An Approach to Integrate the Environmental Impact Assessment Process in the Early Stages of Design

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Abstract:
Nowadays, the integration of environmental dimensions in design process - and particularly in buildings that holding major event - has become not optional anymore. Consideration to environmental principles, effects of climate and sustainability in renewable resources is very important for building's occupants. Adopting these concepts has driven most countries to adopt official strategies and policies in order to insure appropriate building designs. Certain certification such as "LEED"[1], "BREEAM"[2], and "Green Star"[3] become one of the required and essential documents for construction approval. However, policies without awareness of assessment methodologies and tools are not enough, where specific and appropriate methods and tools could be employed. Thus, this research aims at providing a proposed methodology for environmental design process that takes into consideration the environmental impact assessment (EIA). The proposed methodology employs the environmental assessor (LEED) to judge the compatibility of the design with principles of sustainability, in addition to computer based tools in order to quantify the effectiveness of proposed passive strategies and measures. The use of computer allows the visualization of the unseen environmental attributes in a three dimensional interface, allowing by such comprehensive understanding of the issues involved in the assessment process.
In this way, design proposals in the early stages of design; (I.e. design concept, orientation of buildings, using passive strategies…etc) could be quantified. This helps the designer to take the appropriate decisions in the right time. In an advanced stage but before construction, building details such as; building material, façade designs and projections, colours of the buildings, opening size and design, also could be tested and quantified. The result of the current research is the proposed methodology for the integration of the environmental dimensions in the design process. It is worth mentioning here that the author of the paper have applied the proposed methodology successfully on several projects on the regional level. Next paper will show the application of the methodology on these projects.
Key words: Computer based tools, Environmental Impact Assessment (EIA), Environmental Assessors, Renewable Resources, and Sustainability.

[1] LEED: Leadership in Energy and Environmental Design - http://www.usgbc.org/DisplayPage.aspx?CategoryID=19
[2] BREEAM: Building Research Establishment Environmental Assessment Method http://www.breeam.org
[3] Green Star: Green Star environmental rating system http://www.gbca.org.au/green-star/

1. Introduction and Research Problem

Buildings in developing countries such as Egypt are often designed without taking sufficient account of the climate [1-4]. Factors such as urban density, site characteristics, climate, orientation, architectural design of the building and choice of building materials are usually not given enough thought. In the best cases, some thought is given to such factors but without a scientific methodology that takes into consideration using the appropriate climatic data and the appropriate assessment tools. Consequently, buildings often have a poor indoor environment quality which in turn affects human comfort, health and efficiency [1]. The architectural designer should attempt to perform the control task by passive controls (i.e. by the building itself), and resort to active controls (i.e. by energy-based heating or cooling systems), only when the passive controls cannot ensure comfort. The process of investigating the effectiveness of any environmental design control strategy and measure is also complicated. The number of issues related with such investigation is immense, overlapped and interlinked [7]. The tasks involved in the investigation could be summarized as follows.

1. Choosing the assessment criteria "environmental assessor";
2. Setting out the guidelines and recommendations for the design;
3. Analyzing the climatic context including; obtaining, designing, modifying, analyzing and visualizing the climatic data;
4. Identifying promising passive strategies and measures;
5. Quantifying the effectiveness of the proposed passive strategies and measures;
6. Quantifying the compatibility with the appropriate environmental assessor;
7. Revision and feedback;

The current research tries to clarify the relationships of these issues and set out the framework of a proposed methodology aims to integrate these processes in the early stages of the design.

2. Previous work

Nothing, but few, was found in the literature that sets out a framework for a scientific methodology that can be employed to assess the design and quantify the effectiveness of passive strategies and measures in the early stages of design. Mohamed and Gado [7], set out a methodology that can be applied to test the environmental performance of buildings in research projects or existing building. Their methodology included three stages of studies; theoretical study, field study, and computer based study. This methodology was concerned by the process of quantifying the effectiveness of passive strategies and did not cover all the sustainability aspects. Mohamed [1], set out a detailed methodology to investigate and quantify the thermal performance of existing buildings and quantify the enhancement in the environmental performance in case of using modified passive measures to the buildings. In Egypt, most of the environmental assessment for competition projects and practice projects is done based on the superficial understanding of the environmental design principles. Issues such as orientation, sustainability, green architecture are not quantified but only be judged from the appearance point of view. A gap in the environmental design process was identified which this paper tries to fill by devising a detailed comprehensive methodology and discussing the main issues involved.

