

Military Technical College
Kobry El-Kobbah,
Cairo, Egypt



11th International Conference
on Civil and Architecture
Engineering
ICCAE-11-2016

Green Rating for Urban Developments in Arid Zones: An Accreditation Case Study in Egypt

Mohammed A. Barakat¹, Mohammad Fahmy¹, Yasser Ibrahim¹

¹*Department of Architecture, Military Technical College, Cairo, Egypt.*

Abstract:

The last three decades have witnessed a radical change to the urban planning field, since the new urbanism charter gave instructions for livable neighborhoods until rating systems for green buildings and sustainable communities emerged to adapt and enable built environments to respond to future needs. The sustainability concept is now well known worldwide, but still needs more focus on its application in many countries like Egypt, especially on the practice level. Therefore, a recently constructed neighborhood case study in Greater Cairo is accredited using LEED for neighborhood (Leadership in Energy and Environmental Design) to draw the attention towards our built environment in such mid-latitude sites and derive implications simply for what could have been done to increase our communities level of friendship to environment. Results were scheduled using the LEED ND checklist. The results proved the case study to be "not certified" and recommendations were given to reaccredit the project considering the as built situation onsite.

Keywords:

Sustainable development, USGBC, LEED ND.

1. Introduction:

Since the British urban planning act and the garden city concept has emerged in early years of the 20th century, urban planning practice has been developed through the political and social transitions that passed through the neighborhood by mid-20th century, and ended

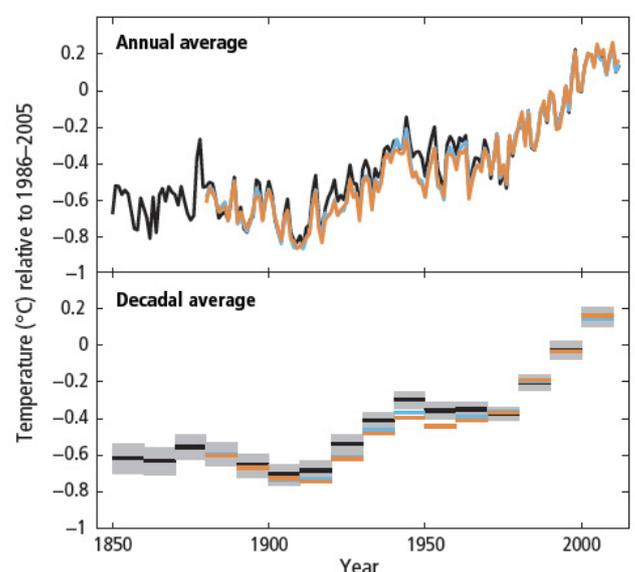
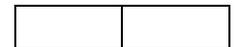


Fig. 1: Observed globally averaged combined land and ocean surface temperature anomaly 1850 - 2012



with the new urbanism and sustainability concepts [1-6].

Climate change is now all time events since Kyoto 1998 [7-9]. The voice of IPCC reports is getting louder to alarm the world about what climate change can do every year and everywhere [8, 10]. “There is a confidence that major symptoms include but not limited to temperature and sea level increase, as well as precipitation decrease under different GHG emission scenarios and according to the level of scientific understanding for the natural and anthropogenic radiative forces of global warming” [11, 12].

The human influence on the climate system is prominent, and recent harmful emissions of greenhouse gases are the highest in history. Recent climate changes have affected the human and the natural systems. Warming of the climate system is obvious, and since the 1950s, many of the observed changes are enormous over decades. The Earth's surface was found to be warmer through last three decades than any preceding decade since 1850. Global average combination of land and ocean surface temperature data as calculated by a linear trend showed a warming of 0.85 [0.65 to 1.06]°C over the period 1880 to 2012 (Fig. 1). The economic and population growth has led to an increase of the anthropogenic greenhouse gas emissions since the pre-industrial era. From 2000 to 2010, emissions made the highest record in history. Historical emissions have caused an unprecedented levels of concentrations of carbon dioxide, methane and nitrous oxide that have been recorded in at least the last 800,000 years (Fig. 2) [13].

