

Green Building Guideline of Jordan

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Abstract: The final draft of the new Green Building Guideline and Rating System of Jordan was established and approved by the Jordan National Building Council, in November 2010. The green building guideline and rating system for Jordan is referenced to Jordan's Related Building Codes (as compulsory requirements), and International green rating systems such as LEED, BREEAM, ESTIDAMA, Dubai green building rating system, QSAS, and many more. The Green building guideline contains parameters and credits that are suitable for Jordan's climate, resources, legislation, policies and policies instrument, building techniques and strategies. This Guideline is attached to a Voluntary rating system that is connected to an incentive scheme given by the government.

Keywords: *Green Building, Energy Efficiency, Rating System, requirements, scoring.*

1. Introduction

Since green buildings have a profound impact on our natural environment, economy, health and productivity, the approach of the green building guideline is to understand the building's total impact on the environment in six categories that provide the foundation for green building design. These categories are:

- Green Building Management.
- Site Sustainability
- Water Efficiency
- Energy Efficiency
- Healthy Indoor Environment
- Materials and Resources

1.1. Justification

The high energy demand of the construction sector with shortage of energy resources in Jordan is the main concern for the need of producing such guideline. Additionally, the importance of finding ways to minimize pollution in the atmosphere is also a major problem to solve.

1.2. Objectives

The objective of the project is to produce a guideline for the use of energy efficient Green Building Rating System along with a green project checklist for the use of candidate that apply for the green building assessment process to design a green building.

In addition to the need for reducing Jordan's energy consumption in buildings, and ultimately decreasing the burden of the energy on the economy.

2. Methodology

By forming a working team from experts in the different disciplines required and augmenting the team with national specialists, the green building rating program key categories and principles were determined.

All of the parameters mentioned in General will be given points and credits according to their importance for green buildings in Jordan, and according to the ability of application for each parameter. Moreover, special ways to accomplish the objectives of the parameter is determined and decided, like suggested available market products, available constructor's techniques and methods. Each parameter's accomplishment is measured either by simulations programs or by mathematical calculations, or by documented plans.

Moreover, the legislative instruments available; laws, by laws, regulations relating to the launch of such program were reviewed.

3. Energy Scoring:

Within the scoring system, the water efficiency part has possessed a 35 percent scoring followed by the energy efficiency part with 33 percent of the total points given to a green building. This is due to the importance of water and energy in Jordan. The following table shows the pointing system and weights given:

| Chapters | Weight | Chapter |
|----------------------------|---------------|----------------|
| Green Building Management | 20 | 6% |
| Site Sustainability | 24 | 8% |
| Water Efficiency | 110 | 35% |
| Energy Efficiency | 98 | 33% |
| Healthy Indoor Environment | 24 | 8% |
| Materials & Resources | 32 | 10% |

The chapters of the Guideline contain credits that are divided into three requirement levels:

- 1) **Mandatory Requirements (MR):** Requirements that are subtracted from related Jordanian Codes and related to the green application of the credit, and it has no points rewarded.
- 2) **Obligatory (rewarded) Requirements (OR):** Requirements that are not mentioned in Jordanian codes of practice as mandatory minimum requirements, but are essential for the green building practice. Therefore, these requirements are obligatory for a building to pursue the green building certification, and they are rewarded with points when achieved.
- 3) **Voluntary Requirements (VR):** Requirements that are totally voluntary for precise building types and specifications, attached to rewarded points.

The energy efficiency chapter contains the following credits:

- Building Envelope
- HVAC System
- Water Heating
- Renewable Energy
- Lifts and Escalators
- Electric Lighting and Power

3.1. Energy Efficiency

This category is addressed in Green Building Guideline of Jordan through the following twenty nine (29) principles and points:

1) Orientation of the Building:

- a. (MR): None
- b. (OR): None
- c. (VR): As the Following

| No. | requirement | points |
|-----|--|--------|
| 1 | Orientation to the South for Cold zones, and North for Hot zones | 1 |
| 2 | Orientation of Long axis to East-West | 1 |

2) Roofs and Walls of the building envelope:

- a. (MR): None
- b. (OR): None
- c. (VR): As the Following

| No. | requirement | points |
|-----|---|--------|
| 1 | Flat roofs and Smooth textures for Building Envelope for Cold zones, and un-flat roofs and Rough textures for Hot zones | 1 |
| 2 | Solar Reflectance Coefficient for Roofs not less than 0.7, emmisivity 0.75 and absorbance coefficient 0.3 at the same time. | 1 |
| 3 | Cold roof for (80) percent of area | 1 |
| 4 | Cold roof for (100) percent of area | 2 |