3. Aim and objectives

This paper aims to device a detailed comprehensive methodology that can be applied on the design process to integrate the environmental Impact assessment (EIA). To fulfil the research main aim, a number of objectives are being achieved. These are:

a. Identifying the environmental design targets and setting out the guidelines and recommendations for the design;

b. Analyzing the climatic context including; obtaining, designing, modifying, analyzing and visualizing the climatic data and Identifying promising passive strategies and measures;

c. Quantifying the effectiveness of passive strategies and measures in buildings during the design process;

d. Conducted the EIA using the proposed environmental assessor.

4. Research general methodology

The proposed methodology includes two main studies; theoretical study and computer based study. The theoretical study is employed in order to identify the design targets and proposed successful strategies and measurements for achieving design goals. While the computer based study is utilized to quantify the effectiveness of those proposed passive strategies and measures. This is achieved through two tasks; climatic context analysis and computer simulation. In order to analyse the climatic context, a suitable set of climatic data of the location under investigation is needed. The proposed methodology employs a method of designing hourly climatic data to be used in case of actual data is not available. On obtaining the hourly climatic data, Weather Tool software is used to visualise and analyse the data to propose potential passive design strategies and measures. Having identified the potential passive measures and strategies through the theoretical analysis and climatic context analysis, a set of computer simulation software (Autodesk Ecotect) is used to simulate the environmental performance of the case studies. Results are then analyzed using spreadsheets to present the effectiveness of the proposed measures and strategies under investigation. Figure 1, illustrate the outline of the proposed general methodology of the research.