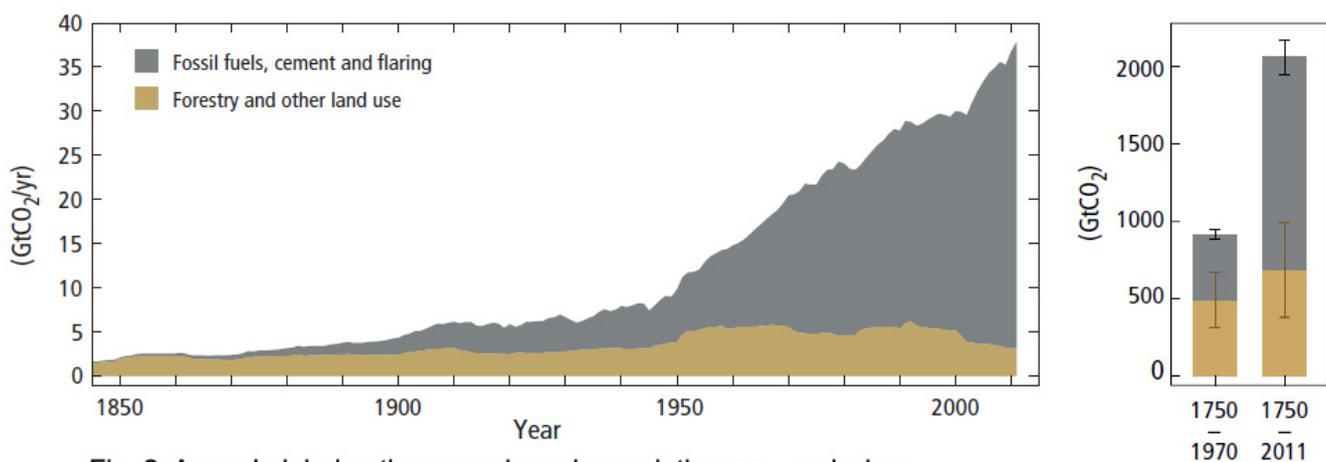
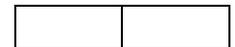


Fig. 2: Annual global anthropogenic and cumulative CO₂ emissions

IPCC, 2014: Climate Change 2014: Synthesis Report: Fifth Assessment Report of the Intergovernmental Panel on Climate Change. 2015.

This climate change threatens equitable and sustainable development. With potential for synergies and trade-offs, adaptation, mitigation and sustainable development are very likely to be related to each other[13]. As the term sustainability refers to make the environment maintain a balance between consuming natural resources and to fill up again [14-16], as defined by Brundtland[16], urban sustainability refers to a combination of its goal and concept. Consequently, the university, industry, and government have to play a key role in maintaining urban communities performing environmentally, socially, and economically balanced [14, 17]. These key points are the main three pillars of sustainability which deal with Social Justice (People), Environment (Planet), and Economics (Profit) which are called the Triple Bottom Line (TBM) [18, 19].



On the other hand, urban planning theories and sustainability concepts have met initially and generated the BRAEM rating system for buildings in the UK in 1990 whilst the LEED rating system came to practice by the year 2000. Nevertheless, regardless LEED has now about 50000 certified projects in comparison to about 200000 ones certified by the BREAM, LEED still the most famous rating system for sustainable buildings and urban developments.

Standing from statistics made by the U.S Green Building Council (USGBC)[19], conventional buildings severely impact the environment as they represent 39 % of CO₂ Emissions, 71% of electricity consumption, 40% of energy use, 12% of water use, and 65% of waste output (Fig. 3).

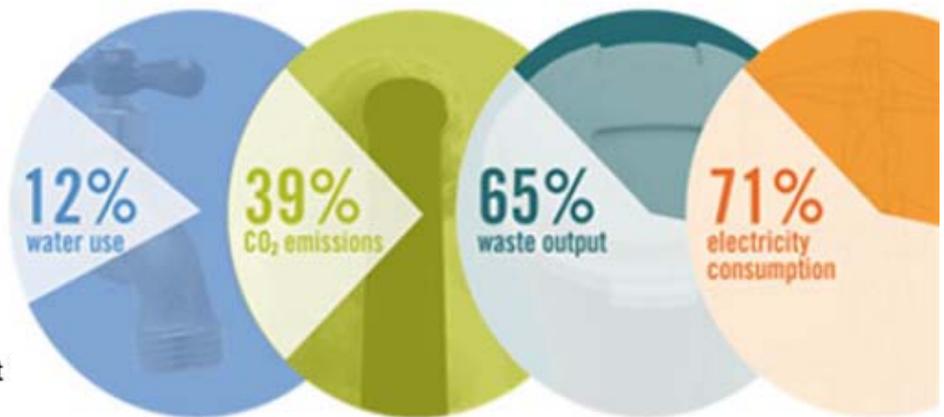


Fig. 3: impact of conventional buildings to the environment
www.usgbc.org

On the other hand, green buildings reduce CO₂ emissions by 33–39 %, reduce water use by 40 %, reduce waste output by 70 % and reduce energy use by 24–50 % (Fig. 4) [18, 19]. The Environmental Protection Agency [20] defined the green building as using environmentally responsible and resource-efficient processes throughout the building's life-cycle from sitting to design, construction, operation, maintenance, renovation and deconstruction. Green Building is

