MANSOURA UNIVERSITY
FACULTY OF ENGINEERING
DEPT. OF ARCHITECTURAL ENGINEERING,

Towards Green Heritage Buildings in Egypt

نحو مباني تراثية خضراء في مصر

A Thesis Submitted to the Department of Architecture,
In Partial Fulfillment of the Requirements of the Degree of

Doctor OF Philosophy
In Architecture

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June
2016

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Towards Green Heritage Buildings in Egypt

BY

Mohanad Ali Mohamed Fouda

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Title	**Towards Green Heritage Buildings in Egypt**			

Research Abstract

Egypt has great heritage assets including the heritage buildings that have high values, most of them, suffering from deterioration, negligence, non-investment, and non-periodic maintenance. Most of the conservation projects of heritage buildings in Egypt don't include any procedures that aim to make the building more compatible with the environment during the restoration works or be more efficient during the operation period, that's lead to a failure or a lack in achieving the goals of the comprehensive conservation strategy and sustainability.

Since the seventieth of the 20^{th} century, many countries all over the world have faced several energy crises that had a great role to concentrate the studies on how they can reduce the energy consumption. That's lead to emergence of the practices of "green buildings" that became more widespread during the last two decades.Green building design and construction practices that meet specified standards will help resolve much of the negative impacts that buildings have on their occupants and on the environment. The green principles are applied on the new buildings and the existing building after making some modifications on the building to be green.

Most of the current green certified heritage buildings all over the world have been assessed under the rating systems of existing buildings umbrella, some of them have set minimum requirements for heritage building, and the others don't have any requirements related to heritage buildings, that could lead to loss the values of those building in the process of transforming them as green Buildings.

The research aims to produce a Green Heritage building Rating System tool which can assess the green heritage buildings in Egypt. This tool aims to merge the principles of the green building practices in the conservation strategies of the heritage buildings, that's mean achieving a comprehensive sustainability for heritage building to meet the current and future needs through conserving the building, maintaining it, and applying the green practices without harming or losing the heritage value of the building.

Themes :**Green Heritage Building, Listed Building , Mansoura, EL-Shenawy Palace, Green Rating systems.**

ABSTRACT

Egypt has great heritage assets including the heritage buildings that have high values, most of them, suffering from deterioration, negligence, non-investment, and non-periodic maintenance. Most of the conservation projects of heritage buildings in Egypt don't include any procedures that aim to make the building more compatible with the environment during the restoration works or be more efficient during the operation period, that's lead to a failure or a lack in achieving the goals of the comprehensive conservation strategy and sustainability.

Since the seventieth of the 20th century, many countries have faced several energy crises, environmental problems, and climate change that had a great role to concentrate the studies on how they can reduce the energy consumption. That's lead to emergence of the practices of "green buildings" that became more widespread during the last two decades.

Green building design and construction practices that meet specified standards will help resolve much of the negative impacts that buildings have on their occupants and on the environment.

The green principles are applied on the new buildings and the existing building after making some modifications on the building to be green. Most of the current green certified heritage buildings all over the world have been assessed under the rating systems of existing buildings umbrella, some of them have set minimum requirements for heritage building, and the others don't have any requirements related to heritage buildings, that could lead to lose the values of those buildings in the process of transforming them as green Buildings.

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Lecturer assistant at Architecture Engineering Department, Faculty of Engineering, Mansoura University Since September 2011 until now.

A member at Presidential Leadership Program – (Batch 1) since 6 February 2016 until now.

LEED Green Associate since 11 June 2014 until now.

A member of the committee of listing of heritage buildings of Ad-dakahlyia governorate- Affiliated to the urban harmony organization – Ministry of Culture since 2007 until now.

A member of the Supreme Commission for Tourism in Ad-dakahlyia Governorate in 2012 – 2013.

A member of tourism Planning for Mansoura city Committee for - faculty of tourism and hotels- Mansoura University in 2011 – 2013.

Awarded the master degree in Architectural Engineering, Mansoura University, Mansoura-Egypt in August 2011. Title of master thesis being: Urban heritage sites sustainable as an approach to the intermediate cities development (Applied study for Mansoura city-Egypt)

Awarded B.Sc. in Architectural Engineering from Mansoura University, Egypt, in July 2006 with degree "Very Good" with honor "79.95%". Ranked the second over Department of Architectural Engineering. Title of B.Sc. project "Abu-Simble International Airport ", with degree Excellent**..**

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CHAPTER 4

INTRODUCTION

Egypt has great heritage assets including the heritage buildings that have high values, most of them, suffering from deterioration, negligence, non-investment, and non-periodic maintenance. Most of the conservation projects of heritage buildings in Egypt don't include any procedures that aim to make the building more compatible with the environment during the restoration works or be more efficient during the operation period, that's lead to a failure or a lack in achieving the goals of the comprehensive conservation strategy and sustainability.

Since the seventieth of the 20th century, many countries have faced several energy crises, environmental problems, and climate change that had a great role to concentrate the studies on how they can reduce the energy consumption. That's lead to emergence of the practices of "green buildings" that became more widespread during the last two decades.

In the USA, The sector of constructions consumes a lot of resources it consumes 72% of the total electricity consumption and 39% of energy uses, 40% of raw materials, 30% of waste output, 38% of all carbon dioxide emissions.[1]

That's lead to the emergence of the practices of "green buildings" that became more widespread during the last two decades.

Green building design and construction practices that meet specified standards will help resolve much of the negative impacts that buildings have on their occupants and on the environment.

The green building concept is more applicable in the developed countries compared with developing countries, despite that the developing countries need to apply these practices for the limited resources they have.

The green principles are applied on the new buildings in the design stage, construction stage, and pre-construction stage during the operation period.

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[1] Green Building Education Services(2009**)," LEED Principles and Green Associate- Study Guide**", Third Edition, ", Lewisville, USA, page 12.

The green principles are also applied to the existing building after making some modifications to the building to be green.

Most of the current green certified heritage buildings all over the world have been assessed under the rating systems of existing buildings umbrella, some of them have set minimum requirements for heritage building as " **BREEAM Domestic Refurbishment scheme and BREEAM 2014 Refurbishment and fit-out scheme**", and the others don't have any requirements related to heritage buildings as **LEED O+M**, that could lead to loss the values of those building in the process of transforming them as green Buildings. The Ecotrust building in Oregon –the USA was one of the examples of a greening heritage building that was be denied to listed as a heritage building due to losing some of its values during the greening project.

THE RESEARCH PROBLEM

Since January 2011, Egypt suffering from an Energy Crisis, Water Crisis, and the disruption of the balance of payment that needs from the Egyptian government to adopt the green practices in the new constructions and refurbishment projects of existing Buildings to decrease the consumption of Fuels, water, and raw and imported materials.

The conservation strategies of heritage buildings in Egypt don't include any Procedures to enhance the operation performance of the heritage Buildings in Energy and Water, as well as managing the consumption of Materials, and waste during the conservation process and during the operations period.

THE MAIN AIMS OF THE RESEARCH

The study aims to:

- Produce a Green Heritage building Rating System tool which can assess the green heritage buildings in Egypt. This tool aims to merge the principles of the green building practices in the conservation strategies of the heritage buildings, that's mean achieving a comprehensive sustainability for heritage building to meet the current and future needs through conserving the building, maintaining it, and applying the green practices without harming or losing the heritage value of the building.

▪ SECONDARY AIMS OF THE RESEARCH

1- Identify the conception of Green Heritage Buildings.
2- Enhancing the efficiency of the operation performance of the heritage buildings.
3- Develop the strategy for listing and dealing with the listed heritage buildings in Egypt by demonstrating the strategies of listing heritage buildings in other countries as the USA and the UK.

▪ HYPOTHESIS OF THE STUDY

- The green practices of enhancing the efficiency of the operation performance of the existing buildings can be applied to the heritage buildings if taken into account preserving the values of heritage buildings.

▪ METHODOLOGY OF THE THESIS

The research seeks to achieve its main aim, through highlights on the definitions of Heritage, its types, the criteria of listing heritage buildings in the USA, the UK and Egypt in chapter 1. Then the research demonstrates the current crises that facing Egypt in Chapter 1. In this chapter, the research also demonstrates the conception of the green building, the strategies of the integration of the heritage conservation and the green concept to set a definition for a greening heritage building. This chapter also overviews the green building rating systems to select the green rating systems that are used to assess the heritage buildings in chapter 3

Chapter 4 will make a comparison study between four green certified heritage buildings. The results and recommendations of this chapter will be useful to define the recommended credits and techniques of the environmental categories of the proposed rating system that will be produced in chapter 5. In this chapter, the research will analyze these green buildings rating systems to produce the green heritage building rating system can assess heritage buildings in Egypt.

Chapter 6 is an applied study that will use the proposed green heritage building rating system (that has been produced in chapter 5) to assess "El-shenawy palace – Mansoura" to be a green heritage building.

- **CONTENTS OF THE THESIS**

- Theoretical study:

- The theoretical study is presented in **Part One** which is divided into three chapters. **Chapter one** includes the presentation of the concept of the heritage buildings, their values, the criteria for listing heritage buildings in United states, United Kingdom, and Egypt.
  Chapter two includes the presentation and the definitions of green concept and the green building rating systems. **Chapter three**, the research demonstrates the green building rating systems that have used to assess the heritage building internationally.

- Analytical studies:

The analytical studies are presented in **Part Two** which comprises the **Chapter four,** the research demonstrates and makes a comparison analyzes between four case studies (two residential heritage buildings, and the others are non-residential heritage buildings), there have certified as a green building under different schemes. **Chapter five** the research adopted the qualitative method in analyzing the green building rating systems that have used to assess the heritage building internationally to produce a green heritage building rating system under Green Pyramid rating system, that can be used to assess the green heritage buildings in Egypt.

- Applied study:

The applied study is presented in **part three** which comprises the **Chapter six (**the applied study) that using the green heritage rating system that has produced in chapter 5 to assess El-Shenawy palace in Mansoura city (listed as an Islamic monument) as a green heritage building, this chapter aims also to merging the green practices in the conservation strategy without harming the values that palace have.

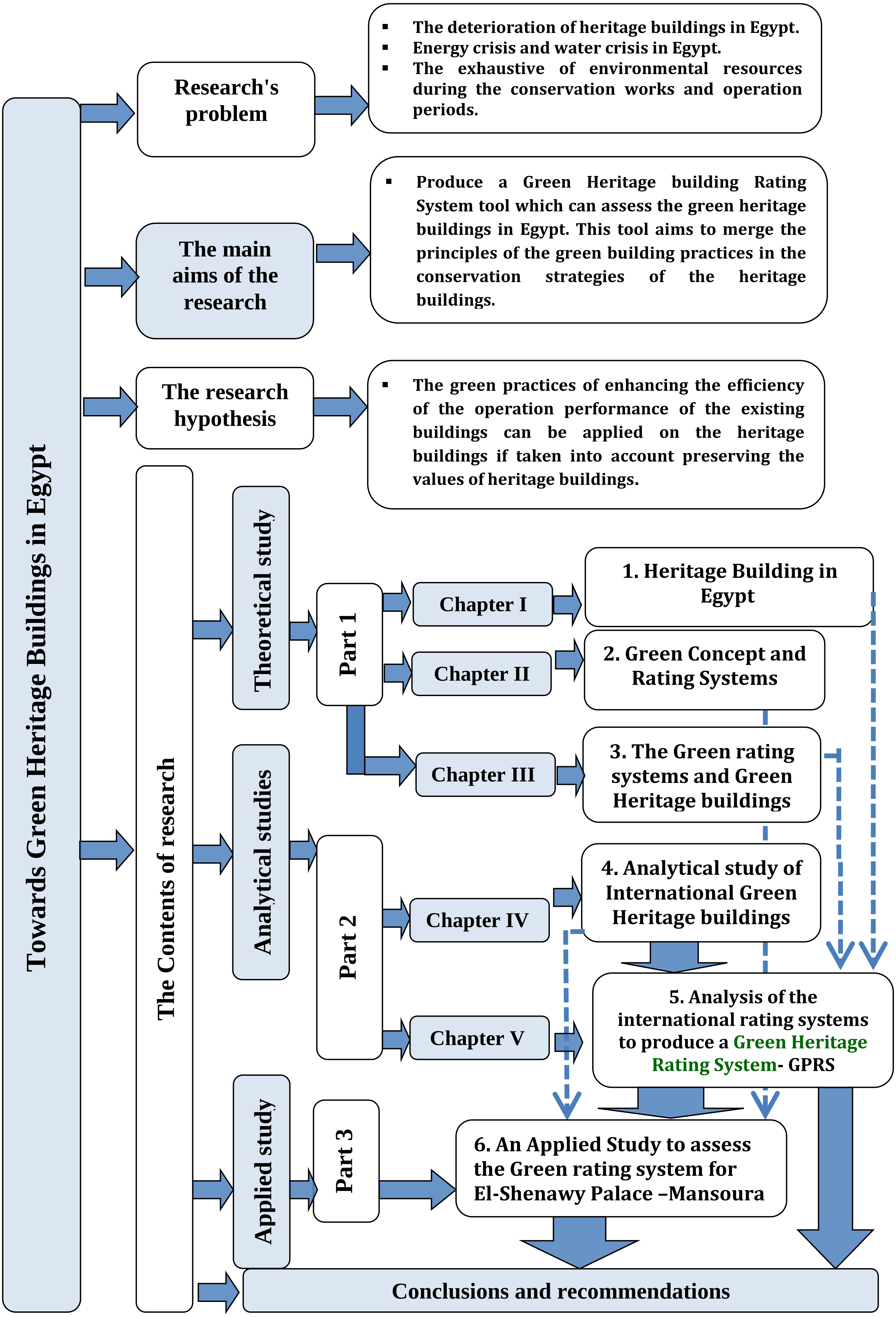
El-Shenawy palace as a green heritage building:

El-shenawy palace is located in Mansoura city – Egypt, it was constructed in 1930. Since 2008, the palace has listed as a monument according to its architectural, heritage, exclusivity, and national values, as well as it had witnessed important events and associated with famous figures.

The palace had awarded a certification signed by Mussolini as the best building in the middle east that was built in the Italian style outside Italy in 1931.

The palace suffering from deterioration of some of its parts due to moisture and rising of the underground water, as well as abuse ,and non-periodic maintenance since 1998.

The Ministry of Aniquities seeks to transform the palace into a cultural center. The research adopts its green proposal for the heritage palace according to this usage, and tries to merging the green practices (that result from chapter 4) into the conservation strategy, and assess the proposed green vision under **the Green Heritage Building scheme of GPRS** (produced from chapter 5).