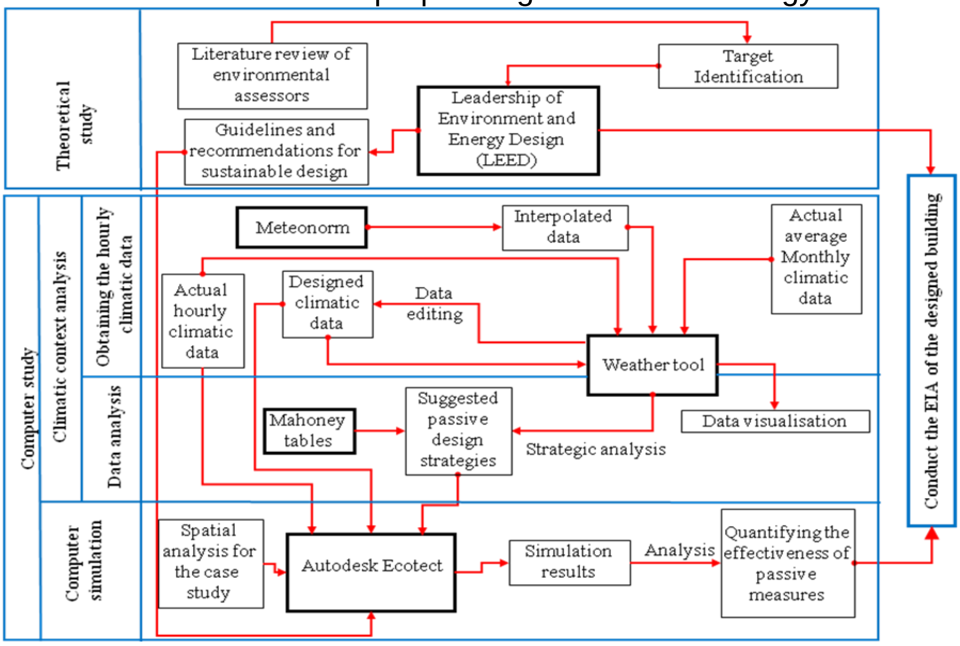


Figure 1: Research proposed general methodology

5. Processes of integrating the EIA during the design process

5.1. Environmental design targets identification

At present, there are few comprehensive environmental assessment tools for major international event buildings. All these tools aim to assess the sustainability of buildings including environmental aspects. This methodology employs the Leadership in Energy and Environment Design "LEED"[1] that developed in USA by the U.S. Green Building Council for new construction as one of the most known environmental assessors in the market nowadays. The first LEED Pilot Project Program, also referred to as LEED Version 1.0, was launched at the USGBC Membership Summit in August 1998. After extensive modifications, the LEED Green Building Rating System Version 2.0 was released in March 2000. This rating system is now called the LEED Green Building Rating System for New Commercial Construction and Major Renovations, or LEED for New Construction [8]. The LEED tool started to be used widely and internationally. Some Arabic country such as United Arabic Emirates UAE and Asian country such as India employed the LEED tool to assess the Environmental Impact Assessment for their buildings. These countries similar to Egypt in their climate (Hot arid zone). Consequently, a new LEED for Egypt could be developed.

The LEED tool aims to provide building stakeholders with a "report card" that indicates the health, efficiency, and comfort of the buildings. LEED recognizes the unique nature of the design and construction of ASHRAE Advanced Energy Design Guide [9] and addresses the specific needs of building spaces and occupant's health issues [10]. LEED is flexible to apply to all project types including healthcare facilities, schools, homes and even entire neighborhoods. Rating systems are groups of requirements for projects that want to achieve LEED certification. Each group is geared towards the unique needs of a project or building type. Projects earn points to satisfy green building requirements. Within each of the LEED credit categories, projects must satisfy prerequisites and earn points. The number of points the project earns determines its level of LEED certification. Based on the LEED for New Construction rating system, it addresses the following five issues in addition to two bonus credit categories [11].

- **Sustainable sites credits** encourage strategies that minimize the impact on ecosystems and water resources;
- **Water efficiency credits** promote smarter use of water, inside and out, to reduce potable water consumption;
- **Energy & atmosphere credits** promote better building energy performance through innovative strategies;
- **Materials & resources credits** encourage using sustainable building materials and reducing waste;
- **Indoor environmental quality credits** promote better indoor air quality and access to daylight and views;
- **Innovation in design or innovation in operations credits** address sustainable building expertise as well as design measures not covered under the five LEED credit categories. Six bonus points are available in this category;
- **Regional priority credits** address regional environmental priorities for buildings in different geographic regions. Four bonus points are available in this category;

The allocation of points between credits is based on the potential environmental impacts and human benefits of each credit with respect to a set of impact categories. The impacts are defined as the environmental or human effect of the design, construction, operation, and maintenance of the building, such as greenhouse gas emissions, fossil fuel use, toxins and carcinogens, air and water pollutants, indoor environmental conditions. A combination of approaches, including energy modelling, life-cycle assessment, and transportation analysis, is used to quantify each type of impact. The resulting allocation of points among credits is called credit weighting [12]. These credit weightings is shown in **Error! Reference source not found.**.

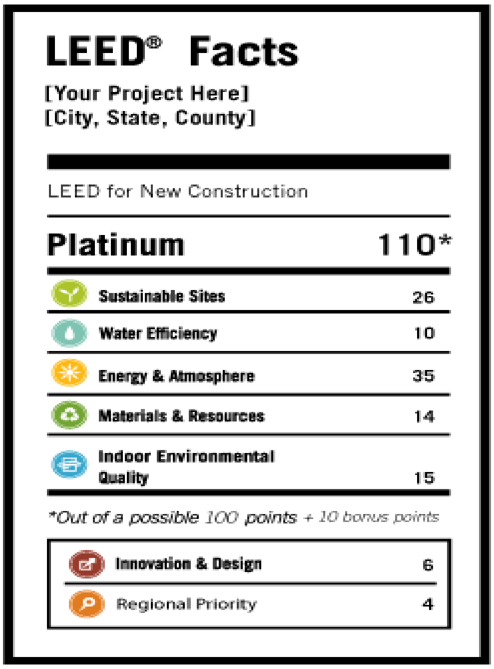


Figure 2: the credits weighting of the environmental categories of the LEED

LEED 2009 for New Construction and Major Renovations certifications are awarded according to the following scale in

Table 1.