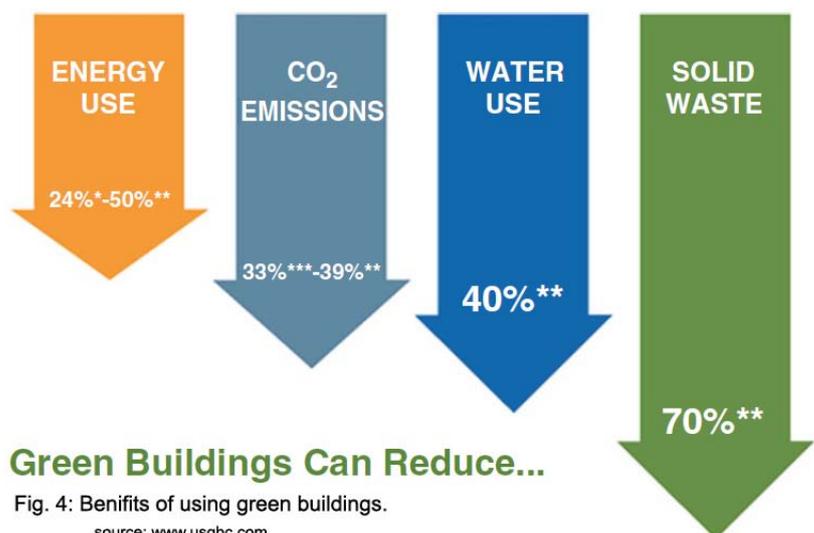
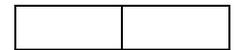


Fig. 4: Benefits of using green buildings.
source: www.usgbc.com

also known as a sustainable or highperformance building which is designed to reduce the overall impact of the built environment on human health and the natural environment. This could be achieved through an efficient use of energy, water, and other resources, and improving employee productivity and protecting occupant health and reducing waste, pollution and environmental degradation[18, 20]. The U.S. Green Building Council (USGBC) was established by Rick Fedrizzi, David Gottfried and Mike Italiano, in 1993 to consider the economic, environmental, and social costs and benefits generated by design and construction options [19, 21]. Enhancing sustainability in the building and construction industry was their mission. Representatives from firms and nonprofit organizations met for the council's founding meeting. Ideas handled the



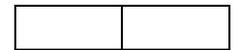
entire building industry and a green building rating system. Nowadays, USGBC's representatives include builders and environmentalists, corporations and nonprofits, elected officials and concerned citizens, and teachers and students. The USGBC has revealed the LEED in March 2000 as a rating system for commercial, institutional and residential projects [19]. The USGBC formulated LEED as an internationally recognized Green Building Certification System that provides third-party verification for a building or a community which was designed and built using strategies intended to improve performance such as water and energy efficiency, CO₂ emissions reduction, improved indoor environmental quality, management of resources and sensitivity to their impacts. LEED provides the project developers and occupants with a framework for identifying and implementing practical and measurable green building design, construction, and operations and maintenance [18]. LEED had a great effect on building and real estate markets, as said Patricia Kirk "[LEED] helps to ensure that users and buyers receive the environmental benefits they pay for, giving green building practices credibility in corporate America" [22, 23]. Prior to 2007, LEED certified only individual buildings until a new LEED rating system has emerged, LEED for Neighborhood Development (LEED-ND), which was formulated to certify development projects that consist of a multiple buildings scaling from a series of buildings to entire neighborhoods.

A partnership of the USGBC, the Congress for New Urbanism and the Natural Resources Defense Council (NRDC) developed LEED-ND rating system to encourage the greening of entire neighborhood developments and master planned communities [22]. "The act is attractive to legislators and developers because it is non-regulatory and offers incentives for creating these types of communities without imposing government standards" [24]. LEED-ND rating system was formulated to include three major categories: Smart Location and Linkage (SLL), Neighborhood Pattern and Design (NPD), and Green Infrastructure and buildings (GIB), besides two supplementary categories: Innovation (IN), and Regional Priority (RP) [19]. Following the many countries like USA in making green ratings for buildings and urban environments, Egypt developed the Green Pyramid Rating System and issued two levels of them; one for new constructions and the other for neighborhoods.

2. Methodology:

2.1. Accreditation:

A hypothetical study was implemented to the case study as if the project is applying for a LEED ND certification regardless that the inner credits of some categories such as NPD and GIB can earn points without achieving the prerequisite. Therefore, the point credits of NPD and GIB have been studied without meeting the prerequisite. This is to examine the project integrative approach to neighborhood development, and defining the developer's mission as to develop a sustainable urban community which has a degree of awareness to the sustainability goals to integrate smart growth, new urbanism, social equity, and green building practices. The study included accreditation of urban planning, architecture, civil engineering, transportation planning, mechanical and electrical engineering, landscape architecture, biology, and botany in the case study. The LEED ND Built Project rating system was selected rather than the LEED ND Plan due to having more than 80% of the project is at full build out. The study reviewed the minimum program requirements and specified the project boundary to calculate the buildable and non-



buildable portions of the project and the densities related to each portion. The study mainly focused on developing a LEED ND scorecard by tabulating an analysis for each prerequisite and credit, and determining how far the project team met the requirements of each prerequisite and credit, and defining the total credit points to decide whether to apply for a certification process.

2.2. Case study:

A project site, which is located 37.0 kilometers north-east of Cairo, in hot arid climate zone and with site area of 4.30 square kilometers, and project boundary perimeter of 9.12 kilometers. The project includes 60% for residential uses, 15% for non-residential and mixed-use, 5% for civic and public spaces, and 20% were assigned for future extension. The project contains multi-family separated and semi-detached dwelling units, at a residential density of 63 dwelling unit per hectare, and non-residential and mixed-use buildings, at a floor area ratio (FAR) of 0.75. The project area landuse is shown in figure 5. Estimated indoor water usage for the whole residential use, assuming 5 persons per dwelling unit, was calculated to be 495 KL/day.