3) Site Landscaping:

- a. (MR): None
- b. (OR): None
- c. (VR): As the Following

| No. | requirement | points |
|-----|---|--------|
| 1 | Proper heights and orientation of trees on site | 1 |
| 2 | Open area- greening and plantation | 1 |

4) Thermal Insulation of the Building Envelope:

- a. (MR): As the Following:

| No. | requirement | points |
|-----|---|--------|
| 1 | Right place of insulation based on climate zone | None |
| 2 | U-value of Opaque walls- $0.57 \text{ w/m}^2.\text{k}$ | None |
| 3 | U-value of Exposed Roofs- $0.55 \text{ w/m}^2.\text{k}$ | None |
| 4 | U-value of Exposed Floors- $0.80 \text{ w/m}^2.\text{k}$ | None |
| 5 | U-value of Separating walls- $2.00 \text{ w/m}^2.\text{k}$ | None |
| 6 | U-value of Separating roof, floor- $1.20 \text{ w/m}^2.\text{k}$ | None |
| 7 | Total U-value of walls- $1.60 \text{ w/m}^2.\text{k}$ | None |
| 8 | Total U-value of Exposed roof, floor $<1.60 \text{ w/m}^2.\text{k}$ | None |

- b. (OR): None

- c. (VR): As the Following:

| No. | requirement | points |
|-----|--|--------|
| 1 | U-value of Opaque walls- $0.50\text{-}0.40 \text{ w/m}^2.\text{k}$ | 1 |
| 2 | U-value of Opaque walls less than $0.40 \text{ w/m}^2.\text{k}$ | 2 |
| 3 | U-value of Exposed roofs- $0.50\text{-}0.40 \text{ w/m}^2.\text{k}$ | 1 |
| 4 | U-value of Exposed roofs less than $0.40 \text{ w/m}^2.\text{k}$ | 2 |
| 5 | U-value of exposed floors- $0.75\text{-}0.55 \text{ w/m}^2.\text{k}$ | 1 |
| 6 | U-value of exposed floors less than $0.55 \text{ w/m}^2.\text{k}$ | 2 |
| 7 | U-value of separating walls- less than $1.80 \text{ w/m}^2.\text{k}$ | 1 |
| 8 | U-value of separating floor, roof $<1.00 \text{ w/m}^2.\text{k}$ | 1 |
| 9 | Total U-value of walls- less than $1.45 \text{ w/m}^2.\text{k}$ | 1 |
| 10 | Total U-value of Exposed roof, floor $<1.00 \text{ w/m}^2.\text{k}$ | 1 |

5) Fenestration in the Building Envelope:

a. (MR): As the Following:

| No. | requirement | points |
|-----|---|--------|
| 1 | Glass 10%-40% area, less than 3.30 w/m ² .k | None |
| 2 | Glass 40%-99% area, less than 2.00 w/m ² .k | None |
| 3 | Total U-value of Wall, less than 1.6 w/m ² .k | None |
| 4 | Solar Heat Gain Coefficient, less than 0.25 | None |
| 5 | Solar Heat Gain Coefficient for skylights <2% area, < 0.40. Skylights (2.1-5%), < 0.25 | None |
| 6 | No skylights more than 5% area allowed | None |
| 7 | Visual transmittance of Glass, more than 0.45 | None |
| 8 | Residential buildings= More than 10% window area for service zones, more than 15% window area for operational zones | None |

b. (OR): As the following

| No. | requirement | points |
|-----|--|--------|
| 1 | Glass shading coefficient not more than 0.35 | 1 |

c. (VR): As the following

| No. | requirement | points |
|-----|--|--------|
| 1 | Glass 10%-40% area, less than 3.00 w/m ² .k | 2 |
| 2 | Glass shading coefficient not less than 0.3 | 1 |
| 3 | Solar Heat Gain Coefficient, less than 0.2 | 1 |

6) Air Sealing of Openings:

a. (MR): As the Following:

| No. | requirement | points |
|-----|---|--------|
| 1 | 3 L/s/m ² air leakage in revolving doors, 2 L/s/m ² air leakage in other doors and openings | None |
| 2 | Sealing of Thermal Insulation joint points | None |
| 3 | Sealing of joints in architectural openings | None |
| 4 | Sealing of conjunction and connection points | None |
| 5 | Sealing of all fixture connections and holes | None |
| 6 | Sealing of Shutter boxes | None |
| 7 | Testing of doors and windows air leakage | None |

b. (OR): None

c. (VR): None

7) Natural Lighting:

a. (MR): None

b. (OR): None

c. (VR): As the following

| No. | requirement | points |
|-----|---|--------|
| 1 | More than 50% occupied area, daylighting | 1 |
| 2 | Height of window for daylight penetration | 1 |
| 3 | Daylight penetration angle <70° for residential | 1 |
| 4 | Smart daylight control systems | 3 |