Towards Green Heritage Buildings in Egypt
Research's problem
The deterioration of heritage buildings in Egypt.
Energy crisis and water crisis in Egypt.
The exhaustive of environmental resources during the conservation works and operation periods.
The main aims of the research
Produce a Green Heritage building Rating System tool which can assess the green heritage buildings in Egypt. This tool aims to merge the principles of the green building practices in the conservation strategies of the heritage buildings.
The research hypothesis
The green practices of enhancing the efficiency of the operation performance of the existing buildings can be applied on the heritage buildings if taken into account preserving the values of heritage buildings.
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2. Green Concept and Rating Systems
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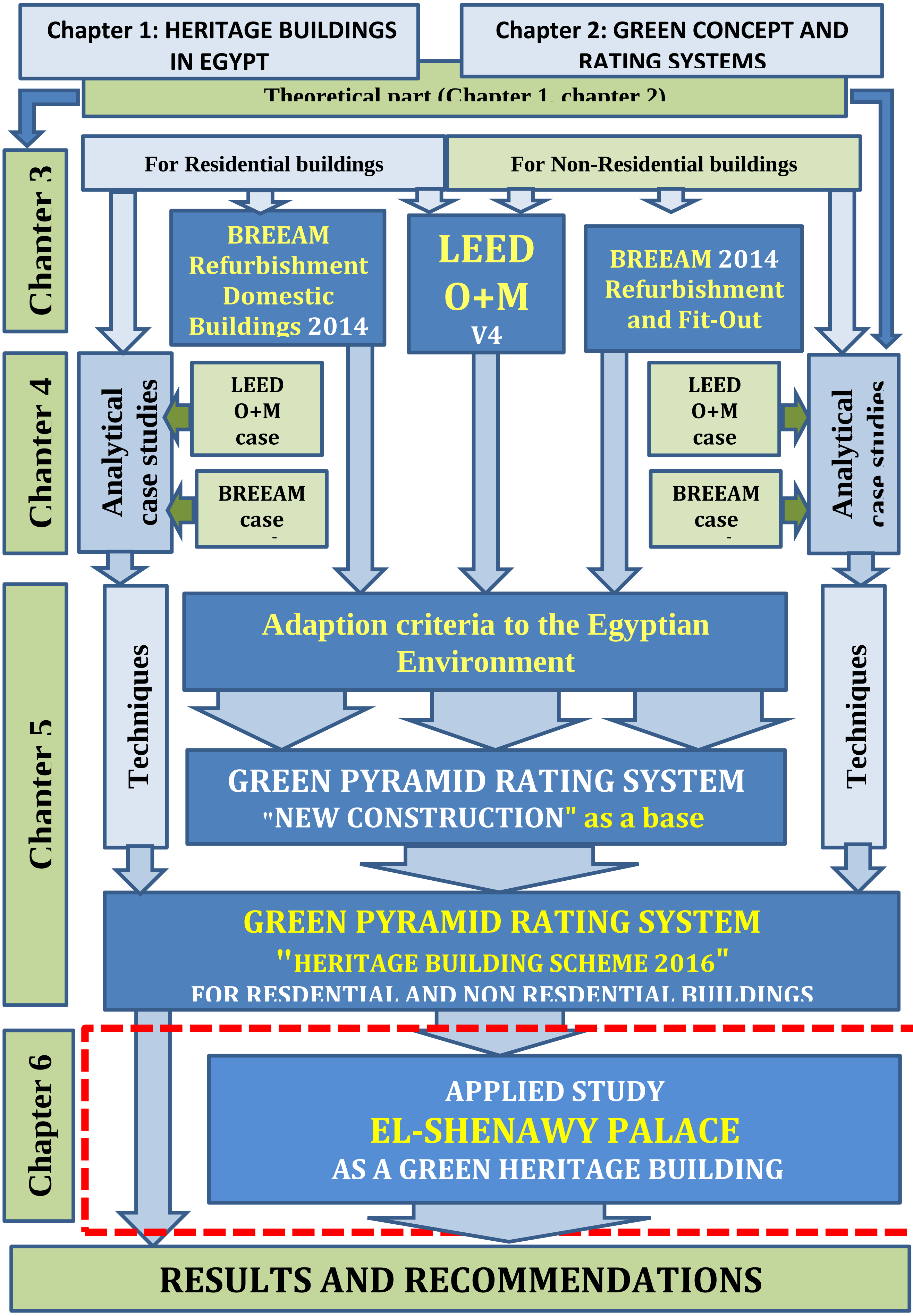
6. An Applied Study to assess the Green rating system for El-Shenawy Palace –Mansoura
Conclusions and recommendations



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Theoretical part (Chapter 1, chapter 2)
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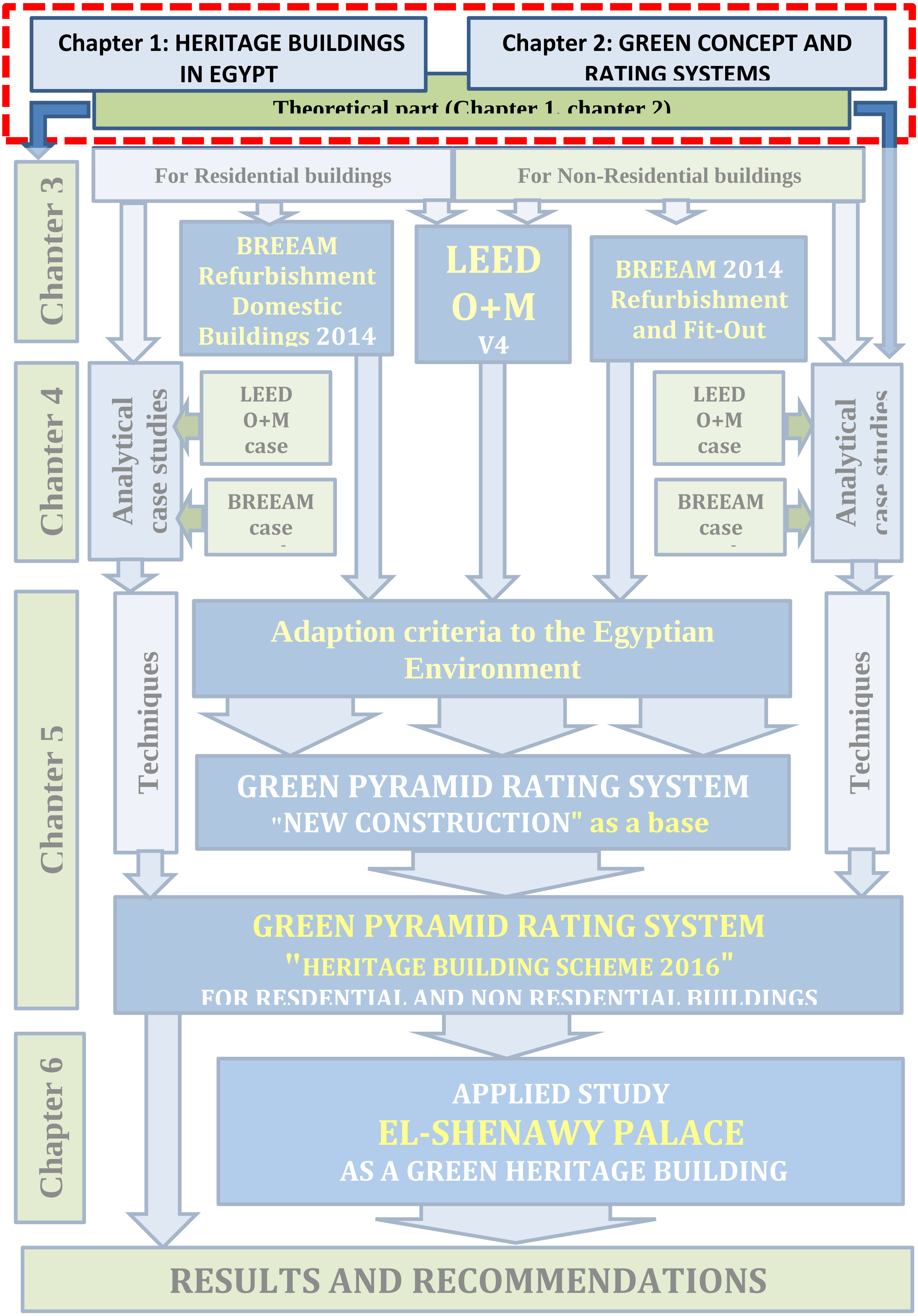
PART ONE

Theoretical Study



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AS A GREEN HERITAGE BUILDING
RESULTS AND RECOMMENDATIONS

CHAPTER

I

HERITAGE BUILDING

IN EGYPT

Chapter I.
HERITAGE BUILDING IN EGYPT

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Egypt has great heritage assets including the heritage buildings that have high values, most of them, suffering from deterioration, negligence, non-investment, and non-periodic maintenance. Most of the conservation projects of heritage buildings in Egypt don't include any procedures that aim to make the building more compatible with the environment during the restoration works or be more efficient during the operation period, that's lead to a failure or a lack in achieving the goals of the comprehensive conservation strategy and sustainability.

The main aim of this chapter to achieve the third secondary aim "**Develop the strategy of listing and dealing with the listed heritage buildings in Egypt**", the research seeks to achieve this aim by demonstrating the strategies of listing heritage buildings in Egypt, and other countries as the USA and the UK. The other aim of this chapter to set a definition of "**Green Heritage Building**", after studying the green concept and its definitions in chapter2.

1-1.The Heritage Buildings

1-1-1.The Heritage

The heritage or the term "inheritance" refers to the entities that come from the past, it used to indicate objects endowed, these objects may have a value or may not.[1]

1-1-2. Types of heritage

Heritage can be represented in two forms: <u>Natural Heritage</u> and <u>Cultural Heritage.</u>

1-1-2-1. Natural heritage

The following are considered as 'Natural Heritage' due to their outstanding universal value from the aesthetic or scientific point of view:[2]

- *<u>Natural features</u>*: consisting of physical and biological formations or groups of such formations.

[1] Carabbelli, Romeo (2005),"**Recent Architecture Inheritance in the Mediterranean**" ,Editions Publish book ,Paris ,France

[2] **UNESCO World Heritage Convention** (November 1972), Article 2, http://whc.unesco.org/en/conventiontext. (accessed: June 2015)

- *Geological and physiographical formations and precisely delineated areas* which constitute the habitat of threatened species of animals and plants.
- *Natural sites or precisely delineated.*

1-1-2-2. Cultural heritage

UNESCO defined 'Cultural Heritage' as " The entire corpus of material signs either artistic or symbolic –handed on by the past to each culture and, therefore, to the whole of humankind"[1], and it is also defined as "The cultural heritage of a people is the memory of its living culture. It is expressed in many different forms, both tangible and intangible; it is our duty to transmit as wholly as possible to our children"[2]

Heritage concept has been expanded in the last decades from beyond monuments, architectural masterpieces, or historic artefacts, to include landscapes, industrial and engineering works, vernacular constructions, urban and rural settlements and intangible elements like temporary art forms and skills. This expansion reflects an increasing interest in heritage across society.[3]

a. Forms of Cultural heritage

A- Tangible heritage [4]

It is a heritage element that can be stored and physically touched; it has a wide range of immovable and movable forms as utensils, from traditional clothes and old vehicles to monuments, heritage sites and buildings. Table (1-1)

The following are considered as '**Tangible Cultural Heritage**' due to their outstanding universal or national value from the historical, artistic or scientific point of view:[5]

- ***Monuments*:** architectural works, works of monumental sculpture and painting, elements or structures of features.
- ***A group of buildings*:** groups of separate or connected buildings which have values due to their architecture, their history, their homogeneity or their place in the landscape.
- ***Sites* :**Topographical areas ,the combined works of nature or of man and areas including archaeological sites, which are of special value by reason

[1] The Drafts of UNESCO medium term plan 1990-1995 (1989), UNISCO, 25 C/4, page.57.
[2] UNESCO 2002, **"United Nations Year for Cultural Heritage, Information Kit"**. Message From the Director– General of UNESCO. page 4.
[3]HCD Project,(Jan2008)" **Sustainable Historic Places- A Background Paper for the Historic Places Branch, Parks Canada**", Revised Edition for Publication.
[4] http://www.sanculture.org.za/defn_tang%20cultural%20heritage.htm. (accessed: June 2015)
[5] **"Convention concerning the protection of the world culture and natural heritage** ",UNESCO, Paris, (1972)

of their beauty or their interest from the archaeological, historical, ethnological or anthropological points of view.

B- ***Intangible cultural heritage (ICH)***

Cultural heritage doesn't include only monuments and heritage elements, it also includes elements that are not physical or tangible as traditions and living expressions inherited by communities from their ancestors and transmitted to their descendants, it reflects the practices and traditions of these communities in respond to their environment.[1]

According to the 2003 Convention for the Safeguarding of the Intangible Cultural Heritage "the intangible heritage or living heritage is the mainspring of our cultural diversity and its maintenance is a guarantee for continuing creativity".[2]Table (1-1)

Table (1-1) Forms of cultural heritage

<table>
<tr><td rowspan="2">Tangible Cultural Heritage [3]</td><td>Immovable</td><td>1- Built Heritage
• Monuments: Buildings, sculpture working .etc.
• Listed Buildings
• Groups of Buildings
2-Sites : as sites under water or on the ground (archaeological ,historical and cultural)</td></tr>
<tr><td>Movable</td><td>1- Artifacts : Photographs- sculpture working- all types of antiquities
2- Media : Books – Documents – visual
3- Consumer and Industrial goods</td></tr>
<tr><td>Intangible cultural Heritage[4]</td><td colspan="2">• Oral traditions and expressions including languages.
• Performing arts such as traditional music, dance and theatre.
• Social practice, rituals and festive events such as Traditions and Folklore.
• Living cultures.</td></tr>
</table>

Source: Researcher

[1] **What is intangible cultural heritage**? http://www.ichscotlandwiki.org/index.php?title=What_is_Intangible_Cultural_Heritage%3F . (accessed: June 2015)

[2] http://www.unesco.org/culture/ich/index.php?pg=00002. (accessed: June 2015)

[3] Ragheb ,Ghada Ahmed M (2002), " **The Heritage Conservation**" , Master Thesis ,Faculty of Engineering ,University of Alexandria, Egypt.

[4] **What is intangible cultural heritage ?**, http://www.unesco.org/culture/ich/index.php?pg=00002, (accessed: June 2015)

According to the ICOMOS 2000 report, there is another classification of the forms of cultural heritage as follows:

1. **Archeological Heritage**
2. **Architectural Heritage.**
3. **Urban heritage** .which are represented in :
   - Urban sites
   - Vernacular Heritage
   - Industrial Heritage
   - Twentieth Century Heritage
   - Components of Heritage sites
   - Elements and Document of Heritage sites.

1-1-3. Heritage buildings definition

In the definition of heritage building, the research has adopted the definition of listed heritage building, because it has specific criteria that define if the nominee building will be listed as heritage building or not, once it has been listed, it has been subjected to many regulations and laws to preserve its values, at the same time, it can utilize the economical and investment features as listed heritage building. In this part, the research selected to study the criteria for evaluation the listed Building from USA, UK, and Egypt, because those are the countries of the selected case studies for the analytical part and applied part from this research.

1-1-3-1. Listed Heritage buildings

In this section, the research highlights on the organizations of listing heritage buildings in the United States, the United Kingdom, and Egypt, their criteria for evaluation, and incentives after listing of listed heritage buildings.

1-1-3-1-1. Listed heritage Buildings in the United Kingdom

The National Heritage list for England (NHLE) is the official and up-to-date database of all UK's nationally designated heritage assets, including listed building, monuments and world heritage sites where located in the UK.[1]It is defined the listed heritage buildings as: "*they are the buildings and other structures of special architectural or historic interest, they are listed by the secretary of state (for culture, media and sport)*".

[1]The official website of the Historic of England, http://www.historicengland.org.uk/listing/the-list/

According to the official site of the National Heritage list for England, the number of individual listed buildings in England is estimated to exceed 500,000.[1]

The official web site of the National list for England has the official records for listed buildings, scheduled monuments, registered parks and gardens, registered Battlefields, and the record of World Heritage Sites (the official record is held by UNESCO). Fig (1-1).