Fig. 5: Project area landuse. (Source: Google earth image)

3. Results:

The accreditation process showed that the project was supposed to earn 1 of 28 points in SLL (3.5%), 18 of

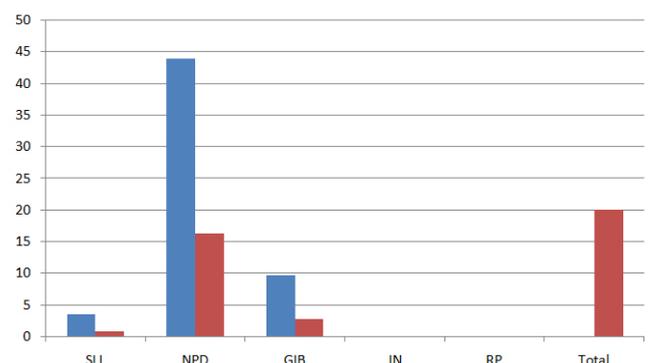


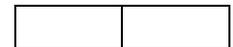
Fig. 6: Percentages of credit points achieved to each category and total certification points.



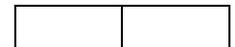
41 points in NPD (43.9%), and 3 of 31 points in GIB (0.9%), with a total 22 of 110 points (20%) as shown in figure 6. Thus, the project is not supposed to apply for a LEED ND Plan, or LEED ND Built Project certification. The Study approach to meet the requirements of prerequisites and credits is shown in Table 1. A LEED ND checklist was scheduled to show the points achieved through each credit and the aggregated points shown in Table 2.

Table 1: Meeting the requirements of prerequisites and credits.

Prerequisite / Credit		Meeting the requirements
Smart Location and Linkage (SLL).		
Prereq.	Smart Location.	The project satisfied the prerequisite as it's located on a site served by an existing water and wastewater infrastructure, and 30% of total gross area is a residential component and located within 400-meter walking distance of more than five uses.
Prereq.	Imperiled Species and Ecological Communities	The project satisfies the prerequisite as the project is located in a site without affected species or ecological communities according to the 4th national report of the Egyptian Environmental Affairs Agency (EEAA).
Prereq.	Wetland and Water Body Conservation	The project satisfies the prerequisite as the project is located in a site without sensitive wetlands, water bodies, land within 15 meters of wetlands, or land within 30 meters of water bodies.
Prereq.	Agricultural Land Conservation	The project satisfies the prerequisite by meeting option 3, as the project is located in a site without affected prime farmland, unique farmland, or farmland of local importance.
Prereq.	Floodplain Avoidance	The project satisfies the prerequisite by meeting case 1, as the project is located in a site without flood hazard areas.
Credit	Preferred Locations	The project doesn't meet any of the requirements of the credit as it's not located in an infill site, or a previously developed site. The project doesn't meet the connectivity requirements, and is not located in a high priority redevelopment area.
Credit	Brownfield Remediation	The project doesn't meet any of the requirements of the credit as it's not located in a Brownfield site.
Credit	Access to Quality Transit	The project doesn't meet any of the requirements of the credit as it's not located in a site within an existing or planned transit service.
Credit	Bicycle Facilities	The project doesn't meet any of the requirements of the credit as it does not include on any bicycle networks or storages or any on-site shower and changing facilities.
Credit	Housing and Jobs Proximity	The project doesn't meet any of the requirements of the credit as though it includes on more than 30% residential component, it's not connected to full-time equivalent jobs whose number equals or exceeds the number of dwelling units in the project.
Credit	Steep Slope Protection	The project doesn't meet any of the requirements of the credit as it's not located in a site with existing slopes greater than 15%.
Credit	Site Design for Habitat or Wetland and Water Body Conservation	The project does meet one of the requirements of the credit as it's not located in a site without significant habitat or wetlands and water bodies, and hence, earned 1 point.
Credit	Restoration of Habitat or Wetlands and Water Bodies	The project doesn't meet any of the requirements of the credit as it's not located in a site with native ecological communities, water bodies, or wetlands.
Credit	Long-Term Conservation Management of Habitat or Wetlands and Water Bodies	The project doesn't meet any of the requirements of the credit as it's not located in a site with native ecological communities, water bodies, or wetlands.
Neighborhood Pattern and Design (NPD).		
Prereq.	Walkable Streets	The project doesn't satisfy the prerequisite as 90% of new buildings don't have a functional entry to the circulation network, and less than 15% have a minimum building height-to-street centerline ratio of 1:1.5.
Prereq.	Compact Development	The project satisfied the prerequisite as it includes on residential density of more than 17.5 dwelling unit per hectare and nonresidential floor area ratio (FAR) of more than 0.6.
Prereq.	Connected and Open Community	The project satisfied the prerequisite as it includes on more than 54 internal intersections per square kilometers, and more than one through connection