Table 1: Certification scale of LEED

LEED Ratings	LEED v3
Certified	40-49 point
Silver	50-59 points
Gold	60-79 points
Platinum	80+ points

Most of the LEED issues could be quantified by analysing the design input data, while other issues such as Indoor Environmental Quality (IEQ) needs a quantification tool to be assessed. This methodology employs thermal comfort and energy efficiency as environmental design targets. The effectiveness of the proposed measures is determined according to its ability to passively achieve thermal comfort by using minimum amount of energy possible. this helps the designer to recognize successful LEED strategies and measurements for achieving credit category goals.

5.2. Climatic context analysis

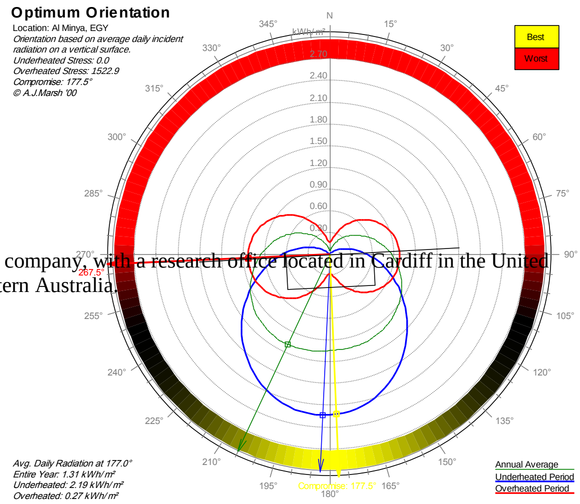
5.2.1. Obtaining climatic data

To conduct any investigation into the environmental performance of buildings, comprehensive climatic data is needed to analysis the climatic context of the case study and to carry out the calculation. The most important data any researcher in this field need are; Dry Bulb Temperature, Relative Humidity, Direct, Solar Radiation, Diffuse Horizontal Solar Radiation, Wind speed, Wind direction, Cloudiness and Rainfall. There is a few numbers of sources which present these data. The commonest of them are; U.S. department of energy[4], Square one research5. Others present only the monthly average, maximum and minimum data e.g. World Climate6, NCDC national climatic data center7…..etc. Unfortunately, these comprehensive and accurate hourly weather data is always difficult to find. Except a few number of countries e.g. USA, UK, Australia, Canada, France, Italy, and Germany. For example, the hourly data is found only for two cities in Egypt which are Cairo and Aswan.

Consequently, to carry out an environmental research in most of the world countries, there are a few options. Firstly is the actual monthly average data which will not lead to comprehensive results. Secondly is the real hourly data meteorological authority. However, the difficulties in obtaining these data are that it is very expensive (for example in Egypt each datum for one element in every hour by 1.5 Egyptian pound[8]) and it is only supplied as a hard print-out, not in an electronic form. Thirdly and may be the only available option is to design the hourly data in two ways:

Firstly: One way is to use Typical Meteorological Year (TMY) climatic file. The author of the current paper participated Joe Huang (the developer of the Egyptian TMY (ETMY) files for the Egyptian cities, He was working at the Ernest Orlando Lawrence Berkeley National Laboratory, University of California [13]) to design The Egyptian Typical Metrological Year "ETMY" file for al-Minya city for the sake of the PhD research of the author. The data of the climatic file had been developed for standards development and energy simulation from raw data provided by the National Climatic Data Centre (NCDC) for periods of record from 12 to 21 year. The procedure used to create the TMY files is based on the method described in the Typical Meteorological Year User's Manual (National Climatic Center 1981). In brief, the creation is done in three steps after having a historical raw climatic data from any provider such as the NCDC for at least 12 years, a) selecting the most representative months from the raw data, b) filling the missing data, c) Creating the TMY file.

Secondly: The other way is to utilize synthesised climatic data generated by Meteonorm software[9] which interpolates the climatic data needed for a certain location using the information from the nearest meteorological



[4] http://www.eere.energy.gov/buildings/energyplus/,
[5] http://www.squ1.com/ecotect/ecotect.html, Square One research is an Australian company, with a research office located in Cardiff in the United Kingdom and the main management / administration office located in Perth, Western Australia.
[6] http://www.worldclimate.com/
[7] http://www.ncdc.noaa.gov/oa/ncdc.html
[8] The Egyptian meteorological authority in March 2005
[9] www.meteotest.ch/en/firma

station to this location. Interpolated data is then rescaled using the 'Synthesis Data' feature of Weather Tool software[10].