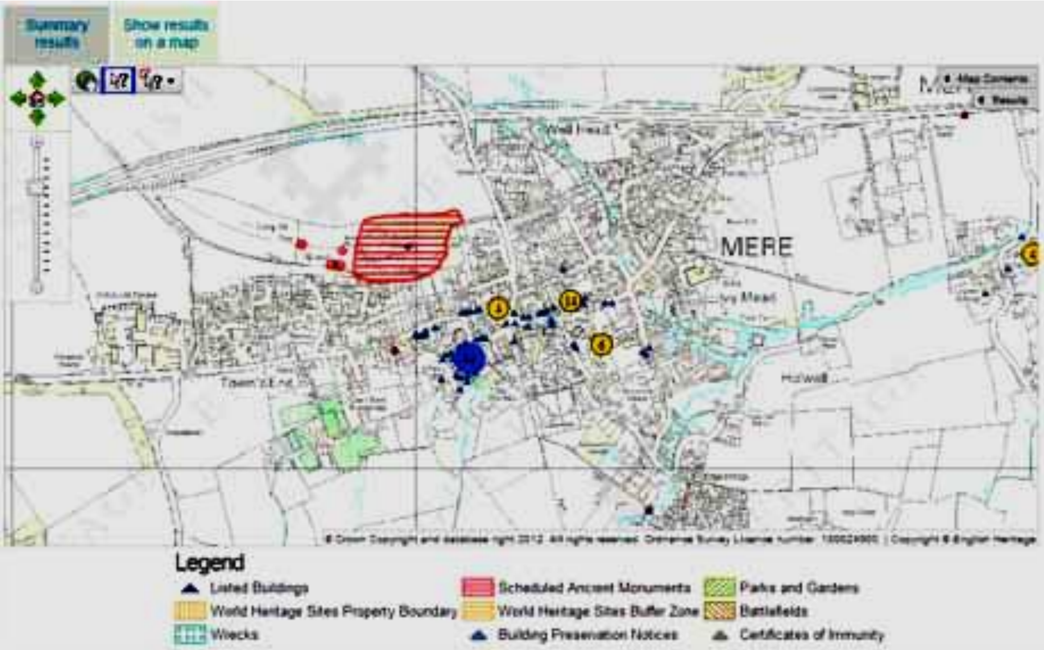

Fig (1-1). Example of map search results from the National Heritage List for England
Source: http://historicengland.org.uk/listing/the-list/map-search?clearresults=True (April 2016)

Fig (1-2). Municipal Water Tower -Jumbo, Colchester, Essex. Listed at Grade II Source: http://historicengland.org.uk/listing/selection-criteria /

<u>The criteria for evaluation for the listed Building depending on</u> if the building has special features and values, therefore should be added to national heritage list: [2]

- **Architectural value**: to be of special architectural value. A building must have an importance of its architectural design or decoration, or represents special building types and innovation techniques.
- **Historic value**: to be a special historic value. A building must illustrate important aspects

[1] https://historicengland.org.uk/advice/hpg/generalintro/extent-and-nature-of-hp/, accessed (28 Nov.2015).
[2] "**Principles of Selection for Listing Buildings**", Department for Culture, media and sport, https://www.gov.uk/government/publications/principles-of-selection-for-listing-buildings (accessed: June 2015)

of the UK's social, economic, cultural or military history, or has related with nationally important people in the UK. The physical fabric of the building should have some quality to justify the statutory protection afforded by listing**.**

- **Group Value**: if heritage buildings comprise an important architectural or historic unity or a fine example of planning (e.g. squares, terraces or model villages) or where there is a historical functional relationship between groups of buildings.

Listed heritage buildings on the UK's heritage list are graded to reflect their relative architectural and historic values. Buildings of historic value may justify a higher grading than would otherwise be appropriate.[1] Heritage listed buildings are classified on the list to Grade I, II* or II. The grading means the level of importance of the listed building. Most of the listed heritage buildings (over 90% of the total) belong to Grade II.

- **Grade I** buildings are of exceptional value;
- **Grade II*** buildings are particularly important buildings of more than special value; Fig (1-2).
- **Grade II** buildings are of special value, warranting every effort to preserve them.[2,3]

Listed building consent[4] is mandatory for demolition or any modification works that affect the character of the building and its values. The consent is sought from the local planning authority. Any works carrying out on the listed building without proper consent may be forced to reverse them and/or face prosecution.

Local planning authorities and the Secretary of State have powers to carry out urgent works to listed buildings at risk and to recover the costs from the owner

Removal the listed building from the National List

The Secretary of State (for Culture Media and Sport) may decide to remove a building from the list if it is no longer considered to hold special architectural or historic interest.

This may happen following a fire, or perhaps on the discovery of new evidence that demonstrates the original listing decision can no longer be supported.

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[1] "**Principles of Selection for Listing Buildings**", Department for Culture, media and sport, https://www.gov.uk/government/publications/principles-of-selection-for-listing-buildings (accessed: June 2015)

[2] Ibid.

[3] https://historicengland.org.uk/advice/hpg/generalintro/extent-and-nature-of-hp/ (accessed: June 2015)

[4] http://historicengland.org.uk/advice/hpg/hpr-definitions/l/536329/ (accessed: June 2015)

1-1-3-1-2. Listed heritage Buildings in the United States

In the United States, the National Register of Historic Places (NRHP) is the official list of the USA's historic places worthy of preservation. It is part of a USA's national program to coordinate and support public and private efforts to identify, evaluate, and protect the American historic and archeological resources. **The National Register** is administrated by the **National Park Service**.[1]

The National Park Service has established a set of criteria that heritage assets must meet in order to be eligible for or listed in the National Register.

The criteria for evaluation for the listed heritage Buildings[2] depending on the quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- The heritage buildings are associated **with events** that have made a significant contribution to the broad patterns of our history.
- The heritage buildings are associated **with the lives of persons** significant in our past.
- The heritage buildings that embody **the characteristics** of a type, period, or method of construction, or the heritage buildings that represent the work of a master, or that possess high artistic values.[3]

Fig (1-3): Anderson-Frank House at Tampa, Florida, USA, it was added to the U.S. National Register of Historic Places in 1982
Source: https://en.wikipedia.org/wiki/File:AndersonFrankHouseTampa01.jpg

After listing the heritage building, its owner will not be obligated to open his property to the public, restore it, or maintain it. The national register brochure mentioned that " Owners can do anything they wish with their property provided that no Federal license, permit, or funding is involved".[4]

Financial incentives for listed buildings:
The owners of listed buildings may be able to obtain many of financial incentives, that will encourage them to preserve their properties and not destruction them, these incentives as follows:

[1] "**National Register Brochure**", the National Register of Historic places- USA, http://www.nps.gov/nr/publications/bulletins/brochure/ , access(June.2015).
[2] Ibid.
[3] Ibid.
[4] Ibid

- **Federal Historic Preservation Grants:**
  Owners of National Register listed buildings may be able to obtain Federal historic preservation funding, when funds are available[1].
- **Easement Donations.**
- **Federal Tax Incentives for Rehabilitation:**

- The federal historic preservation tax incentives program is a partnership among the National Park Service, the state historic preservation officer and the internal revenue service.
- The tax credit lowers the amount of tax owed. A dollar of tax credit reduces the amount of income tax owed by one dollar[2].
- The federal historic preservation tax incentives program offers two tax credits as follows:
  - 20% tax credit for the certified rehabilitation of listed heritage, and non-residential buildings.
  - 10% tax credit for rehabilitation of non-listed and non-residential buildings that built before 1936.
- **20% Rehabilitation Tax Credit**[3]:

The national Park Service must approve or certify all rehabilitation works for the listed building seeking 20% tax credit. The approval is executed by **the state historic preservation officer, he approved** that all works have been carried out with the heritage character of the building and the character of district "if it is located at heritage area", and the alterations if it is occurred to the building not damage, destroy, or cover materials or features, whether interior or exterior that might bad affect the heritage fabric of the building.

Fig (1-4), Fig (1-5): Simmons Manufacturing Company, St. Paul, Minnesota (Built in 1909). Before and after rehabilitation for rental residential use.

Source:

"Historic Preservation Tax Incentives "(2012), Technical Preservation services, National Park Service, U.S. Department of the Interior http://www.nps.gov/tps/tax-incentives/taxdocs/about-tax-incentives-2012.pdf

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[1] "**National Register Brochure**", the National Register of Historic places- USA, http://www.nps.gov/nr/publications/bulletins/brochure/ , access(June.2015)..

[2] **" Historic Preservation Tax Incentives** "(2012), Technical Preservation services, National Park Service, U.S. Department of the Interior http://www.nps.gov/tps/tax-incentives/taxdocs/about-tax-incentives-2012.pdf (accessed: Jan 2015)

[3] Ibid.

After the approval, the owner (Taxpayer) will be able to receive 20% of the tax credit.
The 20% tax credit are available only to the listed building that held for generate income as "Commercial, industrial, agriculture or rental residential purposes and not available for the owner's private residence".

The rehabilitation expenditure must exceed the greater of $5000 or the adjusted basis of the building and its structural component to receive 20% tax credit.

The rehabilitation tax credit is allowed in the taxable year the rehabilitated building is placed in service.

Adjusted basis =	The purchased price of the property – the part of the purchased price attributed to the land cost – depreciation taken for an income producing property + cost of any capital improvement since purchase.

Qualified rehabilitation expenditures include costs of the work on heritage building, as well as, architectural and engineering fees, and legal expenses. They don't include the furniture and devices costs, the costs of a new addition that expand the building, parking lots, sidewalks, landscaping or other related works.

The owner must hold the building for five full years after the completion of the rehabilitation or pay back the credit. If the owner disposes of his building during one year after it is placed in service, he must recapture the 100% of the credit. If he held the building between one and five years, he must recapture a part of tax credit that will be reduced by 20% per each occupied year.

The National Service Park may inspect the building any time during the five years, it may revoke the approval if the rehabilitation works haven't been carried out as described in the approval certification or if unapproved alterations have been made during the five years after the date of approval. The National Park service will notify the Internal Revenue service to recapture the credit from the owner.

For example:

Mr.Dillon has owned a listed building at the downtown area for 30 years, he originally purchases the building for $150,000, and $40,000 of the purchased price was attributed to the cost of land. Since the date of purchase of the building, it had generated $60,000. Recently, Mr. Dillon made some restoration works on the roof at a cost of $8,000.
The adjusted basis would be = 150,000 – 40,000 – 60,000 + 8,000= $58,000

Mr. Dillon he intends to make a major rehabilitation to his listed building and he wants to utilize from the 20% of the tax credit. He must spend more than $58,000 of the rehabilitation cost to utilize from the 20% of the tax credit, For that, he intends to spend $60,000 to fix basement walls, upgrade the HVAC system, and repair the deteriorate storefront.

Mr. Dillon will be eligible for a 20% credit on the cost of his rehabilitation that equal $12,000 credit after he will get the approval of rehabilitation works from the state historic preservation officer. The amount of tax owed for Mr. Dillon will be lowered with $12,000.[1]

- **10% Rehabilitation Tax Credit** has the same requirements of the 20% rehabilitation tax credit that was mentioned above.

1-1-3-1-3. Listed Heritage buildings in Egypt

In Egypt, the heritage assets have been classified into **Monuments** and **listed heritage buildings**.

Listed building as "Monument":

The list of Islamic and Coptic monuments is the official database of all Egyptian Islamic, Coptic and Jewish monuments that include mosques, churches, Palaces, and villas. Pharaonic and Roman assets have been listed in the List of Egyptian Monuments. Both of the two lists are affiliated to Ministry of Antiques.[2]

The definition of monuments according to the issue No. 1 and 4 from Egyptian Law of preserving the monuments No. 117 of 1983: any building compatible with the following criteria would be a **monument** and must be added to the list of the Islamic and Coptic Monuments[3]:

Fig (1-6): Ibrahem El-Shenawy's Palace at Mansoura has been listed as a monument.
Source:

- If it is a product of an Egyptian civilization or from the arts, science and religious that are produced on the Egypt's land from pre-historic time to before one hundred years ago,
- If it has an archeological value or artistic value or a historical value which represents the aspects of the Egyptian civilization in a specific period or other civilizations that had been held on the Egypt's Land.

[1] Bruechert, Daniel (2012), "**Introduction to Federal Tax Credits for Rehabilitating Historic Building : Main Street Commercial Building**", Technical Preservation services, National Park Service, U.S. Department of the Interior, http://www.nps.gov/tps/tax-incentives/before-you-apply.htm (accessed: Jan 2015)
[2] The Egyptian Law of preserve the monuments No. 117 of 1983.
[3] The Article No.1 from The Egyptian Law of preserve the monuments No. 117 of 1983.

- The both previous features must be available at any heritage building to be listed as a monument. It will be considered as non-monument if it has lost one of the previous features defined above. [1]
- The Standing Committee of the Islamic and Coptic Antiquities that has formed by the Egyptian ministry of antiques evaluates the candidate buildings and if they are compatible with the criteria "mentioned above" to be joined to the list of Islamic and Coptic antiques or not.[2]
- Listing the heritage building as a monument on the list of Islamic and Coptic antiques don't effect on the ownership of the property's owner. The monument still remaining in the property of its owner and he/she must preserve it from any risks and deterioration causes. Any modification works on the monument are prohibited.[3] Any restoration process will be carried out on the monument must be executed under the supervision of the Ministry of antiques after getting approval about the works from them.[4] [5]
- When the owner of the monument intends to dispose of his property, he must inform the Ministry of antiques via request about the type of disposing of (waiver, sell,.. etc). In all cases, he must mention the name of the new owner and his address to get the approval of his request within 30 days from the date of the submission of the request. If the 30 days have passed without any response from the Ministry about the owner's request, it will be considered as rejected.[6]
- Any works have been carried out on the monument without getting an approval from the Ministry of antiques, the ministry will remove any unapproved works and restore the monument to its original state at the expense of the owner, and he will face prosecution. [7]
- Any required restoration works of the Monuments are carrying out and financing by the Ministry of antiques and its specialized sectors.[8]

[1] The Article No.3 from the executive regulations of law No.3 of 2010 that has some modification of the Law No. 117 of 1983, http://www.urbanharmony.org. (accessed: June 2015)
[2] The Article No.4 from the executive regulations of law No.3 of 2010.
[3] The Article No.28 from the executive regulations of law No.3 of 2010.
[4] The Article No.29 from the executive regulations of law No.3 of 2010.
[5] The Article No.34 from the executive regulations of law No.3 of 2010.
[6] Ibid.
[7] Ibid..
[8] Ibid.

Listed Heritage buildings:

Fig (1-7): Alexander's Palace at Mansoura has been listed as a listed Heritage Building.
Source:
(Researcher)

The National Organization of Urban Harmony[1] that is affiliated to Ministry of Culture is an official organization that lists the heritage buildings with special architectural or/and Historical features all over Egypt, the criteria for selection the heritage buildings to add to the list of the National Organization of Urban Harmony depending on the following[2]:

1. The buildings possess high architectural or artistic values
2. The buildings have been associated with events that have made a significant contribution to the Egypt's National History.
3. The buildings have been associated with the live of persons significant in the Egypt's history.
4. The buildings represent an era or significant period of Egypt History.
5. The buildings that considered as tourist destinations.

- The addition process to the list of the Heritage buildings is carrying out by **the standing committee of the inventory of valuable buildings** of each Egyptian governorate that has been affiliated with the National Organization of Urban Harmony the committee has been formed by the Minister of Culture and the Governorator concerned.
- The committee adds or removes heritage buildings from the list throw an official minute that is signed by its members, and then signed by the Governorator. The list updates must be approved by the prime Minister to be active.[3]
- According the article No.7 from the executive regulations of law No.144 of 2006, the state seeks at its own expense to consolidate, restore and maintain the listed heritage buildings, after the inventory committee submitted a

[1] **The National Organization of Urban Harmony** has been established to apply the values of beauty to the exterior image of buildings, urban and monumental spaces. The main aim of the organization is preparing a database comprising all buildings with special architectural features all over the country. To achieve these targets, the organization is authorized to make all required decisions and recommendations in accordance with the laws and legislation.
[2] The Law of Urban Harmony No.144 of 2006. http://www.urbanharmony.org . (accessed: June 2015)
[3] Article No.3, from the executive regulations of law No.144 of 2006.

report describes the physical statue of the building, especially the listed heritage buildings that would be at risk and they have been required an urgent intervention.

- The issuance of demolition or add floors licenses are prohibited for Listed Heritage buildings, any one has fully or partial demolished any listed Heritage buildings will face legal sanction, imprisonment and fines, that will include the owners of properties, contactors, and public servants who participate in the demolition process.[1]
- The new construction license for the land of the demolished listed building will be restricted for the next 15 years to be the same floor area and the height of the demolished one.[2]

1-1-3-2.The values of the heritage buildings

Heritage buildings can be classified according to their values as follows: ***Heritage value, Architectural value, Aesthetic value, and Economic and Functional value***. Fig (1-8)

- **Heritage value** that has been acquired during long decades or by witnessed historical, national or specific events, or witnessed born or the life of a famous figure.
- **Architectural value** represents in the style that the architecture building or monument that has been built with at that time .It could be a new style or a way of building, or built by a famous architect, giving both a character and a landmark to the whole site.[3]
- **Aesthetic value** that has been acquired due to the aesthetics of the past, and being as antiques because they have a scarcity value. The heritage building facades adorned with sculpture and ornaments, showing the archaic skills of masons and carvers.[4]
- **Economic and Functional value**
  a) **The economic value** of heritage building has been acquired a great value when using it positively by playing a role in the daily economic life and linking it to the development process.
  b) **Functional value** of heritage building means that: Any heritage was built to do a specific function, If the building is still doing its original function such mosques and churches, the functional value of the building is high but if a building is not used and has become as a

[1] Article No.2, 12, and 13 from the Law No.144 of 2006.
[2] Article No.12 from the Law No.144 of 2006.
[3] Mohareb, Nabil Ibrahim (2003),"**The Role of Urban Spaces in The Revitalization of Historic Sites**", Master Thesis, Faculty of Engineering, University of Alexandria, Page (2-2)
[4] Tiesdell, Steven ,Taner Oc and Tim Health (1998),"**Revitalizing Historic Urban Quarters**", Oxford :Architecture Press .p.13.

monument only and is being used as a visiting place, the functional value is decreasing[1].