		intersecting with abutting intervals of the circulation network.
Credit	Walkable Streets	The project does meet six of the requirements of the credit, as having 80% of total linear distance of building facades facing the circulation network is no more 5.5 meters from the property line, 50% of total linear distance of mixed-use or nonresidential building facades facing the circulation network are within 300 millimeters of sidewalks, all ground-level retail, service, and trade uses facing the circulation network are kept visible at night, 3-meter wide sidewalk on retail or mixed-use blocks and 1.5-meter wide sidewalk on other buildings, and an elevated finished floor of ground floor dwellings 90 centimeters above the grade level. Hence, the project earns 3 points.
Credit	Compact Development	The project earns 3 points as a weighted average of 4 points for residential density as building at more than 63 DU/hectare and 1 point for non-residential density as building at FAR of more than 0.75.
Credit	Mixed-Use Neighborhoods	The project earns 4 points as having more than 20 different uses that represent 5 different categories.
Credit	Housing Types and Affordability	The project earns 4 points as it scored a Simpson Diversity Index score greater than 0.7 as having a diversity of housing types.
Credit	Reduced Parking Footprint	Although the project meets the off-street parking requirements, the project earns no points as having no off-street parking spaces provided for carpool or shared vehicle for each nonresidential or mixed-use building.
Credit	Connected and Open Community	Although the project meets the connectivity requirements of more than 154 internal intersections, the project earns no points as having neither through connection that intersects the circulation network every 122 meters, nor a bicycling network for every new cul-de-sac.
Credit	Transit Facilities	The project earns no points as having no planned or existing transit service, or transit shelters.
Credit	Transportation Demand Management	The project earns no points as not having the following: <ul style="list-style-type: none"> - Valid transit passes subsidized of 100% of regular price, during the first three years. - 45 daily weekend trips and 30 daily weekend trips. - Vehicle sharing program. - Separately sold parking spaces. - Ride home program. - Flexible work arrangements.
Credit	Access to Civic & Public Space	The projects earns 1 point as having 90% of planned and existing units are located within 400 meters of one civic and public space at more than 4000 meters.
Credit	Access to Recreation Facilities	The projects earns 1 point as having 90% of planned and existing units' entrances are located within 800 meters of either six outdoor recreational facilities at more than 4000 sq. meters.
Credit	Visitability and Universal Design	The project doesn't meet the requirements of the credit as no single residential unit is built in accordance with ICC_A117.1, type C, Visitable unit.
Credit	Community Outreach and Involvement	The project earns no points as it didn't advertise or host any community meetings within the pre-design or the preliminary design stages.
Credit	Local Food Production	The project earns no points as having no greenhouses, though having a community garden outside the project boundary, but not within 800 meters of the project boundary. The project hasn't purchased a sharing agriculture program for more than 80% of new dwelling units. The project includes on no one farmer's market.
Credit	Tree-Lined and Shaded Streetscapes	The project earns 1 point as it provides trees along more than 60% of block lengths within the project.
Credit	Neighborhood Schools	The project earns 1 point as it includes on 2 middle schools of less than 4 hectares and 1 elementary school of less than 2 hectares, besides meeting the credit requirement that 50% of dwelling units are within the functional entries of the schools.
Green Infrastructure and Buildings (GIB).		
Prereq.	Certified Green Building	The project doesn't satisfy the prerequisite as no existing or new building is certified under LEED or any third party that have been accredited by an IAF-accredited body to ISO/IEC guide 65, or ISO/IEC 17065.
Prereq.	Minimum Building Energy Performance	The Project doesn't satisfy the prerequisite as having no improvements over ANSI/ASHRAE/IESNA 90.1-2010 or ASHREA 50%, and no buildings meets