8) Shading Devices:

a. (MR): As the following

| No. | requirement | points |
|-----|---|--------|
| 1 | Small space between shading device and facade | None |
| 2 | Shading devices from light materials | None |
| 3 | Shading coefficient <0.2 for shading devices | None |

b. (OR): None

- c. (VR): As the following

| No. | requirement | points |
|-----|--|--------|
| 1 | Proper use of shading devices for orientations | 3 |

9) Natural Ventilation:

- a. (MR): As the following

| No. | requirement | points |
|-----|--|--------|
| 1 | Avoid rain leakage inside ventilation openings | None |
| 2 | Relative humidity between 40-70% indoors | None |
| 3 | Ventilation openings near shaded areas | None |

- b. (OR): None

- c. (VR): As the following

| No. | Requirement | points |
|-----|--|--------|
| 1 | Use of Mashrabeyya, Colestra brick, ...etc | 1 |
| 2 | Use of night ventilation strategy | 1 |
| 3 | Use of Air Shaft for Ventilation purposes | 1 |
| 4 | Use of Chimney for ventilation purposes | 1 |
| 5 | Use of Air Catcher for ventilation | 1 |
| 6 | Use of Atrium or Courtyard in design | 2 |

10) Computer Simulations:

- a. (MR): None

- b. (OR): None

- c. (VR): As the following

| No. | requirement | points |
|-----|--------------------------------|--------|
| 1 | Energy performance- 5% better | 2 |
| 2 | Energy performance- 10% better | 4 |
| 3 | Energy performance- 15% better | 6 |
| 4 | Energy performance- 20% better | 8 |
| 5 | Energy performance- 25% better | 10 |
| 6 | Energy performance- 30% better | 12 |

11) Mechanical Ventilation:

- a. (MR): As the following

| No. | requirement | points |
|-----|---|--------|
| 1 | Control system for Mechanical ventilation | None |
| 2 | Automatic Controls and separate electrical circuits for mechanical ventilation equipments | None |
| 3 | Throttling for air intakes and out | None |
| 4 | Mechanical ventilation for indoor garages | None |
| 5 | Vent. Fans for kitchens and bathrooms | None |

- b. (OR): None

- c. (VR): As the following

| No. | requirement | points |
|-----|--|--------|
| 1 | Speed verified motors | 1 |
| 2 | CO ₂ sensors and monitoring in indoor garages | 1 |

12) HVAC system equipments:

- a. (MR): As the following

| No. | requirement | points |
|-----|--|--------|
| 1 | All equipments accredited, energy efficient | None |
| 2 | All equipments certification, energy efficient | None |
| 3 | All equipments- Jordanian codes requirement | None |
| 4 | All electrical application- Jordanian codes compliance | None |
| 5 | Energy Label on equipments | None |
| 6 | Minimum energy efficiency requirements | None |

- b. (OR): None
c. (VR): As the following

| No. | requirement | points |
|-----|--|--------|
| 1 | Better than minimum energy efficiency- 5% | 1 |
| 2 | Better than minimum energy efficiency- 10% | 2 |

13) Air Conditioning Systems:

- a. (MR): As the following

| No. | requirement | points |
|-----|---|--------|
| 1 | Capacity variation- > loads | None |
| 2 | Control device for each system, thermostat | None |
| 3 | Water temperature control, separate devices for each zone | None |
| 4 | Thermal pumps with secondary electric heaters | None |
| 5 | No Air heating for humidity control- energy loss | None |

- b. (OR): None
c. (VR): None

14) Control system for HVAC:

- a. (MR): As the following

| No. | requirement | points |
|-----|--|--------|
| 1 | Timers- control system of all systems | None |
| 2 | Thermostat- thermal control for all systems | None |
| 3 | Thermal control- Dead band-3 C° | None |
| 4 | Thermostat- no interfering between heating and cooling | None |

- b. (OR): None
c. (VR): As the following

| No. | Requirement | points |
|-----|---------------------------------|--------|
| 1 | Smart automatic control systems | 2 |

15) HVAC Motors:

- a. (MR): As the following

| No. | requirement | points |
|-----|---|--------|
| 1 | 2-speed motors at least- or speed varying control systems | none |

