC (World Green Building Council), with the amendments mentioned in Section 1.2, can greatly help the Egyptian people lead a healthier and more productive way of living and save environmental resources for the coming ones, especially that Egypt is expected to experience shortages in fresh water supply, food, and energy and increase in pollution if the current conduct persists.

5. ENACTING THE ASHRAE STANDARD FOR THE DESIGN OF HIGH-PERFORMANCE GREEN BUILDINGS IN EGYPT

This section observes selected parts of ANSI/ASHRAE/USGBC/IES (Illuminating Engineering Society of North America) Standard 189.1-2011, widely known as ASHRAE Standard 189.1, the jurisdictional compliance option of the IGCC that contains guiding for design processes. It was released in 2011 by a committee with representatives from ASHRAE, AIA, USGBC, ANSI and IES. The scope of the standard is the site management, design, construction and operation of all types of green buildings except low rise residential buildings (ASHRAE and US Green Building Council 2011). The main points that are relevant to the case of Egypt in the standards are;

5.1 Site sustainability

- At least 50% of the site hardscape shall be provided with either vegetation for shade, paving materials with a minimum SRI (Solar Reflectance Index) of 29, shading through the use of structures, or parking spaces under buildings.
- Shade shall be provided for at least 30% of east and west walls to a height of 6 meters above grade or the top of the exterior wall, which ever less, within 5 years of the final certificate of occupancy.
- Roof areas that are not used for vegetation or photovoltaic cells panels are required to be covered with materials that have a minimum of SRI of 78 for low-sloped roofs or 29 for steep-sloped roofs and/or comply with the EPA Energy Star program requirements.
- Maximum energy and lighting usage for site lighting are also set in this section in order to reduce energy consumption and light pollution.

(ASHRAE and US Green Building Council 2011:5-18)

5.2 Water use efficiency

- Any irrigation system for the project site shall be controlled by a qualifying smart controller that uses weather data to adjust irrigation schedules and moisture sensors to readjust irrigation in case of rainfall or increase of moisture.
- Prohibition of the use of potable water in cooling
- Prohibition of the use of potable water in the irrigation of roof vegetations.

(Ibid.:18-23)

5.3 Energy efficiency

- Mandatory provision of space and equipment for the future installation of renewable energy systems such as solar and wind energy collection systems.
- Mandatory provision of measurement devices of remote communication capabilities for all energy sources in the building such as electricity and natural gas, in order to transmit consumption data to a data acquisition system.
- Requirements for fenestration size and orientation depend on climatic analysis of the project location.
- Building envelope design and insulation depend on climatic analysis of the project location.

- Building projects must have automatic systems for peak load reduction, such as demand limiting or load shifting systems, in order to reduce peak load by at least 10% of the projected peak demand.
- Lighting in hallways, commercial and industrial storage areas must be controlled by an occupant sensor having “manual ON” and “automatic OFF” controls with multilevel switching or dimming.

(Ibid.:23-30)

5.4 Indoor environmental quality

- Control over materials with high emissions or toxicity
- Achievement of user thermal comfort according to climatic analysis of the project location.

(Ibid.:31-35)

5.5 Building's impact on atmosphere, materials and resources

- A minimum of 50% of non-hazardous construction and demolition waste material shall be diverted from disposal in landfills and incinerators by recycling or reuse.
- For new buildings, the total mass of construction waste shall not exceed 6000 kg per each 1000 sq.m. floor area.
- For residential projects, there shall be an area that serves the entire building and is designed for the collection and storage of discarded but clean items in good condition.
- As an option, a minimum of 15% of building materials or products used, based on cost, shall be regionally extracted/harvested/recovered or manufactured within a radius of 800 km of project site.