		LEED for Homes v4 EA prerequisite: minimum energy performance.
Prereq.	Indoor Water Use Reduction	The project doesn't satisfy the prerequisite as there are no fixtures or fittings are WATERSENSE Labeled or meeting LEED for Homes v4 WE credit: indoor water use.
Prereq.	Construction Activity Pollution Prevention	The project doesn't satisfy the prerequisite as having no erosion and sedimentation control plan that is selected from the EPA's best management practices (BMPs) for construction and post-construction site runoff control.
Credit	Certified Green Buildings	The project earns no points as no existing or new building is certified under LEED or any third party that have been accredited by an IAF-accredited body to ISO/IEC guide 65, or ISO/IEC 17065.
Credit	Optimize Building Energy Performance	The project earns no points as having no improvements in accordance with ANSI/ASHRAE/IESNA 90.1-2010 or ASHRAE 50% advanced energy design guide or meeting GIB Prerequisite Minimum Building Energy Performance, Option 2 or LEED for Homes v4 EA credit: annual energy use.
Credit	Indoor Water Use Reduction	The project earns no points as there are no fixtures or fittings are Watersense labeled or meeting LEED for Homes v4 WE credit: indoor water use.
Credit	Outdoor Water Use Reduction	The project earns no point as it uses plants species that need permanent irrigation system and not selected or irrigated using environmental protection agency (EPA) water sense water budget tool.
Credit	Building Reuse	The project earns no points as there are no buildings to reuse.
Credit	Historic Resource Preservation and Adaptive Reuse	The project earns no points as there are no historic buildings or contributing buildings in a historic district.
Credit	Minimized Site Disturbance	The project earns no points as it's not located on a previously developed land and undeveloped land is planned for future development.
Credit	Rainwater Management	The project earns no points as it does not use the methodology in the US EPA technical guidance on implementing the stormwater runoff requirements.
Credit	Heat Island Reduction	The project earns no points as it doesn't meet the requirements of non-roof or the high-reflectance and vegetated roofs.
Credit	Solar Orientation	The project earns 1 point as more than 75% of total block lengths are +8 degrees of geographical east-west and the project earned 3 points in NPD CREDIT: COMPACT DEVELOPMENT.
Credit	Renewable Energy Production	The project earns no points as it doesn't use on-site renewable energy generation.
Credit	District Heating and Cooling	The project earns 2 point as includes on a district heating and/or cooling system that covers more than 80% of the project's annual heating and/or cooling consumption.
Credit	Infrastructure Energy Efficiency	The project earns no points as it didn't achieve a 15% annual energy reduction from a baseline energy use for the infrastructure.
Credit	Wastewater Management	The project earns no points as it doesn't include on a wastewater treatment facility.
Credit	Recycled and Reused Infrastructure	The project earns no points as it doesn't include on recycling station, drop-off point for hazardous materials, compost station, recycling containers, and the project didn't use any recycled or reused construction materials.
Credit	Solid Waste Management	The project earns no points as it doesn't include on recycling station, drop-off point for hazardous materials, compost station, recycling containers, and the project didn't use any recycled or reused construction materials.
Credit	Light Pollution Reduction	The project earns no points as it doesn't comply with IES TM-15-11, Addendum A.
Innovation and Design Process (IN).		
Credit	Innovation	The project earns no points.
Credit	LEED® Accredited Professional	The project earns no points as the project team doesn't include a LEED Accredited Professional (APs).
Regional Priority (RP).		
Credit	Regional Priority Credit: Region Defined	The project earns no points as the project is not located in a regional priority defined by the USGBC.

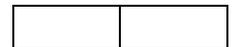


Table 2: LEED ND Checklist.						
		LEED v4 for Neighborhood Development.				Project Name: Future city
		Project Checklist				
Yes	?	No				
1	0	27		Smart Location & Linkage		28
Y			Prereq	Smart Location		Required
Y			Prereq	Imperiled Species and Ecological Communities		Required
Y			Prereq	Wetland and Water Body Conservation		Required
Y			Prereq	Agricultural Land Conservation		Required
Y			Prereq	Floodplain Avoidance		Required
0		10	Credit	Preferred Locations		10
0		2	Credit	Brownfield Remediation		2
0		7	Credit	Access to Quality Transit		7
0		2	Credit	Bicycle Facilities		2
0		3	Credit	Housing and Jobs Proximity		3
0		1	Credit	Steep Slope Protection		1
1		0	Credit	Site Design for Habitat or Wetland and Water Body Conservation		1
0		1	Credit	Restoration of Habitat or Wetlands and Water Bodies		1
0		1	Credit	Long-Term Conservation Management of Habitat or Wetlands and Water Bodies		1
18	0	23		Neighborhood Pattern & Design		41
		N	Prereq	Walkable Streets		Required
Y			Prereq	Compact Development		Required
Y			Prereq	Connected and Open Community		Required
3		6	Credit	Walkable Streets		9
3		3	Credit	Compact Development		6
4		4	Credit	Mixed-Use Neighborhoods		4
4		3	Credit	Housing Types and Affordability		7
0		1	Credit	Reduced Parking Footprint		1
0		2	Credit	Connected and Open Community		2
0		1	Credit	Transit Facilities		1
0		2	Credit	Transportation Demand Management		2
1		0	Credit	Access to Civic & Public Space		1
1		0	Credit	Access to Recreation Facilities		1
0		1	Credit	Visitability and Universal Design		1
0		2	Credit	Community Outreach and Involvement		2
0		1	Credit	Local Food Production		1
1		1	Credit	Tree-Lined and Shaded Streetscapes		2
1		0	Credit	Neighborhood Schools		1
3	0	28		Green Infrastructure & Buildings		31
		N	Prereq	Certified Green Building		Required
		N	Prereq	Minimum Building Energy Performance		Required