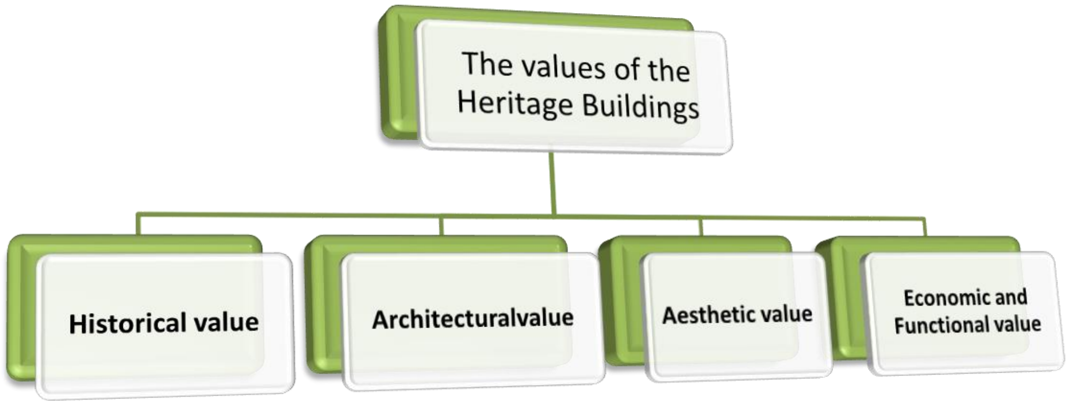

Fig (1-8) The values of heritage buildings
Source: (Researcher)

1-4. The Current conservation strategies of heritage buildings in Egypt

The current conservation strategies of heritage buildings in Egypt (whatever they are residential or non-residential buildings) that have been classified as **monuments** (whatever they are palaces, villas, or public buildings) aim to expose and restore the internal and external heritage features and values of the assets, retain their original character ,and transform the usage of them (in most cases) into tourism activities as museums, or cultural activities such as: Beshtak palace (the house of Arab singing) , Prince Taz palace (culture events and festivals) in old Cairo, Fig (1-9), and Arab Kelly's House (Rosetta's Museum) in Rosetta.

Fig (1-9). The external Façade of Taz Palace
Source: http://archive.aawsar.com

The current conversation strategy that deals with **listed heritage buildings is not defined by the state and the law no.144 for 2006 that concerns of the listed heritage buildings until today,**

There is few conversation strategies have carried out at the state related to the listed heritage buildings level, most of them are individual projects, that have executed by their owners or buildings' inhabitants, the others have executed by the public sector, such as the conversation project that carried out in the Khedive Cairo (Cairo's downtown), it was only superficiality restoration. The strategy based on painting the

Fig (1-10). The painting works of a heritage building at Downtown-Cairo
Source: http://elyoumnew.com/news/

[1] El-yazal ,Samir saif (March 1983),"**The Ways to Conserving the Architecture Heritage**", Alam El-Benaa magazine ,p.31.

exterior façades of the listed heritage buildings without any upgrade or restoration works for their internal parts. Fig (1-10).

From the pervious, **the most of the conservation strategies of the heritage Buildings** in Egypt whatever they were classified as monuments or listed buildings don't include strategies that improving the operating performance of those building in energy, as well as water, or indoor environmental quality**.**

Conclusions:

From the previous studies, that have highlighted on the definition of listed heritage building in the United States, the united kingdom, and Egypt, the comparison among them, and according to the current strategies of heritage buildings in Egypt, the research illustrates the following:

- The current conservation strategies of listed heritage buildings in Egypt are superficiality restoration, needed to be comprehensive conservation strategies comprises all parts of the heritage building and incorporate green practices that enhancing the energy efficiency performance and water efficiency of the building as well as managing the consumption of materials resources and the waste during conservation works or operation period.

- The criteria for listing the heritage Buildings in Egypt is similar to those that applied in the USA and the UK, the owners of the listed building in USA, may be able to obtain many of financial incentives, that will encourage them to preserve their properties and not destruction them as (Federal Historic preservation grants, easement donation, federal tax incentives for rehabilitation, and 20% rehabilitation tax credit which is received to the listed building's owner after the conservation officer has approved that all works have been carried out in the heritage building with the heritage character of the building).

CHAPTER

II

GREEN CONCEPT AND RATING SYSTEMS

Chapter II.
GREEN CONCEPT AND RATING SYSTEMS

The energy crisis, global warming and the ozone depletions had a great role to the emergence of the Green concept and the application of the green practices in the buildings' sector, then the green concept has expansion to include reduction of the exhaustion of Material resources, reduction of the water consumption, and reduction of the waste resulted from the constructions works and operation period. In this chapter, the research overviews the energy crisis in Egypt and The effect of Global warming on Egypt, then the research overviews on the green building's concept, the integration of the heritage conservation and the green concept, and the rating system of the green buildings.

2-1. The Energy Crisis and Global Warming

2-1-1. The deffnition of the Energy Crises

An Energy Crisis is any great shortfall (or price rise) in the supply of energy to an economy. The term of "Energy Crisis" usually refers to the shortage of oil, electricity, gas, or others natural resource of fuel. The energy crisis has effects on the other sectors of the economy of any state; it leads to raise the manufacturing costs that raise the price of products. [1]

2-1-2. The Energy Crises in Egypt.

Egypt is one of the largest non-OPEC oil producer in Africa and the second largest gas producer on the continent, the Egyptian energy sector is currently witnessing enormous challenges. It is important to notice that energy production has been dominated largely by fossil fuels. Egypt has never been a major oil producer, however, until the 1990s proven oil reserves were able to meet domestic demands. In addition, despite the well-established reputation of Egypt as a major regional producer and exporter of natural gas, the country's current status with regard to natural gas is a reversal on all levels.[2]

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[1] Abd Elrazak, Nancy Mohamed(Dec. 2012)," **Zero Carbon City**", unpublished master thesis, Architecture Department, Faculty of Engineering, Alexandria university- Egypt.
[2] Hegazy, Karim (2015)," **Egypt's Energy Sector: Regional Cooperation Outlook and Prospects of Furthering Engagement with the Energy Charter**" occasional paper, Energy Charter Secretariat Knowledge Centre 2015, ISSN: 2406-6087. Page 2.

In recent years domestic supplies have fallen short of demand, due to the ongoing increase in consumption, stagnation in production, and a very generous subsidy policy which heavily contributed to increasing consumption.
Moreover, the political upheaval and instability since the Egyptian revolution in 2011 have had a robust impact on the overall energy sector, particularly with regard to foreign investment (which retreated by 3.7% in 2013), economic growth and employment. In addition to political instability, the subsidy system, mainly for energy products, contributed heavily to the budget deficit and hindered the government's capacity to pay off its debts to foreign operators, Egypt's oil sector witnessed a stark change beginning in the early 2000s.[1]

The country drifted away from being an oil exporter to a net oil importer, as domestic supplies have fallen short of demand. This was mainly due to different factors including: the enormous rise in population; growing economic development mainly in projects generated by fuel; and a drop in new investments in the oil sector (most likely as a repercussion of the energy subsidy system along with the political instability since 2011). That is lead to an increase in oil consumption in parallel with stagnation in production. Egypt's oil consumption has clearly outpaced production since 2010.[2]

Since the early 2000s, Egypt has emerged as an important producer and exporter of natural gas. Egypt started turning to gas to replace oil in the domestic market, most importantly for fuelling heavy industries and electric power plants in order to save more crude oil for exports. Until 2011 about 18% of gas production was exported. Around 80% of Egypt's natural gas reserves are in the Mediterranean and the Nile Delta, followed by smaller amounts in the Western Desert and the Gulf of Suez.[3]

Electricity consumption in Egypt is increasing faster than capacity expansion, and the country is currently witnessing a substantial power crisis. Egypt's power generation capacity is around 27 GW per year, though only about 60-70% of its capacity is operating، mainly due to the country's inability to import

[1] Hegazy, Karim (2015), pages 2, and 3.
[2] Ibid.
[3] Ibid.

raw materials necessary to produce power.[1] Egypt had originally outlined plans to install 30 GW of capacity between 2010 and 2020, with annual investment in power infrastructure initially targeted at $3bn, including significant investments in renewable energy. However, the political unrest following 2011 has disrupted these plans، discouraging investment and draining government finances.[2]

Electricity generation is fueled by around 80% natural gas and 20% oil and renewable sources. The electricity sector is by far the largest gas consumer, accounting for over half of the total gas consumption in the country. Overall, Egypt's power crisis is a result of a number of overlapping factors including: rising demand, natural gas supply shortages, aging infrastructure, political instability, and inadequate generation and transmission capacity.[3]

To overcome the crisis, the ministry of electricity and renewable energy has taken numerous steps to better implement an integrated strategy for electricity through 2027. It is based on specific pillars including: wide implementation of energy efficiency policies; diversifying sources of electricity production; expanding the usage of renewable energy (to reach 20% of production by 2020); and improving and maximizing the local component in the manufacturing process of electricity grids and infrastructure.[4]

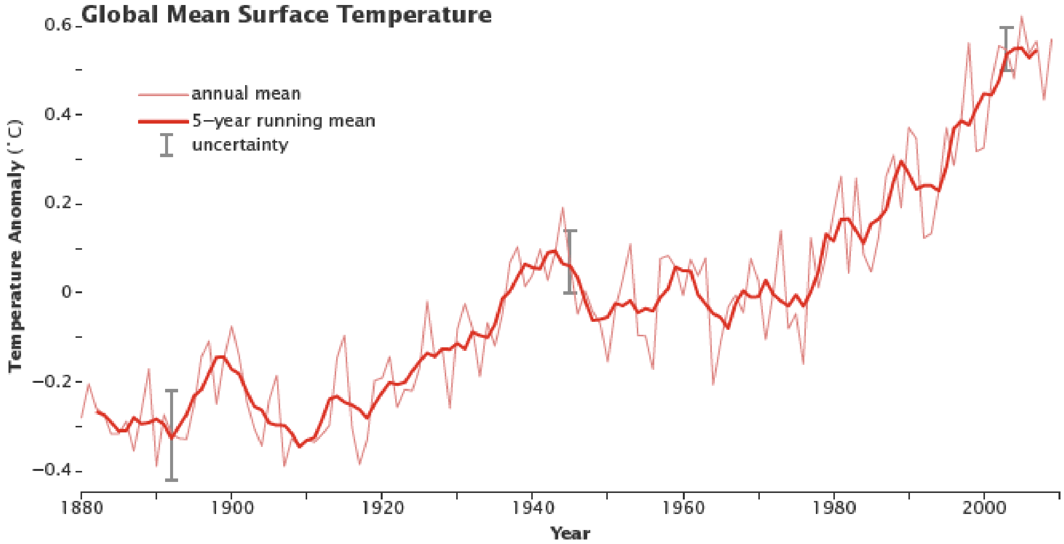
2-1-3. The definition of the Global warming

The global warming is the gradual increase of average temperature of the near surface of the earth; this term is most often used to refer to the warming that results from increased emissions of CO_2 and other greenhouse gases released by the burning of fossil fuels, and other human activities are the primary sources of global warming that has occurred over the past 50 years[5]. The scientists of climate have observed that the global average surface temperature raised from 0.6 to 0.9 degrees Celsius (1.1 to 1.6° F) between 1906 and 2005,

[1]Hegazy, Karim (2015), page 9.
[2] Ibid, page 10.
[3] Ibid.
[4] Ibid.
[5] LEED Principles and LEED Green Associate Study Guide,

and the rate of temperature increase has nearly doubled in the last 50.[1] They have recently predicted that average global temperatures could increase between 1.4 and 5.8 °C by the year 2100.[2]

Increasing global temperature will meet the polar ice caps that will raise the sea levels, it also will expanse of subtropical desert regions; increase the intensity of extreme weather events as severe storms, changes in agriculture yields, species extinctions and increase in the ranges of diseases.[3]



Fig(2-1). Global Surface Temperature

Source: NASA figure adapted from Goddard Institute for Space Studies, http://earthobservatory.nasa.gov/Features/GlobalWarming/page2.php

2-1-4. Climate change in Egypt

2-1-4-1. Geography

Egypt is located between 22 to about 33 N and 36 to about 24 E. at the northeast of Africa. It is bordered by Libya, Sudan, and Palestine. About one-third of Egypt's coast is on the Mediterranean and the rest is on the Red Sea. Egypt's land area is larger than 995,000 km2 and its coastline is 3,500-km long.[4]

[1]Global warming, http://earthobservatory.nasa.gov/Features/GlobalWarming/page2.php, The Earth Observatory-NASA.
[2] http://www.livescience.com/topics/global-warming/
[3] LEED Principles and LEED Green Associate Study Guide,
[4] Smith, Joel and Others (2013)"Potential Impacts of Climate Change on the Egyptian Economy",United Nations Development Program, Cairo, Egypt. Pages 36-37.

2-1-4-2.Climate

The climate of Egypt is described as a hot and dry. The average daily temperature ranges from 17 to 20 C along the Mediterranean coast, it becomes more than 25 C in the Upper Egypt along the Nile[1]. Fig(2-2) displays average annual temperatures across Egypt.

Rainfall is generally very low in Egypt, except, along the mediterranean coast, that the rainfall is highest where it averages more than 200 mm/yr. Rainfall rates decreased as one moves away from the coast. Most of Egypt regions receives about 2 mm of rain per year. Most of Egypt is a desert and can be classified as arid. The exception is Mediterranean coast that is slightly wetter, and can be considered semi-arid.

Generally, the small amount of rain that does fall comes in the winter, and hence Egypt has a Mediterranean climate.[2]

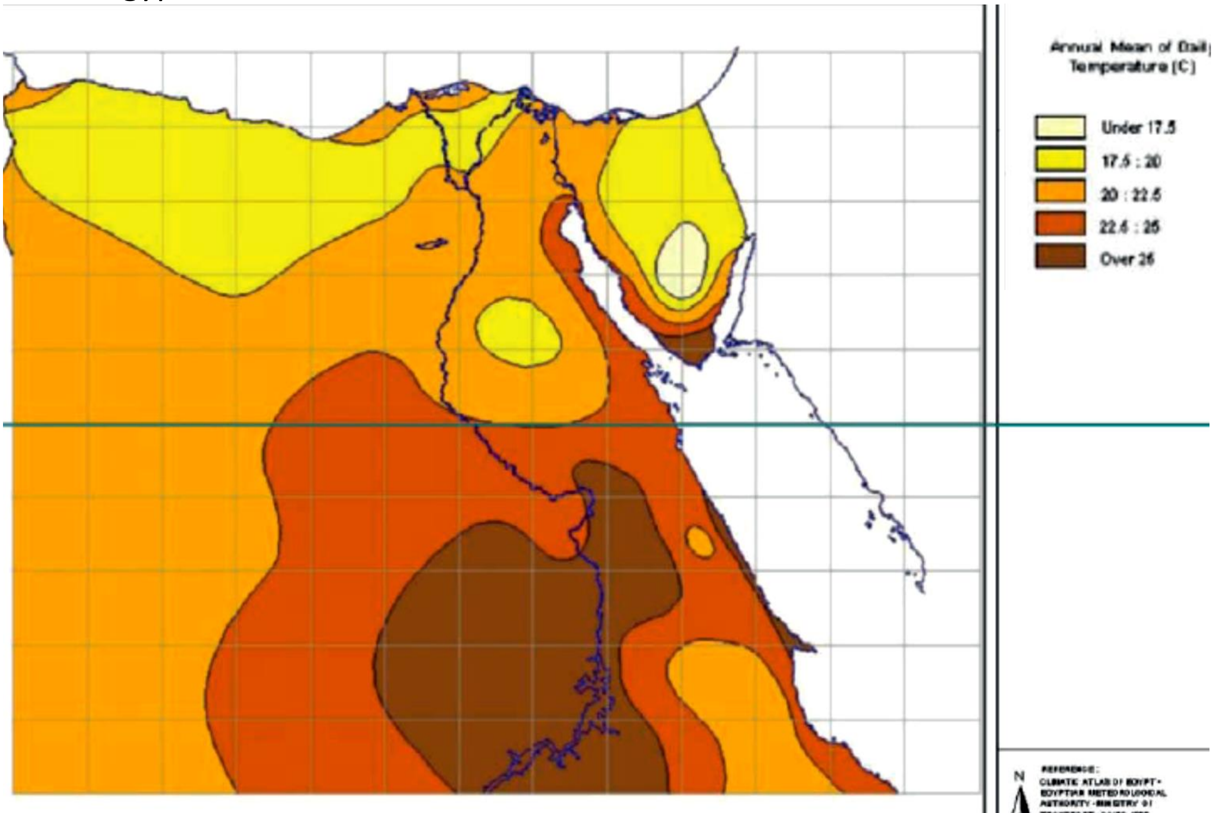


Fig (2-2). Average annual temperatures in C in Egypt.
Source : EEAA. (2010)

2-1-4-3.The effect of Global warming on Egypt.