5.2.2. Visualization and analysis

There are several computer-based tools in the market that can be used to analyse climatic data. The majority of the available software is limited to a single function such as plotting psychometric charts. Example of such tolls is HDPsyChart [11] and CYTSoft [12]. In addition, they are not intended to architectural use but rather oriented towards thermodynamics-related industries such as HVAC to help solving problems involving moist air [7]. The proposed methodology utilizes Weather Tool to visualize and analysis both monthly and hourly climate data. It recognizes a wide range of international weather file formats such as fixed format weather files, separated value files, and linear row data files. Most importantly, it can also perform several analysis functions including assessing the relative potential of different passive design strategies and measures and accurately determining the optimum orientation for specific building design criteria as shown in Figure 3.

Figure 3: Example of using the Weather Tool to visualise the best orientation for the building, for Al-Minya City, by the author after Weather Tool

5.3. Computer simulation

5.3.1. Formulating potential passive strategies and measures

The proposed methodology uses three methods to formulate potential passive strategies and measures that can be applied to the case study to improve its environmental performance.

Analytical investigation into methods of dealing with climatic used by vernacular and contemporary architecture within the context of the case study.

Weather Tool software that uses Svszokolay method of Psychrometric analysis is used to plot the hourly climatic data points on a Psychrometric chart. An overlay is drawn representing the comfort zone before and after using any of six passive strategies including passive solar heating, natural ventilation, night purge ventilation, direct passive cooling, indirect passive cooling and thermal mass. [7].

Computer-based version of Mahoney tables developed at the department of Housing Development & Management at the School of Architecture, Lund University [13] is used to suggest passive strategies.

5.3.2. Quantifying the effectiveness of the proposed passive measures

Techniques used to assess building environmental performance and quantifying the effectiveness of the proposed passive strategies and measures can be grouped into two main categories; experimental and mathematical. Experimental category includes scale model and full-scale experiments and field monitoring. The later obviously requires the

[10] www.squ1.com/software/ weather-tool/features.html
[11] www.chempute.com/psychro.htm
[12] www.cytsoft.com
[13] www.hdm.lth.se/TRAINING/Postgrad/AEE/index.htm

building to be built already. Mathematical category includes analytical study and numerical study (Computer based assessment) could be applied any time; before, during and after constructing the building. These four tools are explained below [14].

Scale model (physical model) can be used when the physical phenomena are not scale dependent or if the loss of accuracy is acceptable. Parameters such as lighting and acoustics performance of spaces could be investigated. Scale models are cheap and can be tested under real conditions. Under artificial conditions, experiments are reproductive, which facilitates variants comparison. But, measurement errors may be resulted from scale model effects, level of detail and material effects. Energy consumption and other environmental parameters such as thermal performance, environment impact assessment is not accessible on a scale model.

Full-scale experimentation is probably the oldest method used to assess a physical phenomenon and supplies unarguable information. It is appropriate to collect information to assess directly the environmental performance or to compare a mathematical model with in-site measurements. The advantage of the experimental approach is that it deals with reality and therefore errors are limited to experimental procedures. However, it is very expensive and time consuming.

Many physical phenomena are predictable with complex mathematical models. Under appropriate and acceptable assumptions, complex equations can be simplified with certain assumptions to provide analytical solutions, which show the degree of dependence between the parameters and the relative importance of the various terms. These analytical equations are simple but must be used within the assumption frame. Otherwise it will lead to an erroneous analysis and inaccurate results.

The appearance of computer-based environmental analysis tools has made possible the numerical resolution of complex physical phenomena. The model implementation may be complex and may require a calibration/validation of the model, but the numerical approach simplifies the study of parametric analysis.

A holistic approach to building design requires a method to estimate the performance that will result from the interactions between the different domains. Table 2, summarizes the capabilities of the available approaches.