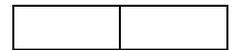
		N	Prereq	Indoor Water Use Reduction	Required	
		N	Prereq	Construction Activity Pollution Prevention	Required	
0		5	Credit	Certified Green Buildings	5	
0		2	Credit	Optimize Building Energy Performance	2	
0		1	Credit	Indoor Water Use Reduction	1	
0		2	Credit	Outdoor Water Use Reduction	2	
0		1	Credit	Building Reuse	1	
0		2	Credit	Historic Resource Preservation and Adaptive Reuse	2	
0		1	Credit	Minimized Site Disturbance	1	
0		4	Credit	Rainwater Management	4	
0		1	Credit	Heat Island Reduction	1	
1		0	Credit	Solar Orientation	1	
0		3	Credit	Renewable Energy Production	3	
2		0	Credit	District Heating and Cooling	2	
0		1	Credit	Infrastructure Energy Efficiency	1	
0		2	Credit	Wastewater Management	2	
0		1	Credit	Recycled and Reused Infrastructure	1	
0		1	Credit	Solid Waste Management	1	
0		1	Credit	Light Pollution Reduction	1	
0	0	6	Innovation & Design Process			6
0		5	Credit	Innovation	5	
0		1	Credit	LEED [®] Accredited Professional	1	
0	0	4	Regional Priority Credits			4
0		1	Credit	Regional Priority Credit: Region Defined	1	
0		1	Credit	Regional Priority Credit: Region Defined	1	
0		1	Credit	Regional Priority Credit: Region Defined	1	
0		1	Credit	Regional Priority Credit: Region Defined	1	
24	0	86	PROJECT TOTALS (Certification estimates)			110
Certified: 40-49 points, Silver: 50-59 points, Gold: 60-79 points, Platinum: 80+ points						

4. Discussion:

Results have shown that the project is not supposed to apply for a LEED ND certification. Therefore, the following are the study recommendations for the project team whether to apply for the certification later on:

For Smart Location and Linkage (SLL), the project team is recommended to include the following to meet the requirements of credits:

- A public transit service such that transit stops are located within 400 meters of all residential and nonresidential unit entrances, and to provide a minimum of 60 weekday trips and 40 weekend trips;
- Bicycling network which is connected to residential, nonresidential, and mixed-use buildings, providing sufficient bicycle storage for regular occupants and peak visitors; and
- Provide sufficient on-site showers and changing facilities.



It's recommended to document a Credit Interpretation (CIR) to the USGBC to assign credit points to developments on sites that are not located on brownfields, and developments that are located on sites with slopes more than 15%.

The Housing and Building Research Center (HBRC) is recommended to develop a list of priority sites, infill sites, previously developed sites, or sites that have existing connectivity to its boundaries, on which the development to be promoted.

The Public Transportation Authority has to commit funding and facilitating the transit service.

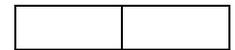
For Neighborhood Pattern and Design (NPD), the project team is recommended to consider and include the following to meet the prerequisites and credits:

- Building the functional entries to the circulation network or other public spaces;
- Circulation network has both sides of continuous sidewalks minimum 2.5m wide so that off-street parking lots are located on side and rear of the buildings.
- The block lengths have to be at a minimum of 1:1.5 from street centerline to building façade;
- Retail, service, and trade uses are located on the ground floor with more than 60% clear glass of its facades, such that no more than 40% of its facades are blank;
- Define restriction speeds at 30-40 km/h for every residential and mixed-use motorized part;
- Priced affordable housing for householder earning less than the Area Median Income (AMI);
- Preferred parking for car pool and shared-use vehicle;
- Designing the circulation network so that a through connection links and intersects the project boundary or other intervals of circulation network at short distances ranging from 100-120 m;
- Install transit agency-approved shelters that must be covered, be at least partially enclosed, have seating and illumination, and have signage that display transit schedules and route information;
- Valid transit passes subsidized of 100% of regular price, to each resident and employee locating within the project during the first three years of project occupancy;
- Bicycle racks but no less than one bicycle rack per transit stop;
- Parking spaces must be sold separately;
- Guarantee a ride home program and flexible work arrangements;
- Design the residential units in accordance with ICC_A117.1, type C, VISIBLE unit standards;
- Ongoing means for communication between the developer and the community throughout the design and construction phases; and
- Shade using trees and permanent structures along the circulation network.

It's recommended to document a Credit Interpretation (CIR) to the USGBC to exclude the car pool and shared-use vehicle points out of this credit, so that it might be stated in a separate credit.

For Green Infrastructure and Buildings (GIB), the project team is recommended to do the following to meet the prerequisites and credits:

- Achieve improvements to the energy consumption over ANSI/ASHRAE/IESNA 90.1-2010 and ASHREA 50%. The Project team is recommended to work in accordance to LEED for Homes V4;
- Provide WATERSENSE labeled fixtures and fittings to all residential and nonresidential units within the project;



- Create and implement a plan for erosion and sedimentation control, selected from the EPA's best management practices (BMPs);
- Certify one or more buildings through LEED rating system;
- Include Plants species with no need for permanent irrigation system, and selected or irrigated using environmental protection agency (EPA) water sense water budget tool;
- Use the methodology in the US EPA technical guidance on implementing the stormwater runoff requirements;
- Use renewable energy generation systems, vegetated roofs, and material with high solar reflectance indices, and provide shade to paving areas;
- Use infrastructure with recycled content according to ISO/IEC 14021, to achieve annual energy reduction;
- Include a wastewater treatment plant;
- Include recycling or reuse station, specify a drop-off point for potentially hazardous wastes, install recycling containers, and make use of recycled or reused construction materials; and
- Comply with the backlight-uplight-glare (BUG) rating as defined in IES TM-15-11, Addendum A, and IES/IDA MLO.