[1] EEAA. (2010) "**Egypt Second National Communication Under the United Nations Framework Convention on Climate Change**", Egypt Environmental Affairs Agency, Cairo, Egypt

[2] Smith, Joel and Others (2013).

Brad Plumer mentioned in the introduction of his article "**Why which countries worry about global warming than poor ones**" that: "*the experts of climate have long warned that global warming will have an unequal impact around the world. Poorer countries will get hit harder than rich countries despite that, those are less well-equipped to deal with the rise of sea level, heat waves, droughts, and other disasters. Egypt will have more difficult time coping than the Netherlands*".[1]

According to the MYWorld[2] (the united nations global survey for the citizens), that showed through a survey has carried out by the citizens of different countries all over the world, that but the wealthy countries rank climate 9th on the priority list, but the poorest nations and some of the med-rang nations as Egypt has ranked "**need to take action on climate change**" as the last priority 16th on the priority list. The Egyptian citizens according to survey set their priorities to a good education, then Better healthcare and Better job opportunities, Despite Egypt will be from the most potential vulnerable countries due to the climate change.

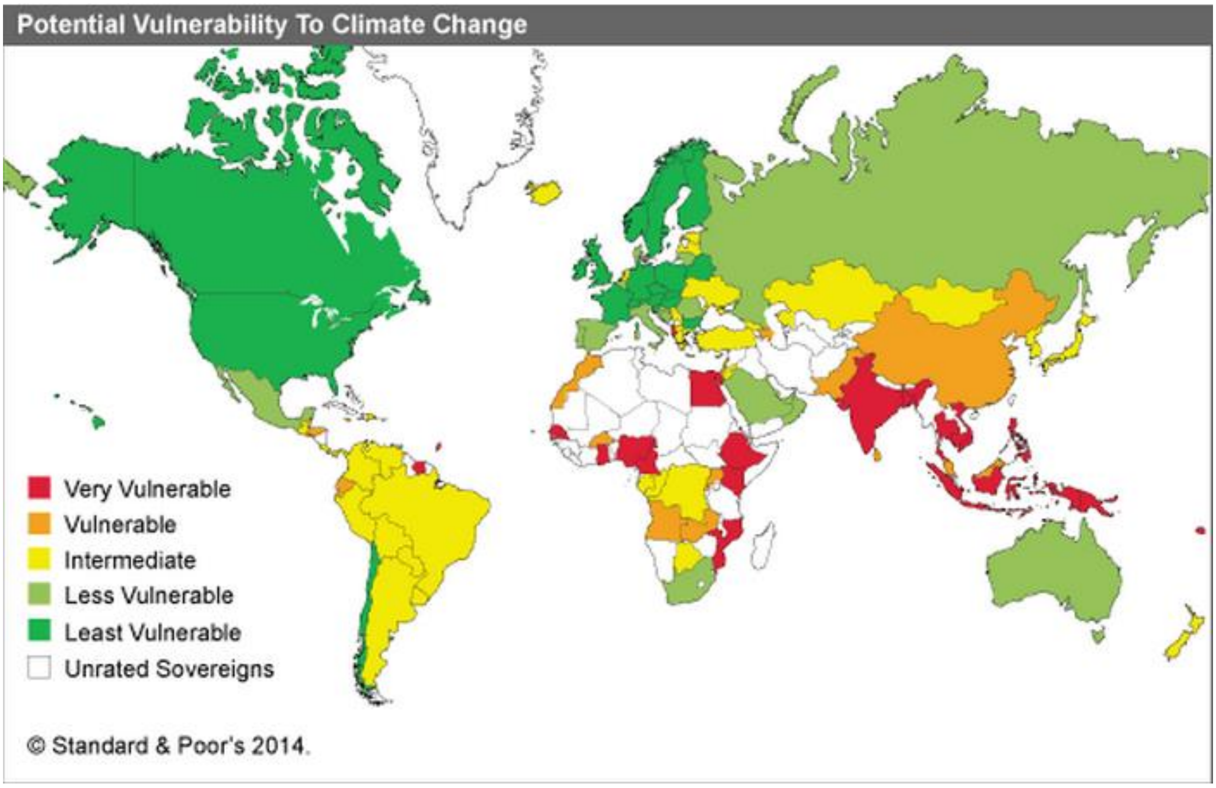


Fig (2-3), the map of potential vulnerable countries to climate change

[1]Brad Plumer, (23th September 2014)," Why rich countries worry more about global warming than poor ones", Vox energy and Enviroment, http://www.vox.com/2014/9/23/6835285/why-rich-countries-worry-more-about-climate-change-than-poor-ones , (access :May,2016)

[2] MY World (United Nations global survey for citizens) official website, http://data.myworld2015.org/?_ga=1.25276341.906524643.1407967607 , (access :May,2016).

Source: http://cdn1.vox-cdn.com/assets/4536631/climate_change_inequality_map.png

From 1961 to 2000, Egypt is getting warmer, the mean maximum air temperature increased 0.34 C/decade, while the mean minimum air temperature increased 0.31 C/decade[1]. There was a slight cooling trend across northern Egypt and a warming trend in the south from 1941 to 2000, but from 1971 to 2000 there was a clear warming trend in all stations.[2]

Temperature data from Aswan, Luxor, and Kharga show much variability but a long-term increase in temperature. Data from Alexandria, Port Said, and Asyut show that temperatures in the 1950s and 1960s were higher than in the 2000s but temperatures appear to rise slightly in recent decades.[3]

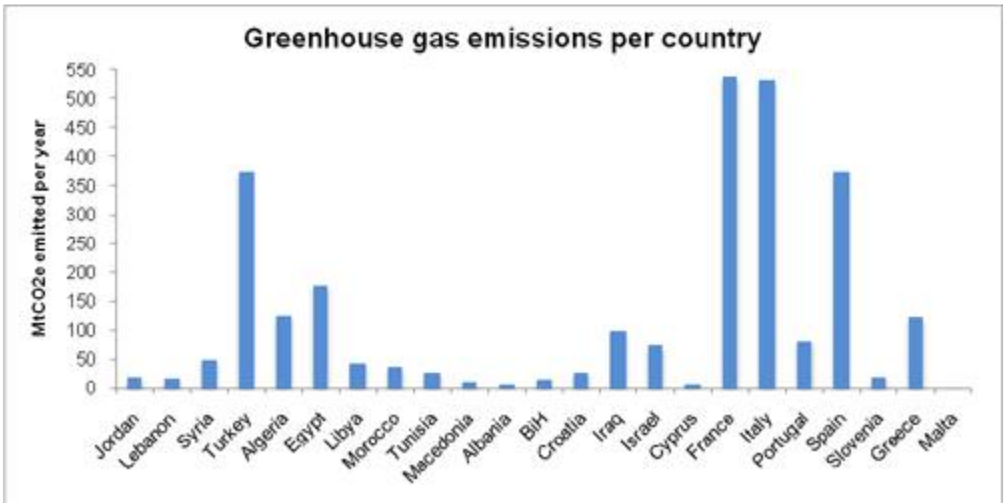


Fig (2-4). Greenhouse Gas Emissions Per Country within the Mediterranean Basin Hotspot Per Year, MtCO2e per year; GHG emissions are limited to those countries for which data exists;
Source: CAIT, 2009

2-2.Green Building Concept

The sector of constructions consumes a lot of resources. In the USA, this sector consumes resources and has negative impacts as a following[4]:

- 72% of electricity consumption.
- 39% of energy use.
- 38% of all carbon dioxide (CO2) emissions.

[1] Domroes, M. and A. El-Tantawi. (2005)," **Recent Temporal and Spatial Temperature Changes in Egypt. Int. J. Climatol**". 25:51–63.
[2] Ibid.
[3] Ibid
[4]"Green Building Education Services(2009**)," LEED Principles and Green Associate- Study Guide**", Third Edition, ", Lewisville, USA, page 12.

- 40% of raw materials use.
- 30% of waste output (136 million tons annually).
- 14% of potable water consumption.

Green building design and construction practices that meet specified standards will help resolve much of the negative impacts that buildings have on their occupants and on the environment, but reducing impacts is not the end goal.

The green buildings' concept is constantly changing and progressing. Today’s new idea may become tomorrow’s standard practice.

There are projects that already have achieved net-zero energy use or have found a way to achieve water balance and only use the water naturally occurring on the project site for water needs, other projects have achieved carbon neutrality through reduced energy use and on-site energy generation.

Green is already moving to the next level by striving for regenerative design. These would be projects that do not end, but rather renew resources for future use.[1]

2-2-1. Definition of Green Building

U.S. Environmental Protection Agency (EPA) defines the Green building as "*the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. Green building is also known as a sustainable or high performance building*".[2]

U.S. Green Building council has defined the Green buildings as the buildings are designed structures that reduce the overall negative impact of the built environment on human health and the natural environment by:

- Efficiently using energy, water, land, and materials.
- Protecting occupant health and improving employee productivity.
- Reducing waste and pollution from each green building.
- Continuously looking for ways to improve performance.

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[1]" Green Building Education Services(2009**),** page 12.
[2]U.S. Environmental Protection Agency, http://www.epa.gov/greenbuilding/pubs/about.htm , access date (09.2015).

High-performance green buildings adopt the sustainable development during the building's entire life cycle – from the beginning, since the site selection of the building to the end of the building's life. Green and Sustainable buildings are better than standard buildings. They use less energy, provide better occupant health and comfort, save money over time and are better for the environment. [1]

The Egyptian Green Building Council that is affiliated to the Egyptian Ministry of Housing and utilities has defined the green building as "Green buildings reduce pollution and enhance the efficiency of energy and water use, they are designed and constructed in such a way that the activities of their occupiers and users do not have negative impacts on the environment or human health. Green building uses green paratices such as the use of renewable energy, recycling the materials and reduction of pollution and waste, sustainable use of land, energy, water and raw materials. This in turn should create a healthier more comfortable environment and a stronger economy for building's users". [2]

2-2-2. Green building versus sustainable building:

Sustainable buildings minimize the bad impacts on the environment through the efficient use of resources without exhaustion them, respect ecological harmony, and support the traditions and community life. Sustainable buildings require balancing among economic, social, cultural and financial demands with the need to responsibly manage the environment.

Green building is another term more directly focused on the natural environment, including consideration of: site impact, water and energy consumption, greenhouse gas emissions, indoor air quality and waste management. [3]

The importance of sustainably lies in the future factors, that set a higher standard than those used to define green building. The following two examples could clarify the difference between "green" and "sustainable" concepts.

Sometimes the green material could be unsustainable material as the green bamboo flooring that is used in some green buildings and could award credits in the LEED rating system, it is a renewable resource "**Green**", but most

[1] Green Building Education Service (September, 2010), "**LEED Green Associate- study Guide**", Lewisville, USA, page 3.

[2] The Egyptian Green Building Council (April 2011), "**The Green Pyramid Rating System**", First Revision: following Draft document dated May 2010, For Public review, The Housing and Building National Research Center, Ministry of Housing, Utilities and Urban Development, Egypt. page 5.

[3] HCD Project,(Jan2008)" **Sustainable Historic Places- A Background Paper for the Historic Places Branch, Parks Canada**", Revised Edition for Publication.

of the bamboo is harvested in china and transported by ships to all over the world, the transportation process causes air pollution that is produced from fuel consumption, as well as causing carbon emissions that contributes to global climate change, all of these turn the material to be **unsustainable** material but it is still **green** material. Another example is wood that used in a green certified building, it can be **"green and sustainable"** if the company that cuts down the trees doesn't permanently deplete the forest, but if it cuts the wood in an irresponsible way, the wood produced will be **unsustainable** material at all. For that LEED v3, award the project that using reclaimed or FSC controlled wood credits that is considerate as **green and sustainable material**.[1]

In contrast, many references and studies do not distinguish between the meaning of **green building** and **sustainable building** as U.S Environmental Protection Agency (EPA) that defines the Green building as " *Green / sustainable building is the practice of using more resource-efficient and healtheir models of construction, refurbishment, operation, maintenance and demolition.*"[2]

Between the two opinions (the first is the difference between the green building and sustainable building and the second is no difference between them) **the research adopts through its methodology the most common opinion that believes that green building is a sustainable building.**

2-3. The sustainability of Heritage building.

2-3-1. Definition of the sustainability of heritage buildings:

It is the development process of the heritage buildings that has carried out respecting their heritage values and character-defining elements while reflecting sustainable building practices contribute to sustainable development**.**[3]

2-3-2. The indicators of the sustainability of heritage building:

The indicators of sustainability have been used for examining the performance of environmental, social, economic and urban planning for more than 40 years. A total of 18 indicators have been used to assess the level of heritage building

[1] Maetty,Mercedes (2015),"The Difference Between Green and Sustainable", Sourceable, industry news and analysis, https://sourceable.net/difference-green-sustainable/#

[2] U.S Environmental Protection Agency(EPA), http://archive.epa.gov/greenbuilding/web/html/

[3] HCD Project,(Jan2008)", Page 6.

sustainability. The 18 indicators are divided into three dimensions: environmental dimension, social dimension, and economic dimension.[1]

- **Environmental dimension:**

Any building as well as heritage building consumes the energy and produces waste brings negative impacts to the environment. The consumption of energy for the older building may be higher for maintain the humidity to avoid the building deterioration.

Eight indicators are developed to measure the environmental sustainability of the heritage building and be ensuring that the building is environmentally sound such as[2]:

- Measuring the carbon emissions of a heritage building that generating from its electricity usage.
- The presence of on-site renewable energy systems provided that not harming the values of the heritage building.
- Compliance with the building standards helps to ensure the health and safety of the occupants.
- The presence of environmentally friendly devices may result in less energy consumption and reduce the negative effects that leading to climate change.
- Availability of public transit such as mass transit train and buses will bring less traffic.
- Contributing less consumption of fuels and air pollution,
- Managing the building's waste.
- Reducing using of ozone- depleting substances.

- **Social dimension:**

Heritage sustainability includes the social aspect such as social security, equity, labor market relations, etc. Social dimension of heritage building sustainability has six indicators, such as[3]:

- The importance of heritage building to a sense of place need to be examined, its demolition could make a felling a loss to local inhabitants,
- Provides knowledge to present and future generation about the importance of heritage and the past.
- The process of maintenance of the heritage building could develop skills of the local people if they involved in it.
- Accessibility of the heritage building, everyone should have a fair access to the building, physically or virtually via websites.

[1] Liusman, Ervi. C.W.HO, Daniel. and X. GE, Janet (2013)," **Indicators for Heritage Buildings Sustainability**",Decision-support tools and assessment methods, Central Europe towards Sustainable Building 2013 conference, Prague, Czech Republic.
[2] Liusman, Ervi. C.W.HO, Daniel. and X. GE, Janet (2013).
[3] Ibid.

- Promotion of leisure.
- Promotin arts program for a heritage building.

- **Economic dimension:**

To be sustainable, the heritage building should be growth-oriented and economically sound. The economic sustainability has four indicators:[1]

- The economically sustainable heritage building can create the employment opportunities and boost the local economy.
- Investing the heritage building.
- using it economically can generate income for operating expenses,
- Periodic maintenance and future restoration.