Table 2: Comparison of environmental assessment techniques, after Citherlet [14]

Approach	Type	Advantage	Disadvantage
Experimental	**Scale model**	Low cost Reproductive experiment Comparison of variants	Scale effects Model approximation/error Measurement errors
	Full scale	Complex phenomenon Very accurate results	Time consuming High cost Measurement errors
Mathematical	**Analytical**	Ease to use	Simplified model
	Numerical (computer)	Complex model Fast calculation Comparison of variant	Request calibration/validation Model might be complex Model approximation/error (if not validated)

Based on the above, choosing the method of assessment depends on several factors such as the time the analysis is required (before/after construction), the accuracy of the results needed, budget and time limitation. As the experimental approach is time consuming and expensive, it can be argued that computer simulation is the preferred option for the holistic appraisal of design options.

The case study is spatially analysed and all the analysis parameters are defined. Proposed measures are evaluated by comparing the environmental performance of the spaces before and after introducing the proposed measure to the case study one at a time in terms of thermal comfort and energy consumption.

The methodology proposes using whole-building analysis software such as ESP-r[14], IES[15] <Virtual Environment> or <VE>,, Design builder[16], or Autodesk Autodesk Ecotect[17] instead of using a combination of several simulation packages such as using Radiance, EnergyPlus and FLOVENT to conduct lighting, energy and air flow analysis correspondingly[18].

This methodology suggests to use Autodesk Ecotect for several reasons. Its user-friendly interface allows constructing 3D models easily by architects. It can import CAD models from AutoCAD and 3D studio. It also can import and export gbXML files that developed by Green Building Studio to facilitate integrated interoperability between CAD building design models and wide Variety of engineering analysis tools. It can export and import data to and from more sophisticated simulation tools such as Radiance, EnergyPlus and HTB2 allowing by such conducting more in-depth analysis if needed. Ecotect has especial environmental analysis features such as solar access and exposure analysis, solar shading design, overshadowing calculation, and can assess the effect of space geometry on room acoustics ...etc. More importantly, Ecotect incorporates Humphreys' adaptive algorithms [19] allowing by such to take in

[14] **ESP-r website:** http://www.esru.strath.ac.uk/Programs/ESP-r.htm

[15] **IES website:** http://www.iesve.com/content/default.asp? page=home

[16] **Design Builder website:** http://www.designbuilder.co.uk/

[17] **Autodesk Autodesk Ecotect website:** http://Autodesk Ecotect.com/products/Autodesk Ecotect

consideration the adaptive action taken by building occupants. The simulation output is fed into a spreadsheet to calculate the percentage of benefit or loss due to the use of each measure.

5.4. EIA of the designed building

The last step in the methodology is to use the check list of the (LEED) to assess the EIA of the designed building and achieve the credit category goals.

Figure 4, shows the LEED 2009 checklist for healthcare to assess EIA during a renovation for Dr. Samir Abass Hospital, Jeddah - Saudi Arabia that was done by the author of this paper.

6. Future work

This paper is the start point of several papers discussing the EIA of buildings. Other researches are needed such as:

a. A general methodology for a Post Occupancy Assessment/ Evaluation (POA /POE);

b. EIA during the early stages of design, an application on case studies;

c. A new developed LEED for Egypt.