The USGBC is recommended to exclude GIB Prerequisite: Certifies Green Building of the certification process as meeting the other prerequisites for this category includes on distinguished improvements to the energy performance, heat island reduction, and water use management.

5. Conclusion:

The study has demonstrated that our communities needs to stand for the social, economical and environmental aspects in the early design stage of new urban developments, considering public transit and bicycling networks, and the public realm amenities as well, in order to enhance the social life of the community and to promote the green living. Giving more attention to the passive solar design using of renewable energy strategies help to reduce the total energy consumption of our communities and thus to preserve our environment. A better way through to achieve such green living requires the best use of our natural resources, taking into consideration the recycling strategies within each design stage. The study has shed some light on one of the most common and used tool for achieving the sustainability goals, the LEED ND, which extends the limits of urban planners and developers beyond the conventional neighborhood design, reaching to an integrative design process of urban planning to a sustainable urban development.

References:

1. Cullen, G., *Townscape*. . 1961, London: The Architectural Press.
2. Howard, E., *Garden cities of to-morrow : being the second edition of "Tomorrow: a peaceful path to real reform"*. London: Swan Sonnenschein & Co. 2 ed. 1902, Cambridge, MA: MIT Press
3. Jacobs, J., *The Death and Life of Great American Cities*. . 1961, New York: Random House.
4. Lynch, K. and G. Hack, *Site Planning*. 1984, Cambndge, MA: MIT press.
5. Mumford, E.P., *The CIAM Discourse on Urbanism*. 2002, Cambridge, MA: MIT press.
6. Andrusz, G., *From Wall to Mall*, in *Winds of Societal Change: Remaking Post-Communist Cities*. 2004: University of Illinois, June 18-19.
7. IPCC. *HadCM3 climate scenario data download page*, www.ipcc-data.org/sres/hadcm3_download.html. 2010 [cited 2010 25-5].
8. IPCC, *Climate Change 2007: Synthesis Report, fourth assessment report of climate change*. Online at: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml. 2011: Valencia, Spain.



9. Levermore, G.J., *A review of the IPCC Assessment Report Four, Part 1: the IPCC process and greenhouse gas emission trends from buildings worldwide*. Building Service Engineering, 2008. **29**(4): p. 349-361.
10. Holmes, M.J. and J.N. Hacker, *Climate change, thermal comfort and energy: Meeting the design challenges of the 21st century*. Energy and Buildings, 2007. **39**(7): p. 802-814.
11. Fahmy, M., *Numerical assessment for urban developments on a climate change basis; A case study in New Cairo, Egypt in 2nd International Conference on quality of life, Modern University for Technology & Information* 2012: 18-19 March 2012, Cairo, Egypt.
12. Fahmy, M., *Climate Change Adaptation for Mid-latitude Urban Developments, in PLEA2012 - 28th Conference, Opportunities, Limits & Needs Towards an environmentally responsible architecture* 2012: Lima, Perú 7-9 November 2012.
13. Contribution of Working Groups I, I.a.I., *IPCC, 2014: Climate Change 2014: Synthesis Report: Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. 2015.
14. Rizk, H. and M. Fahmy, *Hybrid microclimatic village planning methodology for sustainable desert settlements; revisiting Mid -Sinai as a case study, in 9th International Conference on Civil and Architecture Engineering ICCAE-9-2012*. 2012: Military Technical College.
15. Hoballah, A., *Sustainable development in the Mediterranean region*. Natural Resources Forum, 2006. **30**(2): p. 157 - 167
16. Brundtland, G.H., *Global change and our common future*. Environment, 1989. **31**(5): p. 16-42.
17. Lombardi, P., *An Advanced Triple-Helix Network Model for Smart Cities Performance, in Green and ecological technologies for urban planning: creating smart cities*. 1977.
18. Seigel, J.S., *The Green Building Revolution: Advancing Sustainability at Exponential Speed, in CSR, Sustainability, Ethics & Governance* 2013. p. 253-264.
19. *United States Green Building Council (USGBC)*. 2016 February 24, 2016]; Available from: <http://www.usgbc.org>.
20. *U.S Environmental Protection Agency (EPA)*. 2016 February 25, 2016]; Available from: www.epa.org.
21. Solomon and Nancy, *How Is LEED Faring After Five Years in Use?* Architectural Record, 2005. **193**(6).
22. Black, E., *Green Neighborhood Standards from a Planning Perspective: The LEED for Neighborhood Development (LEED-ND)*. Focus, 2008. **5**(1).
23. Kirk, P., *designing the way to green: Environmental design is now synonymous with sustainable, or green, design*. Urban Land, 2006.
24. Stromberg, M., *Illinois to Offer Incentives for LEED Certified Developments*. American Planning Association, 2007. **73**(10): p. 53-53.