(Ibid.:36-37)

Enacting these regulations as complementary to the IGCC regulations can help Egypt get back on the way to a green and fruitful future. The main regulations of the ASHRAE Standard version 189.1 that Egypt needs to enact are;

- Provision of shade for walls receiving high solar radiation (according to the solar radiation data in each city)
- Any irrigation system for the project site shall be controlled by a qualifying smart controller that uses weather data to adjust irrigation schedules and moisture sensors to readjust irrigation in case of rainfall or increase of moisture.
- Provision of measurement devices of remote communication capabilities for electricity and natural gas, in order to transmit consumption data to systems allowing the central government to monitor and analyse consumption rates and distribution quickly and accurately.
- Lighting in hallways, commercial and industrial storage areas must be controlled by occupant sensors that allow also switching or dimming.
- A certain minimum percentage (that can be decided by means of a specific study) of non-hazardous construction and demolition waste material shall be diverted from disposal in landfills and incinerators by recycling or reuse.
- A certain minimum percentage (that can be decided by means of a specific study) of building materials or products used, based on cost, shall be regionally extracted, harvested, recovered or manufactured within a certain distance (that can be decided by means of a specific study) from the project site.

However, it is crucial to point out that the regulations that are recommended for enacting cannot be adopted as-is due to the contextual differences and should be edited according to the Egyptian cultural and climatic context.

6. GREENING THE BUILDING CODE

After raising awareness about green architecture and its various benefits through marketing, it is crucial to put down a green building code for Egypt. The need for this building code was revealed in Section 1.2. The Egyptian green building code should be created in the light of the principles enacted from the IGCC in Section 4 and the ASHRAE Standard in Section 5 on the condition of conformity to the bioclimatic classification of the Egyptian climatic zones.

The broad lines for the Egyptian Green Building Code and their respective relevance to the IGCC and ASHRAE Standard regulations suggested for enacting are:

6.1. Building site

- Flexibility with building orientation that improves environmental performance.
- Enforcing growing green areas and vegetation either around buildings or above roofs, with reference to the IGCC and ASHRAE Standard regulations.
- Provision of shade at a minimum of a certain percentage that differs according to climatic zone analysis.
- Limitation of use of materials/soil types/plants that are alien to the project site nature, with reference to IGCC regulations.

6.2. Building Envelope

- Presenting the standard classification of the bioclimatic zones of Egypt and their respective building envelope design recommendations.
- Enforcement of bioclimatic calculations and analyses as part of construction documents necessary for licensing.
- Limitation to the use of materials and building techniques which are incompatible with the results of the bioclimatic analysis for the specific climatic zone, with reference to IGCC and ASHRAE regulations.

6.3. Energy efficiency

- Provision of scientific bases for the use of energy collection systems that can be installed on-site.
- Enforcement of zEPI calculation, according to IGCC regulations, as part of construction documents necessary for licensing.
- Enforcement of the use of smart lighting controls, with reference to ASHRAE Standard regulations, in selected spaces to a certain minimum percentage and support of their manufacturing locally.
- Enforcement of the use of high-tech electric consumption meters with reference to IGCC regulations.

6.4. Water efficiency

- Enforcement of the use of smart water sensor controls in residential units and gardens to reduce water waste.
- Strict prohibition of the use of potable water in the irrigation of vegetation and landscapes.
- Enforcement of the use of high-tech water consumption meters with reference to IGCC regulations.

6.5. Environmental impact

- Enforcement of laws of environment protection against harmful construction material factories.
- Implementation of IGCC regulations concerning maximum total construction wastes per project area and enforcement of monetary fines against law-breakers.
- Enforcement of IGCC regulations for the regionalism of building materials.

Using these broad lines Egypt can create a green building code that is conforming to its environmental and cultural context and at the same time is in harmony with the international community codes and regulations. These regulations can be adapted into a new building code or integrated into the existing building code as amendments to the executive appendix to the Unified Building Law No.119/2008.

CONCLUSION

It is to be concluded that the Unified Building Law no.119 released in 2008 and its executive appendix released by the Ministerial decree no. 144 in 2009 were not formulated having green concepts in mind, while the GPRS was not designed to be in harmony with the Unified Building Law nor its executive appendix. However, it is also evident that integration opportunities are existent. The analysis of selected articles and regulations of the IGCC and its compliance option, the ASHRAE Standard for the Design of High-Performance Green Buildings, shows possibility for adopting some of them in Egypt through integration into the Unified Building Law.

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