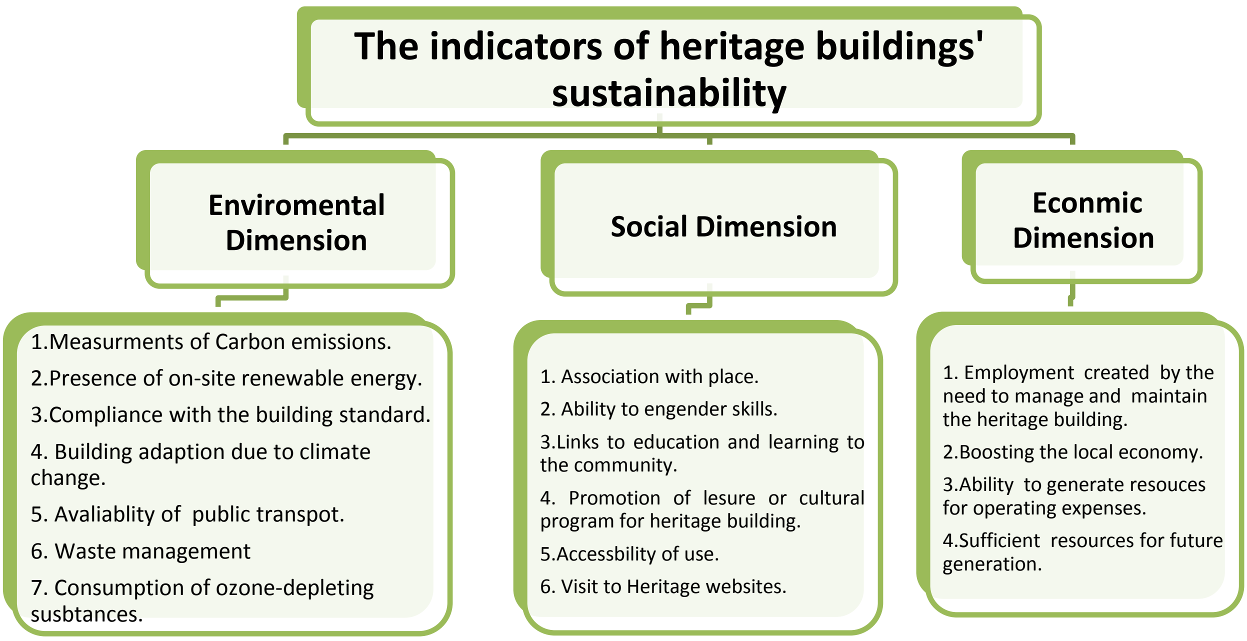

Fig (2-5). The indicators of heritage buildings' sustainability
Source: (Liusman, Ervi. C.W.HO, Daniel. and X. GE, Janet 2013)

2-3-3. Strategies for the integration of the heritage conservation and the green concept:

The integration of the heritage conservation and the green concept including five strategies: the integrated design process, life-cycle assessment,

[1] Liusman, Ervi. C.W.HO, Daniel. and X. GE, Janet (2013).

operating and embodied energy, the durability of building materials and assemblies, construction and demolition waste management, and the mitigation of hazardous materials.[1]

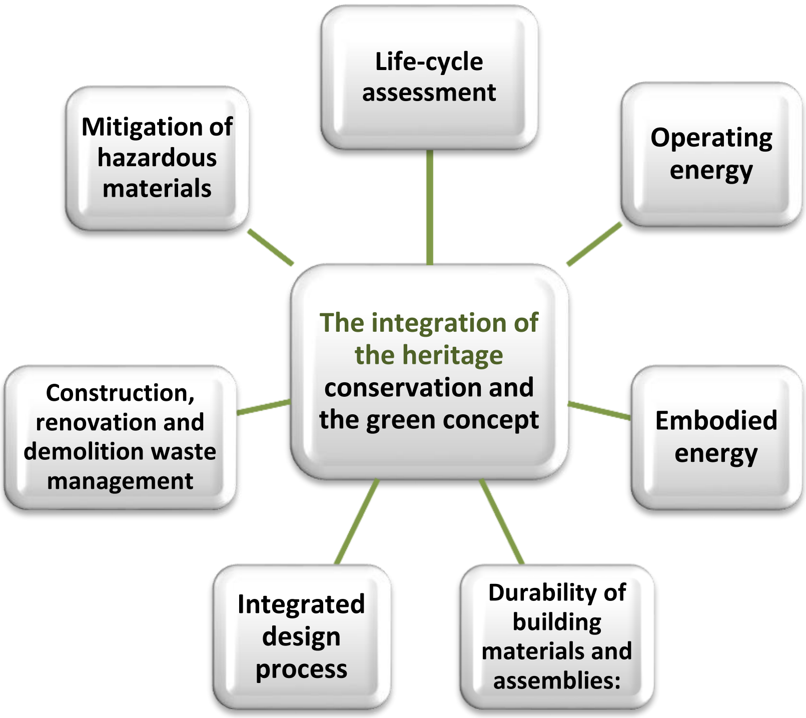

Fig (2-6). The integration of the heritage conservation and the green concept

Source: (reseracher) based on the data of HCD Project,(Jan2008).

- **Integrated design process**: The integrated design process (IDP) is a collaborative process that aims to the high performance of heritage building, enables every member of the project team to share his vision for greening the building, and working collaboratively to achieve the sustainability and green goals. This process enables the team to optmize systems, reduce opearing and maintenance costs, and minimize the need for incremental capital[2], as well as, involve the environmental consultants from an early stage in project planning for the heritage building.

  The value of early consideration and discussion of heritage in project planning is already well understood in heritage conservation. In particular in cases that may later involve approvals by authorities that can lead to delays or major changes, earlier integration can help avoid wasting human energy and time.

[1] HCD Project,(Jan2008)" **Sustainable Historic Places- A Background Paper for the Historic Places Branch, Parks Canada**", Revised Edition for Publication

[2] The integrated design process, http://www.nrcan.gc.ca/energy/efficiency/buildings/eenb/integrated-design-process/4047

Adaptation of the IDP to a heritage project should be fairly clear, meaning involvement of heritage goals, information, and expertise from the beginning.[1]

- **Life-cycle assessment[2,3]:** Life-cycle assessment (LCA) is a methodology for assessing the environmental performance of the materials, products, or systems that used in the building over its full life cycle, also called a "cradle-to grave" analysis.

  LCA considers the impact at every stage, from the extraction of raw materials, to manufacturing, transportation, assembly and construction, use, maintenance and disassembly and reuse or disposal, with respect to energy used, greenhouse gases emitted, water polluted, etc. LCA data on environmental impacts include global warming, ozone depletion, smog formation and micro particulate matter. These impacts can be converted to negative human health impacts, ecosystem toxicity and natural resource depletion.

  LCA is useful for the comparison between two materials or products that have similar functions, for that it is critical to informed sustainability decision making, particularly with regard to heritage buildings, these sensitive buildings need to evaluate the environmental aspects of replacement of their materials versus renovation them.

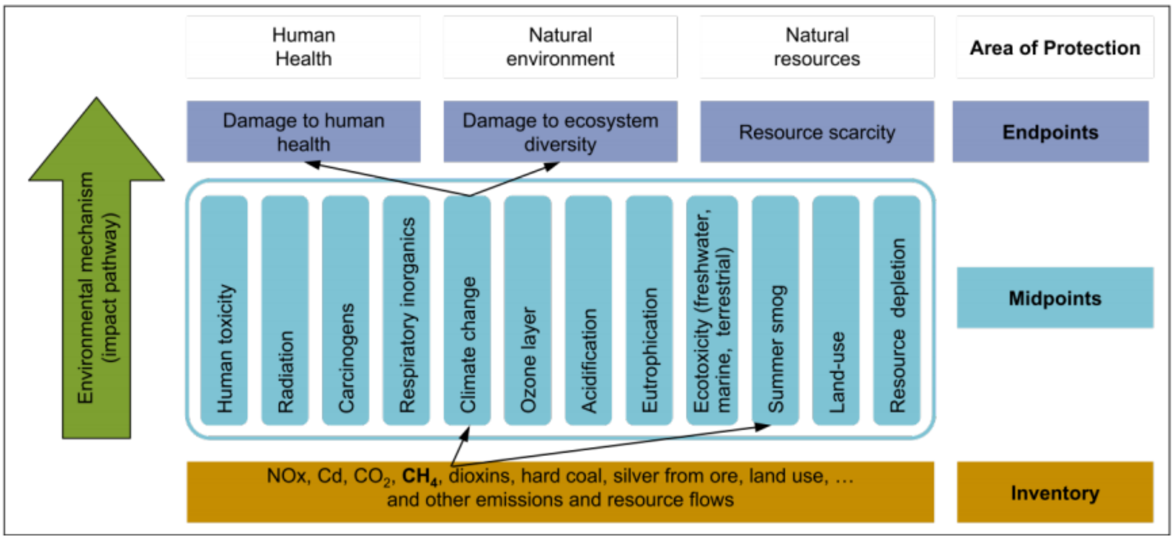

Fig (2-7) Life cycle assessment categories

Source: European Commission. (2010). ILCD Handbook - General guide on LCA - Detailed guidance. doi:10.2788/38479

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[1] HCD Project,(Jan2008).

[2] HCD Project,(Jan2008).

[3] Fan, Dennis(2014),"Greening a Heritage Building",Greenest city scholar, city of Vanouver, Canada, https://sustain.ubc.ca/sites/sustain.ubc.ca/files/Sustainability%20Scholars/GCS%20reports%202014/GCS%20Heritage%20Report.pdf

- **Operating energy:** Operating energy is the total energy consumed by heating, cooling, ventilation, lighting, equipment and appliances in the heritage building; it is a key performance issue for sustainability because of the direct connection to consumption of non-renewable resources and greenhouse gas emissions. Operating energy modelling (computer modeling programs) enables clear comparisons between various building technologies. To achieve potential savings in operations energy, that could need a major modification on the building envelop, that will be critical for a heritage building. to improve the thermal comfort of the building, that will need adding insulation and vapour barrier or replacing the old windows with double glazed ones, that may have a negative impact on heritage value.[1]

- **Embodied energy:**

There are two main forms of embodied energy: Initial embodied the energy and Recurring embodied energy.

Initial embodied energy of a building is the total energy required for extracting, processing, manufacturing, and transporting the building materials to the building site, the energy consumption for those processes produces CO2 that contributes to the greenhouses gas emissions, so the initial embodied energy is considered as an indicator for the overall environmental impacts of the building materials and system in the initial process. That will be useful in the comparisons that are occurred at the selection process for the materials for new buildings, and for renovation projects that need to replace old materials with new ones.

Recurring embodied energy is the energy consumed to maintain, repair or replace during the service life of the material. For that, the recurring embodied energy of a material increases over time, but its initial embodied energy remains the same.[2]

The embodied energy is measured as the quantity of non-renewable energy which is consumed of building material or system per unit. It is expressed in mega joules(MJ) or gigajoules (GJ) per unit weight per unit weight (kg or tonne) or area (m2), but the calculation of embodied energy is complex as the component factors can vary for the same material in different places.[3]

At fig (2-8) aluminum sheet has highest embodied energy per one tonne, and the concrete has lowest embodied energy per one tonne, in spite of that, materials with the lowest embodied energy, such as concrete, and bricks are usually consumed in large quantities, but materials with high energy content such as stainless steel and aluminum are often used in much smaller amounts. As a result, the greatest amount of embodied energy in a building can be from either

[1] HCD Project,(Jan2008).
[2]Ibid.
[3]The authority on sustainable building- New Zealand, http://www.level.org.nz/material-use/embodied-energy

low embodied energy materials such as concrete or high embodied energy materials such as steel.[1]

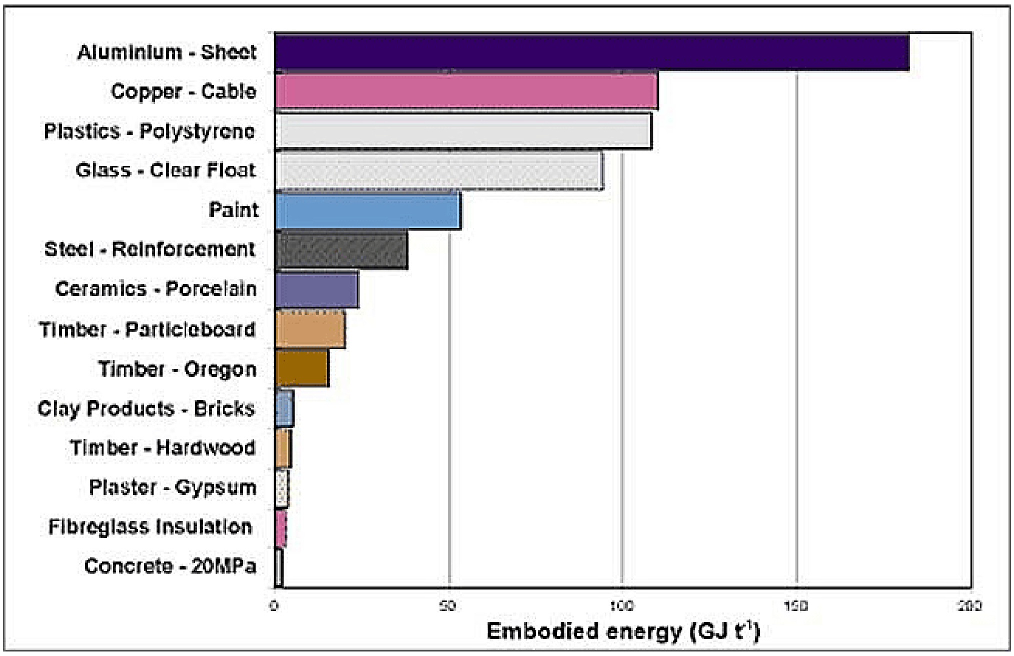

Fig (2-8) Levels of embodied energy for materials used in the average Australian house.
Source: Milne. Geoff (2013)

The team of a project can reduce the embodied energy for the whole heritage building, the selection process of building materials should be balanced between the embodied energy of each material and factors such as climate, availability of materials, transport costs, the durability of materials, avoiding waste, prefer locally sourced materials, prefer the recycled materials, and selecting materials that are manufactured using renewable energy resources.

The durable materials of well-built heritage buildings may mean lower recurring energy, and should therefore not be replaced by initially cheaper but ultimately more costly alternatives. When a building has demolished the benefits of the embodied energy are lost and energy is consumed in the demolition process.

Life cycle assessment (LCA) allow more accurate accounting of not just energy stored within the material, it looks at the avoided impacts, taking into account the impacts of new construction and what can be avoided by reusing the existing structure. This approach compares heritage buildings to new construction by analyzing impacts associated with the changes needed to improve the existing building versus a total replacement with a new building.[2]

[1] Milne, Geoff (2013),"**Embodied energy**", Your home- Australia's guide to environmental sustainable homes, Australian government, http://www.yourhome.gov.au/materials/embodied-energy .
[2] Fan, Dennis(2014).