- b. (OR): None
c. (VR): None

16) Thermal Insulation of HVAC system:

- a. (MR): As the following

| No. | Requirement | points |
|-----|---|--------|
| 1 | Insulation, $R=0.7 \text{ c.m}^2/\text{w}$, heating $>60 \text{ C}^\circ$ | None |
| 2 | Insulation, $R=0.35 \text{ c.m}^2/\text{w}$, heating $40-60 \text{ C}^\circ$ | None |
| 3 | Insulation, $R=0.35 \text{ c.m}^2/\text{w}$, cooling $<15 \text{ C}^\circ$ | None |
| 4 | Proper covering of insulation, waterproofing | None |
| 5 | Proper duct insulation | None |

- b. (OR): None
c. (VR): As the following

| No. | requirement | points |
|-----|---|--------|
| 1 | Insulation, $R>1.0 \text{ c.m}^2/\text{w}$, heating $>60 \text{ C}^\circ$ | 1 |
| 2 | Insulation, $R>0.70 \text{ c.m}^2/\text{w}$, heating $40-60 \text{ C}^\circ$ | 1 |
| 3 | Insulation, $R>0.70 \text{ c.m}^2/\text{w}$, cooling $<15 \text{ C}^\circ$ | 1 |
| 4 | Proper duct insulation- better than (MR) | 2 |

17) HVAC balance:

a. (MR): As the following

| No. | requirement | points |
|-----|---|--------|
| 1 | Balance of systems according to Jordanian Code requirements | None |
| 2 | Proper adjustment of fan speed | None |
| 3 | Diffusers balancing- according to design plans | None |
| 4 | Balance of water using systems- decrease throttling or other means. | None |
| 5 | For motors more than 7.5 kw power- balance of pump speed | None |

b. (OR): None

c. (VR): None

18) Thermal Condensers:

a. (MR): As the following

| No. | requirement | points |
|-----|---|--------|
| 1 | Cooled condensers- proper installation | None |
| 2 | High standard- treated water for condensers | None |
| 3 | When using thermal condensers- cooling should be from central unit or split AC units or heat pump | None |
| 4 | When using thermal condensers- heating should be from central unit or split AC units or under floor heating from boiler | None |

b. (OR): None

c. (VR): None

19) Economisers:

a. (MR): As the following

| No. | requirement | points |
|-----|---|--------|
| 1 | All cooling systems that works on fans and design capacity more than 1200 L/s and mechanical cooling capacity more than 22 kw, should have an air or water economiser | None |
| 2 | Air economisers should be able to adjust dampers and provide 100% of air intake, through an automatic control system | None |
| 3 | Water economisers should be able to provide 100% of cooling loads, through an automatic control system | None |
| 4 | Economisers should be able provide partial additional thermal loads, with no increase in energy consumption | None |
| 5 | Designed for varying flows | None |
| 6 | Should include control valves | None |

b. (OR): None

c. (VR): None

20) Heat Recovery Systems:

a. (MR): As the following

| No. | requirement | points |
|-----|--|--------|
| 1 | The mandatory use of heat recovery system in certain buildings | None |
| 2 | Heat recovery system should be able to provide the building with 60% of maximum laod | None |
| 3 | Heat recovery efficiency- more than 50% | None |

b. (OR): None

c. (VR): As the following

| No. | requirement | points |
|-----|--|--------|
| 1 | The use of heat recovery systems in all AC systems | 1 |
| 2 | Heat recovery efficiency- more than 75% | 1 |

21) Water Heating:

a. (MR): As the following

| No. | requirement | points |
|-----|--|--------|
| 1 | The use of one of renewable energy sources in water heating | None |
| 2 | Water heating system, isolated and separated | None |
| 3 | Thermal insulation of Pipes and tanks | None |
| 4 | Minimum efficiency requirements for water heating equipments | None |
| 5 | Proper thermal control system utilisation | None |
| 6 | For heated swimming pools, they should be covered with proper material | None |

b. (OR): As the following

| No. | requirement | points |
|-----|--|--------|
| 1 | Include anti- deposition pole for all water heater systems | 1 |

c. (VR): As the following

| No. | requirement | points |
|-----|--|--------|
| 1 | Thermal insulation of tanks- 7cm | 1 |
| 2 | Heat recovery for pools | 1 |
| 3 | Solar system for heating of swimming pools | 1 |