LEED 2009 for Healthcare: New Construction and Major Renovations

Project Checklist

Project Name

Date

Y	?	N			
7	7	4	**Sustainable Sites**		Possible Points: 18
Y			Prereq 1	Construction Activity Pollution Prevention	
Y			Prereq 2	Environmental Site Assessment	
1			Credit 1	Site Selection	1
	1		Credit 2	Development Density and Community Connectivity	1
		1	Credit 3	Brownfield Redevelopment	1
	3		Credit 4.1	Alternative Transportation—Public Transportation Access	3
		1	Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Room	1
1			Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Ve	1
1			Credit 4.4	Alternative Transportation—Parking Capacity	1
		1	Credit 5.1	Site Development—Protect or Restore Habitat	1
		1	Credit 5.2	Site Development—Maximize Open Space	1
	1		Credit 6.1	Stormwater Design—Quantity Control	1
	1		Credit 6.2	Stormwater Design—Quality Control	1
1			Credit 7.1	Heat Island Effect—Non-roof	1
1			Credit 7.2	Heat Island Effect—Roof	1
1			Credit 8	Light Pollution Reduction	1
1			Credit 9.1	Connection to the Natural World—Places of Respite	1
	1		Credit 9.2	Connection to the Natural World—Direct Exterior Access for Patie	1
5	3	1	**Water Efficiency**		Possible Points: 9
Y			Prereq 1	Water Use Reduction—20% Reduction	
Y			Prereq 2	Minimize Potable Water Use for Medical Equipment Cooling	
	1		Credit 1	Water Efficient Landscaping—No Potable Water Use or No Irrig	1
1	1		Credit 2	Water Use Reduction: Measurement & Verification	1 to 2
1	1	1	Credit 3	Water Use Reduction	1 to 3
1			Credit 4.1	Water Use Reduction—Building Equipment	1
1			Credit 4.2	Water Use Reduction—Cooling Towers	1
1			Credit 4.3	Water Use Reduction— Food Waste Systems	1
10	3	26	**Energy and Atmosphere**		Possible Points: 39
Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
5	2	17	Credit 1	Optimize Energy Performance	1 to 24
		8	Credit 2	On-Site Renewable Energy	1 to 8
1	1		Credit 3	Enhanced Commissioning	1 to 2
1			Credit 4	Enhanced Refrigerant Management	1
2			Credit 5	Measurement and Verification	2
		1	Credit 6	Green Power	1
1			Credit 7	Community Contaminant Prevention—Airborne Releases	1
4	6	6	**Materials and Resources**		Possible Points: 16
Y			Prereq 1	Storage and Collection of Recyclables	
Y			Prereq 2	PBT Source Reduction—Mercury	
		3	Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
		1	Credit 1.2	Building Reuse—Maintain Interior Non-Structural Elements	1
1	1		Credit 2	Construction Waste Management	1 to 2
1	2	1	Credit 3	Sustainably Sourced Materials and Products	1 to 4
1			Credit 4.1	PBT Source Reduction—Mercury in Lamps	1
	2		Credit 4.2	PBT Source Reduction—Lead, Cadmium, and Copper	2
1	1		Credit 5	Furniture and Medical Furnishings	1 to 2
		1	Credit 6	Resource Use—Design for Flexibility	1
12	6	0	**Indoor Environmental Quality**		Possible Points: 18
Y			Prereq 1	Minimum Indoor Air Quality Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
Y			Prereq 3	Hazardous Material Removal or Encapsulation	
1			Credit 1	Outdoor Air Delivery Monitoring	1
1	1		Credit 2	Acoustic Environment	1 to 2
1			Credit 3.1	Construction IAQ Management Plan—During Construction	1
1			Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
4			Credit 4	Low-Emitting Materials	1 to 4
1			Credit 5	Indoor Chemical and Pollutant Source Control	1
1			Credit 6.1	Controllability of Systems—Lighting	1
1			Credit 6.2	Controllability of Systems—Thermal Comfort	1
1			Credit 7	Thermal Comfort—Design and Verification	1
	2		Credit 8.1	Daylight and Views—Daylight	2
	3		Credit 8.2	Daylight and Views—Views	1 to 3
2	3	1	**Innovation in Design**		Possible Points: 6
Y			Prereq 1	Integrated Project Planning and Design	
1			Credit 1.1	Innovation in Design: Specific Title	1
	1		Credit 1.2	Innovation in Design: Specific Title	1
	1		Credit 1.3	Innovation in Design: Specific Title	1
	1		Credit 1.4	Innovation in Design: Specific Title	1
1			Credit 2	LEED Accredited Professional	1
		1	Credit 3	Integrated Project Planning and Design	1
0	4	0	**Regional Priority Credits**		Possible Points: 4
	1		Credit 1.1	Regional Priority: Specific Credit	1
	1		Credit 1.2	Regional Priority: Specific Credit	1
	1		Credit 1.3	Regional Priority: Specific Credit	1
	1		Credit 1.4	Regional Priority: Specific Credit	1
40	32	38	**Total**		Possible Points: 110

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

Figure 4: Checklist of the LEED 2009 for Healthcare.

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