- **Durability of building materials and assemblies:** it is the ability of a building and any of its parts, components and materials to perform their required function/ to resist the action of degrading agents over a period of time. Older building materials are often much more durable than those used today.
  The durability of the original building materials and assemblies has an important impact on the life-cycle assessment of the building.
  Two concepts to understand with respect to heritage conservation are <u>differential durability</u> and <u>service quality</u>. The concept of **differential durability** means the service life; different materials or components of a building may have different service lives. The service life of a material is defined when it need intervention "such as replace it", but **service quality** is a concept related to durability that goes beyond the purely functional performance of a product, component, or construction to include attributes such as aesthetics.
  Two materials might have the same service life, but one of the two might age in a more acceptable way, for example by developing an acceptable patina.[1]

- **Construction, renovation and demolition waste management**: Construction, renovation and demolition (CRD) waste management is intended to reduce the amount of landfill by reduction, reuse and recycling activities. Some of the case studies carried out include renovation of heritage buildings demonstrate high levels of diversion from landfill through reuse and recycling.
  One of the strategies to manage the waste is the re-use of the salvaged materials from the old building that need to be demolished, such as doors, windows, bricks, tiles, wood, and fireplaces. From the heritage conservation perspective, there are some obvious dangers in the development of the salvaging industry. First, it can lead to a false or confusing sense of place that will have many components from many ages and styles. Second, it can lead to encourage the demolition of the heritage building to reuse their components and materials. In this context, the Standards and Guidelines for the Conservation of Historic Places in Canada explicitly discourage the falsification of history and encourages the appropriate conservation of archaeological resources.[2]

- **Mitigation of hazardous materials**: Renovations to existing buildings often involve dealing with hazardous materials that are no longer used. The removal and disposal of these materials require special planning to don't loss their values. In heritage building, the mitigation of the removal of building materials that classified recently as hazardous materials on the human and animal health such as lead pain and the asbestos in plaster and insulation could lead to loss the value of heritage building. it would be better to consider encapsulation, as opposed to

[1] HCD Project,(Jan2008).
[2]Ibid.

complete removal of these elements and loss their values. For that the mitigation of hazardous materials of heritage buildings need more careful planning that must determine the risks and consider available alternative solutions without harming the values of these buildings or cause a negative effect on the health of the potential users and the renovation workers.[1]

2-4. Sustainable and green characteristics of Heritage Buildings in Egypt:

While it is difficult to generalize about the sustainable characteristics of heritage buildings especial the environmental performance of them due the vary differently in their site, size, materials, the date or the era of their construction, but many of them especially those that were built before the 1940s -1970s period (that are considered to be the poorest performers from an energy point of view) already has green ideas in their original design or construction[2] that can often be identified when considered in terms of modern green design strategies, such as :

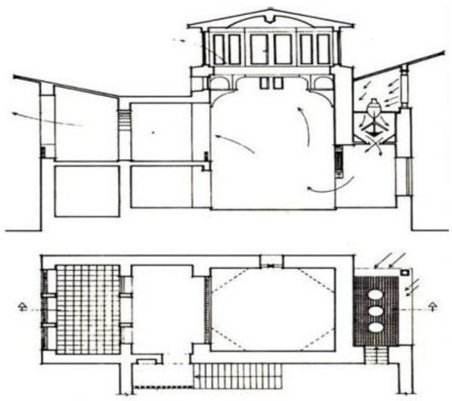

Fig (2-9), *Wind catcher at one of Cairo's old houses*

Source:
Tolba,M.M (2014), (Wind Towers "Wind Catchers" A Perfect Example of Sustainable Architecture in Egypt), International Journal of Current Engineering and Technology, E-ISSN 2277 – 4106, P-ISSN 2347 – 5161.

- The use of durable materials.
- The use of local traditional materials and skills, such as "wood, stones, granite, and brick".
- Energy saving features through bearing walls that have greater depth.
- The use of natural ventilation by hanged windows and malqaf "wind catcher". Fig(2-9).
- Smaller recessed windows, windows shutters and awnings. Fig(2-10).
- The use of natural daylight by glass windows, mashrabyia, skylight and the ability to open shutter windows. Fig(2-11), Fig (2-12).
- Most of those building are existing in dense urban forms "the cities' downtown and its surrounding areas", often easily accessible by public transportation or with little provision of parking.

[1] HCD Project,(Jan2008).
[2] Ibid.

Fig (2-10). *Some examples of the windows of El-Sekka el-Gedida street's heritage buildings at Mansoura city-Egypt, despite the different forms of them, the common feature is used the shutter windows for thermal comfort and privacy purposes.*
Source:
*Foda, Mohanad ali (2011),"***Urban Heritage Sites' Sustainable as an Approach to Development Intermediate Cities***", unpublished master thesis, Mansoura University, Egypt.*

The houses of Rosetta are considered as sustainable and green examples according to the previous concept, it consists of 3 or 4 floors, their construction from bearing walls from the moulded and grouted bricks, in the buildings' facade these bricks were painted red and black for decorative purposes fig(2-12), used wooden corbel celling for added more strength to the house's construction, used the mashrapuyas as windows as well as skylight (shokhsikha) at the last floor's roof for ventilation, thermal performance and daylight purposes. Fig(2-11).

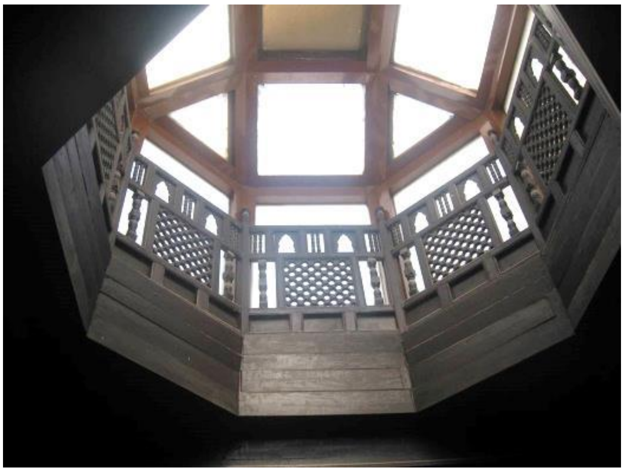

Fig (2-11) the main façade of *Arab Kully's house in Rosetta-Egypt.*
Source: *(Researcher)*

Fig (2-12) *the skylight of the third floor's roof of Arab Kully's house in Rosetta-Egypt,*
Source: *(Researcher)*

2-5. Green building rating system tools

Green rating systems help to evaluate new or existing buildings based on their environmental performance. They inform how the building has comptaible with the environment, providing clarity to what extent green components have been merged and which sustainable principles and practices have been employed.[1]

Owners, designers, builders and governments all over the world are using these rating tools to help define and set sustainability performance targets, measure progress toward meeting them and verification of post project performance. The best known of these rating tools is probably **LEED** (Leadership in Energy and Environmental Design) but there are others that are widely used.[2]

The Building Research Establishment in the UK developed **BREEAM** (Building Research Establishment's Environmental Assessment Method) that is considered the world's first sustainability rating system. BREEAM is now an international standard that is locally adapted, operated and applied through a network of international operators, assessors and industry professionals.[3]

Canada LEED and **Green Globes** are increasingly used in Canada. some major institutions and associations (Canadian Wood Council, Sustainable Forests Council) have developed rating systems of their own to ensure their particular circumstances are considered.[4]

Green Star is a green building rating system in Australia; it is a voluntary rating system for buildings and communities. It is transforming the way of Australian built environment is designed, constructed and operated. The green star is helping to ehnance environmental efficiencies in the Australian buildings. [5]

CASEBEE is a green building rating system in Japan, CASBEE is composed of four assessment tools, CASBEE for Pre-design, CASBEE for New Construction, CASBEE for Existing Building and CASBEE for Renovation.[6]

All the previous rating systems provide a means of assessing a building's or project's impact on the environment, by rating its environmental performance across a broad range of environmental considerations such as environmental

[1] Abbo-Assy, Hala Fouad(2013), "**Sustainable Rating Systems**", Unpublished Master thesis, architectural department, Faculty of Engineering, Alexandria University, Egypt.
[2] Ibid.
[3] BREEAM refurbishment domestic buildings, technical manual SD5077-2014-1.0, page 2.
[4] HCD Project,(Jan2008).
[5] Green Building Council of Australia (2013) "**Introducing Green Star**", Green Star Rating system tool, Australia, http://www.gbca.org.au/uploads/110/35950/Introducing_Green_Star.pdf. . Accessed (April,2016).
[6] The official site of CASBEE, http://www.ibec.or.jp/CASBEE/english/method2E.htm . Accessed (April,2016).

management policy, site usage, water, energy, greenhouse gas emissions, materials and resources, indoor environmental quality (IEQ), workplace quality and other factors.[1]

The Green Pyramid Rating System (GPRS) is an Egyptian environmental rating system for buildings. It provides definitive criteria that can evaluate the environmental credentials of buildings, and the buildings themselves can be rated.[2]

Each rating systems has developed their tools for different uses such as commercial, industrial, retail, and educational and health buildings, some of them developed the ability to applied this evaluation to the global, local, and internal environments, focusing on design stage assessments as (new build and refurbishment) and also to the ongoing operation and management of the building .[3]

Each tool seeks to a rating of the building that is used to market the building. such as **LEED** in the USA uses a scale of platinum, gold, silver, and bronze to indicate a higher or lower rating, **BREEAM** in the UK adopts scale from pass to excellent, Green Star in Australia adopts a star rating from 1 to 6, the projects that are assessed under Green Star can achieve a Green Star certification of (4 – 6 Star) Green Star, but the buildings that been assessed using the Green Star – Performance rating tool can achieve a Green Star rating from(1 – 6 Star) Green Star.[4] A five-level scoring system is used in **CASBEE**, and a score of level 3 indicates an "average.[5] **Green Pyramid** rating system in Egypt adopts uses a scale of green ,platinum, gold, silver pyramid to indicate a higher or lower rating, which a green pyramid is the highest rating.[6]

The following sections make an overview of the LEED rating system, BREEAM rating system, and Green Pyramid rating system.

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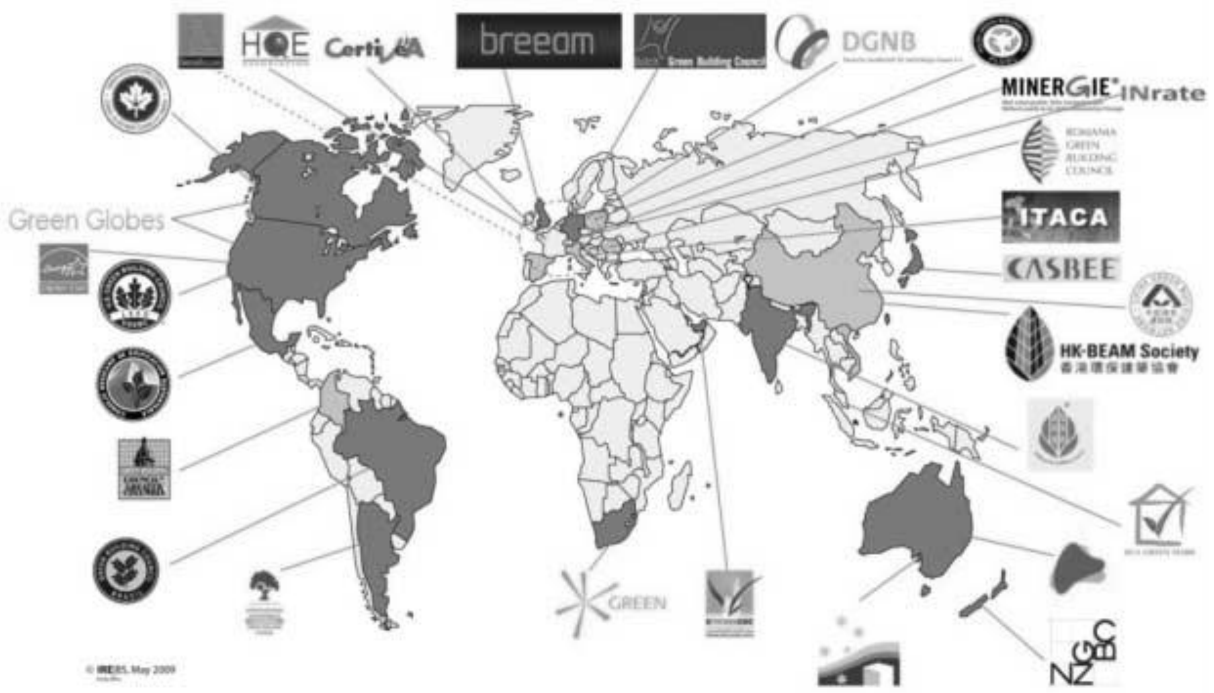
[1] HCD Project,(Jan2008).
[2] The Egyptian Green Building Council (April 2011), page 6.
[3] Abbo-Assy, Hala Fouad(2013).
[4] Green Building Council of Australia (2013).
[5] The official site of CASBEE, http://www.ibec.or.jp/CASBEE/english/method2E.htm . Access (April,2016).
[6] Ibid.



Fig(2-13) Green building rating systems
Source: http://ecogreenbuilder.com.my/green-info/green-building-rating-systems/

The following table compares among seven rating systems, to define the rating systems that will be analyzed to produce an Egyptian rating system for assessing the heritage buildings in Egypt (in chapter 5).

Table (2-1), The comparison among rating systems.

	The origin country	**The type of rating system**	**New construction scheme**	**Rating Existing Buildings**	**Can be used to assess existing Buildings in Egypt**
LEED	USA	International	√	√	√
BREEAM	UK	International	√	√	√
Green Globes	Canada	The USA and Canada only	√	√	×
Green Star	Australia	Australia	√	√	×
CASBEE	Japan	Japan	√	√	×
GPRS	Egypt	In Egypt only	√	×	×
GBC Historic Building (Pilot Version)	Italy	In Italy only	×	**Assess heritage buildings only**	×

Source: (Researcher)

Among the seven rating systems, there only two international rating systems (LEED and BREEAM), both of them have certified several heritage buildings all over the world through their different schemes. Both of them also can be used to assess existing building in Egypt.

For that, the research will make an overview of LEED rating system, BREEAM rating system, and Green Pyramid rating system in the following section in this chapter. In the next chapter, the research will study and comparison among the three rating systems: **LEED O+M**, **BREEAM 2014 Refurbishment and fit-out** for non-residential existing buildings, **BREEAM Domestic Refurbishment** for residential existing buildings, as well as the research will make an overview of "**GBC historic building rating system**".

2-5-1. LEED (Leadership in Energy and Environmental Design) rating system.

The Leadership in Energy and Environmental Design (**LEED**) is a voluntary, market-driven program that provides third-party verification of green buildings, from new constructions to existing buildings and from individual buildings and homes, to entire neighborhoods, and applies to institional, commercial and residential buildings.

Fig(2-14). *LEED's logo.*
Source : http://www.usgbc.org/
(access Feb. 2015)

History of LEED:

LEED was developed by U.S. Green Building Council (**USGBC**) which was founded in 1993. The LEED standard was created through volunteer committees. LEED grew from one standard for new construction to a comprehensive system of different standards covering all aspects of the development, enviromental issues and construction process from 1994 to 2006,.[1] LEED also has grown from 6 volunteers on one committee to more than 200 volunteers on 20 committees and nearly 150 professional staff.[2]

Green Building Certification Institute (GBCI) was established in 2008 with the support of the USGBC to independently administer credentialing programs

[1] LEED Principles and LEED Green Associate Study Guide.
[2] Ibid

related to building practice. GBCI manage all aspects of the LEED professional accreditation program, including examination.

USGBC respinsibles for the developing of the LEED rating systems while **GBCI** administers all LEED AP[1] accreditation and LEED project certification.[2]

LEED online is a tool allows team members to submit all project's documentation online, including documents, pictures, and drawings. Via LEED online, the team members can update credit templates, view and submit CIR, contact customer services.