22) Lighting Control System:

a. (MR): As the following:

| No. | requirement | points |
|-----|--|--------|
| 1 | Automatic controls for indoor lighting | None |
| 2 | Occupancy sensors for offices | None |
| 3 | Control systems divided based on zones | None |
| 4 | Provide task lighting- control systems | None |

b. (OR): None

c. (VR): As the following:

| No. | requirement | points |
|-----|---|--------|
| 1 | Provide light intensity sensors for daylighted areas | 2 |
| 2 | Provide motion sensors for corridors and entrances | 1 |
| 3 | Provide occupancy sensors for classrooms and conference rooms | 1 |
| 4 | Smart Key- for hotels and motels | 2 |

23) External Lighting:

a. (MR): As the following:

| No. | requirement | points |
|-----|--|--------|
| 1 | Photocell with timer for external lighting | None |
| 2 | Separate control system for external lighting of facades | None |
| 3 | Billboard lighting- separate control system | None |
| 4 | 60 lumen/w for light bulbs of external plazas | None |

b. (OR): None

c. (VR): As the following:

| No. | requirement | points |
|-----|---|--------|
| 1 | Entrances and corridors leading to external areas- motion sensors | 1 |
| 2 | 80 lumen/w light bulbs for external lighting | 1 |
| 3 | External lighting only for safety and security | 1 |
| 4 | Renewable energy sources for external lighting | 2 |

24) Lighting Power:

a. (MR): As the following

| No. | requirement | points |
|-----|---|--------|
| 1 | Energy Efficient Building code requirements | None |

b. (OR): None

c. (VR): As the following:

| No. | requirement | points |
|-----|---|--------|
| 1 | Proper design of lighting zones | 1 |
| 2 | Proper Daylight design- to be introduced into corridors and large halls | 1 |
| 3 | Light indoor colours | 1 |
| 4 | Low partitions- open plan offices | 1 |
| 5 | Task lighting | 1 |
| 6 | Technological solutions for introducing natural light into deep areas- fibre optics | 2 |

25) Lighting Efficiency:

a. (MR): As the following:

| No. | requirement | points |
|-----|--|--------|
| 1 | Light condensers- power factor more than 0.92 in magnetic ballasts | None |

b. (OR): None

c. (VR): As the following:

| No. | requirement | points |
|-----|--|--------|
| 1 | High efficiency light bulbs | 1 |
| 2 | Light fixtures with high utilization factor | 1 |
| 3 | Use of T5 florescent lamps instead of T8 | 2 |
| 4 | Electronic ballasts instead of magnetic ballasts | 2 |

26) Electric Motors Efficiency:

a. (MR): As the following:

| No. | requirement | points |
|-----|---|--------|
| 1 | Minimum efficiency requirements | None |
| 2 | Power factor efficiency- labelled on motors | None |
| 3 | Testing certifications | None |

b. (OR): None

c. (VR): As the following:

| No. | requirement | points |
|-----|--------------------------------|--------|
| 1 | High efficiency motors | 1 |
| 2 | Earthing of motors- separately | 1 |

27) Electric power Correction Factor:

a. (MR): As the following:

| No. | requirement | points |
|-----|---|--------|
| 1 | power factor more than 0.92 for specified loads | None |

b. (OR): None

c. (VR): As the following:

| No. | requirement | points |
|-----|---|--------|
| 1 | power factor more than 0.95 for ALL loads | 2 |

28) Renewable Energy on site:

- a. (MR): None
- b. (OR): None
- c. (VR): As the following:

| No. | requirement | points |
|-----|--|--------|
| 1 | Renewable energy- 2.5% of total electric use | 2 |
| 2 | Renewable energy- 5% of total electric use | 4 |
| 3 | Renewable energy- 7.5% of total electric use | 6 |
| 4 | Renewable energy- 10% of total electric use | 8 |

29) Elevators, escalators and conveyor belts systems:

- a. (MR): None
- b. (OR): As the following:

| No. | requirement | points |
|-----|--|--------|
| 1 | Elevators- fan off after 5 minutes of non-use | 1 |
| 2 | Elevators- Lights off after 5 minutes of non-use | 1 |
| 3 | Escalators and conveyor belts- slow speed after 3 minutes of non-use | 1 |
| 4 | Escalators and conveyor belts- stops after 15 minutes of non-use | 1 |

- c. (VR): As the following:

| No. | requirement | points |
|-----|---|--------|
| 1 | Non hydraulic Elevators- proper control systems | 1 |
| 2 | Elevators- special requirement motor | 1 |
| 3 | No truss motor for elevators | 1 |
| 4 | Light weight materials for elevators | 1 |

Acknowledgment

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