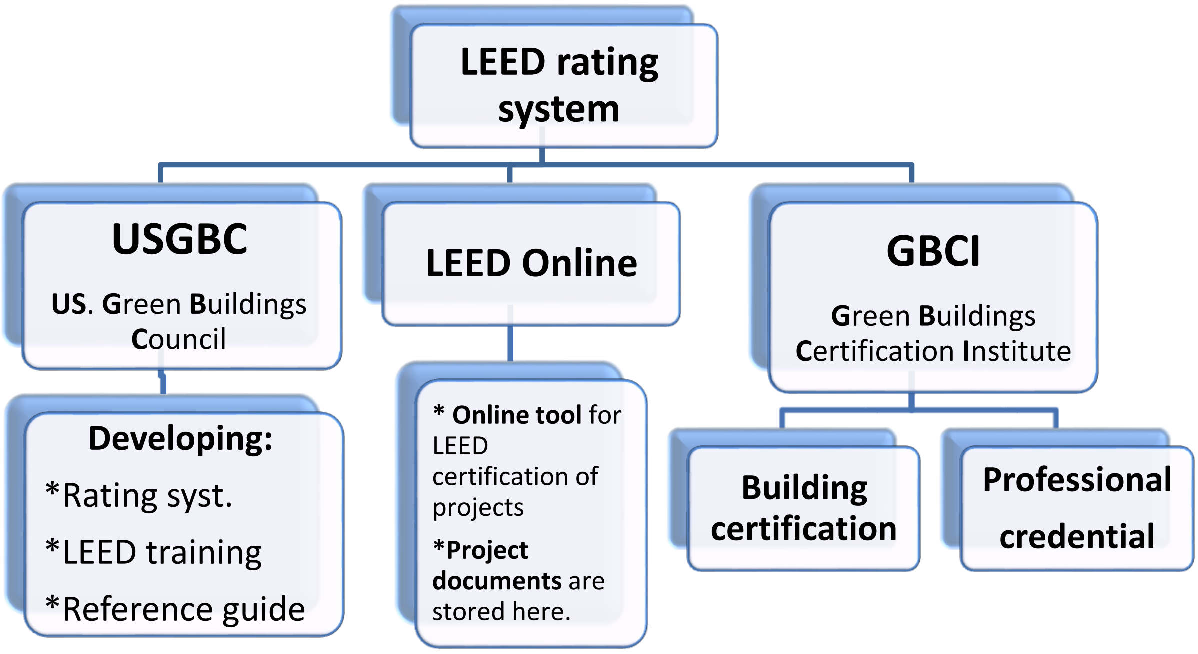


Fig (2-15).the difference among USGBC, LEED online, and GBCI
Source : LEED Principles and LEED Green Associate Study Guide

LEED provides building owners and operators, the tools they need to assess their buildings' performance, while providing healthy enternal spaces for a building's occupants.[3] According to LEED version four that has been launched in July 2014, LEED recognizing performance of building into six main credit categories: table (2-2)[4,5]

Location and Transportation, Sustainable sites, Water efficiency, Energy and Atmosphere, Materials and Resources, Indoor environmental quality, and Innovation in design, plus additional bonus credit categories **Innovation in design**, and **Regional priority** that applies only to the projects inside the USA.

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[1] LEED AP: LEED accredition Proffissional
[2] LEED Principles and LEED Green Associate Study Guide,
[3]Abbo-Assy, Hala Fouad(2013),page 13.
[4] Fouad, Faten Fares **(2012),"Nano Architecture and Sustainability",** unpublished Master thesis, Architecture Department, Faculty of Engineering, Alexandria university- Egypt., page 23,24
[5] http://www.usgbc.org/LEED#credits access(Feb.2015)

<u>LEED for neighborhood development</u> has different credit categories**: smart location & linkage**, **neighborhood pattern& design**, **Green infrastructure & buildings**, plus additional bonus credit categories **Innovation**, and **Regional priority**.

<u>LEED for homes</u> in LEED v4 became the same credit categories like the other types of LEED rating systems.

Table (2-2). The catogeries of LEED rating system

The Main credit categories of LEED rating systems exclude neighborhood development rating system.	
	**Location and transportation (LT):** this category encourages building on previously developed or infill sites and away from environmentally sensitive areas. Credits reward projects in the dense areas, near diverse uses, with access to a variety of transportation options, near already-existing infrastructure, community resource and transition locations that promote access to open space for walking, physical activity and time outdoors.
	**Sustainable site development (SS):** this category encourages strategies that minimize the impact on ecosystems and water resources. This category controls storm water runoff, promotes the reduction of erosion, light pollution, heat island effect and constructed-related pollution.
	**Water efficiency (WE)**: credits promotes smarter use of water, inside and out, to reduce potable water consumption by using more efficient appliances, fixtures and fitting inside and water-conscious landscaping outside.
	**Energy and atmosphere (EA):** this category promotes better building energy performance through innovative strategies by encouraging commissioning, , efficient design and construction, efficient appliances and lighting , energy use monitoring, , the use of renewable and clean sources of energy, generated on-site or off-site, and other innovative measures.
	**Materials and resources (MR):** this category encourages strategies that minimize the impact on ecosystems and water resources by selecting a sustainable grown, harvested, produced and transported products and materials. This catergory also promotes the concept of waste reduction, reusing, and recycling.
	**Indoor environmental quality (EQ): this catergory** promotes better indoor air quality and access to natural daylight and views, and improves acoustics.

Table (2-2) continued. The catogeries of LEED rating systems

The Main credit categories of LEED neighborhood development rating system.	
	Smart location & linkage: this category promotes walkable neighborhoods with efficient transportation options and open space.
	Neighborhood pattern & design: this category emphasizes compact, walkable, vibrant, mixed-use neighborhoods with good connections to nearby communities.
	Green infrastructure & buildings: this category reduces the environmental consequences of the construction and operation of buildings and infrastructure.
Additional bonus credits categories for all LEED rating systems.	
	Innovation: this category addresses sustainable building expertise as well as design measures, innovation technologies and strategies not covered under the main LEED credit categories. This catergory also rewards the project one point if it has one LEED® Accredited Professional (LEED AP) in the project team.
	Regional priority: this category addresses regional environmental priorities for buildings in different geographic regions of the USA only

Source : http://www.usgbc.org/ (access Feb. 2015)

LEED projects have been successfully registered in 135 countries. International projects, those outside the United States, make up more than 50 % of the total LEED registered square footage.[1]

There are five rating systems that address multiple project types:

Fig(2-16) the LEED's rating systems

Source : http://www.usgbc.org/ (access Feb. 2015)

[1] Abbo-Assy, Hala Fouad(2013), page 13

Minimum program requirement (MPRs):

According to LEED v4, there are 3 of mandatory requirements that the project must comply with, in order to achieve certification as a follows[1]:

1. **Be a complete or permanent building or space.**
2. **Use a reasonable site boundary.**
3. **Comply with minimum floor area requirements.** Minimum gross floor area of the building LEED BD+C and LEED O+M Rating Systems: 1000 square feet (93 m2), for LEED commercial interior rating system: 250 square feet (22m2). The LEED project should contain at least two habitable buildings and be no larger than 1500 acres for LEED Neighborhood Development
   Rating System.

Credits

Each sustainable category comprises from a group of credits that acheives a particular sustainability goal, credits are optional elements. The project only needs to achieve enough credits for the certification level the project is aiming for - certified, silver, gold, or platinum.

Prerequisites:

A fundamental of every LEED Rating System are the prerequisites. Prerequisites are mandatory credits do not earn your project any points because they are required for the project to be considered.
Each project must satisfy all the catogeries' prerequisites outlined in the LEED rating system that it is registered. The Failure in meeting any prerequisite will render a project ineligible for certification.[2]

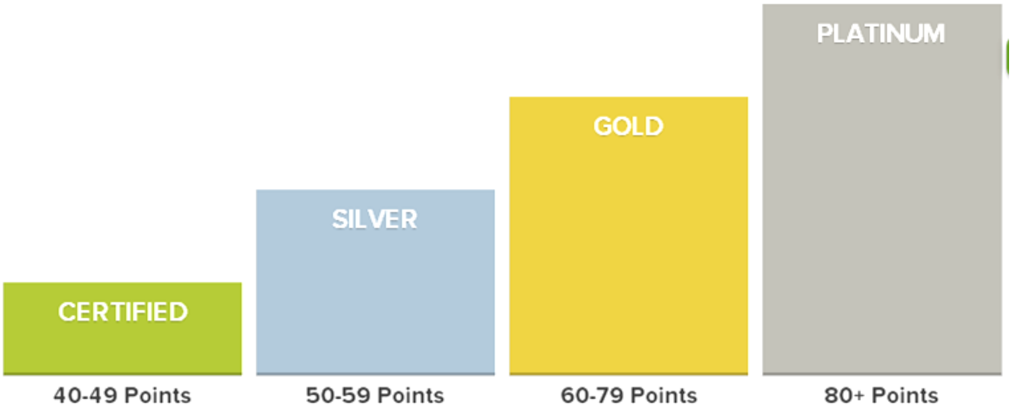
How to achieve certification

In LEED v4, all types of LEED rating systems has 100 possible base points plus 10 bonus points (6 points for innovation , and 4 points for regional priority). A project must satisfy all minimum program requirements (MPRs), all prerequisites and earn a minimum number of points to be certified.

[1] LEED Principles and LEED Green Associate Study Guide, Third Edition, Green Building Education Services, LLC, 2014, page 53,54.
[2] Ibid, page 47.

Certification levels:

There are four levels of certification- the number of points a project earns determines the level of LEED certification the project will receive.

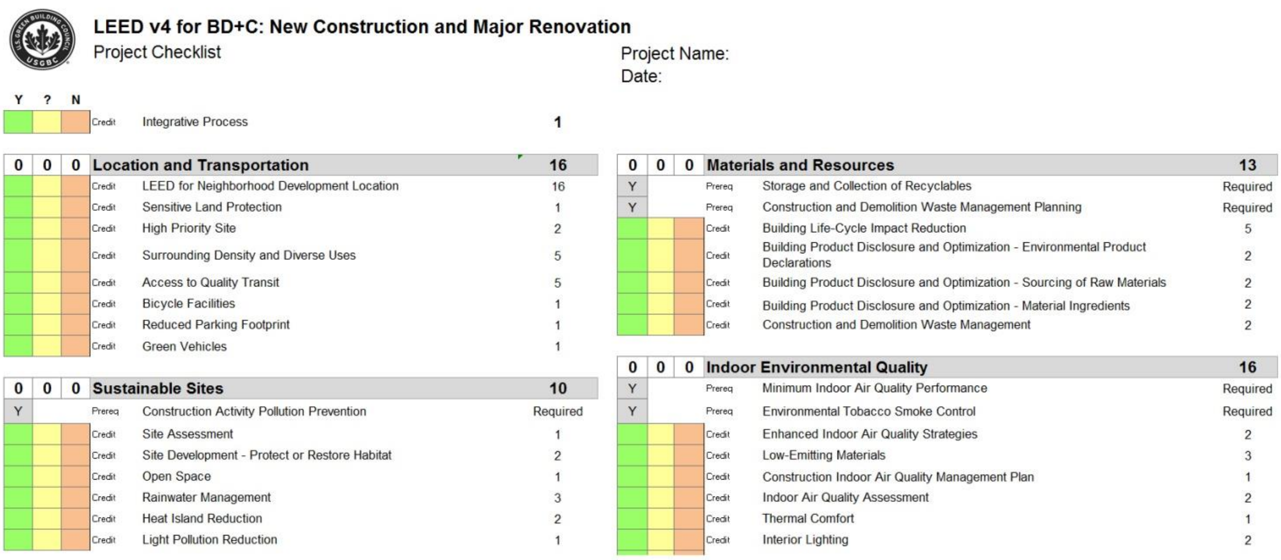


Fig(2-17) LEED's certification Levels

Source : http://www.usgbc.org/ (access Feb. 2015)

LEED score card:

USGBC provides score card (also called the LEED checklist) for each rating system via its websites. The score card lists all of the prerequisites and credits for the specific rating system, it can be used to identify the possibility of earning each credit as a (Yes, No, May be). It helps the project team track which ones are ideal for the project to attempt and those that are ‘maybes’ and need to be further investigated. The score card should be used at the beginning of the project to identify which LEED points make the most sense for the project.[1] Fig (2-18).



LEED v4 for BD+C: New Construction and Major Renovation
Project Checklist

Project Name:
Date:

Y	?	N			
			Credit	Integrative Process	1
0	0	0		**Location and Transportation**	**16**
			Credit	LEED for Neighborhood Development Location	16
			Credit	Sensitive Land Protection	1
			Credit	High Priority Site	2
			Credit	Surrounding Density and Diverse Uses	5
			Credit	Access to Quality Transit	5
			Credit	Bicycle Facilities	1
			Credit	Reduced Parking Footprint	1
			Credit	Green Vehicles	1
0	0	0		**Sustainable Sites**	**10**
Y			Prereq	Construction Activity Pollution Prevention	Required
			Credit	Site Assessment	1
			Credit	Site Development - Protect or Restore Habitat	2
			Credit	Open Space	1
			Credit	Rainwater Management	3
			Credit	Heat Island Reduction	2
			Credit	Light Pollution Reduction	1

Y	?	N			
0	0	0		**Materials and Resources**	**13**
Y			Prereq	Storage and Collection of Recyclables	Required
Y			Prereq	Construction and Demolition Waste Management Planning	Required
			Credit	Building Life-Cycle Impact Reduction	5
			Credit	Building Product Disclosure and Optimization - Environmental Product Declarations	2
			Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
			Credit	Building Product Disclosure and Optimization - Material Ingredients	2
			Credit	Construction and Demolition Waste Management	2
0	0	0		**Indoor Environmental Quality**	**16**
Y			Prereq	Minimum Indoor Air Quality Performance	Required
Y			Prereq	Environmental Tobacco Smoke Control	Required
			Credit	Enhanced Indoor Air Quality Strategies	2
			Credit	Low-Emitting Materials	3
			Credit	Construction Indoor Air Quality Management Plan	1
			Credit	Indoor Air Quality Assessment	2
			Credit	Thermal Comfort	1
			Credit	Interior Lighting	2

Fig(2-18): A part of template of LEED score card / checklist of LEED V4 for BD+C

Source : http://www.usgbc.org/ (access Feb. 2015)

[1] LEED Principles and LEED Green Associate Study Guide, page 65.

To certify a building outside the United States:

The projects are located outside the USA have two options:

- **Option no. 1**: if the project located at a country working with U.S green buildings council to make a local version of LEED compatible with its local systems and regulations, the project team can register their project under this local version of LEED, such as: LEED Canada, LEED India, LEED Italy, LEED Sweden, LEED Brazil, and LEED Spain.
- **Option no. 2**: the team of the project can register their project under the US version of LEED even the project located in those countries that have local versions of LEED[1,2].

CII
Confederation of Indian Industry
CII-Sohrabji Godrej Green Business Centre

Indian Green Building Council (IGBC)

hereby certifies that

Kohinoor Hospital

Mumbai

has successfully achieved the Green Building Standards required for the following level of certification under the Leadership in Energy and Environment Design (LEED) India Green Building Rating System

LEED India for New Construction Platinum

December 2009

C N Raghavendran
Chairman, LEED India

Dr Prem C Jain
Chairman, IGBC

Jamshyd N Godrej
Chairman, CII-Godrej GBC

Fig(2-19): A platinum certification of a project in India has been registered under India version of LEED.

Source: http://kohinoorhospitals.in/images/Leed_India_Nc_Platinum_2009.jpg (access Feb. 2015)

1 Abbo-Assy, Hala Fouad(2013), page 19.

2 The official site of USGBC : http://www.usgbc.org/, (access: March 2015)

2-5-2. BREEAM (Building Research Establishment's Environmental Assessment Method)

BREEAM is the world's first sustainability rating system, for the built environment and has contributed much to the strong focus in the UK on sustainability in building design, construction and use. BREEAM is now an international standard that is locally adapted, operated and applied through a network of international operators, assessors and industry professionals. BREEAM helps clients measure and reduce the environmental impacts of their building through its application.[1]

To date, BREEAM has been used to certify with 425,000 buildings with the assessment ratings of the BREEAM assessment ratings and two million registered for assessment since it was first launched in 1990. It is being applied in over than 50 countries.[2]

History of BREEAM

BREEAM was established in 1990, as a tool for non-domestic buildings in the UK. It has been updated regularity in line with UK building regulations and underwent a significant facelift on 1 August 2008, called "BREEAM 2008".[3]

BREEAM 2008 had updated all previous BREEAM schemes, it had included mandatory post-construction reviews (became Design stage and construction stage), minimum standards, innovation credits and adding a new rating level of BREEAM outstanding. In this year also, international versions of BREEAM have been launched.

BREEAM 2008 was categorized according to the building type to **BREEAM for offices, BREEAM Retails, industrial BREEAM, BREEAM EcoHomes, BREEAM schools and health buildings**.

BREEAM has launched **Code for sustainable homes** in 2006, Instead of the BREEAM **EcoHomes** which had been launched in 2000 to assess and certify new homes in the UK. EcoHomes has expired on the 8th of April 2012 in England, Wales and Northern Ireland. Now all new UK homes can assess and certify under Code for sustainable homes scheme.[4]

In 2011, BREEAM scheme has another extensive update, resulted in launch of **BREEAM New Construction 2011** which is used to assess and certify all new buildings through its both versions (the UK and international), it has consolidated difference schemes for different building types into one scheme

[1] BREEAM refurbishment domestic buildings, technical manual SD5077-2014-1.0, page 2.
[2] The official site of BREEAM Rating System, http://www.breeam.org/ (access: March 2015)
[3] Sustainable rating syst. (40), page 20.
[4] http://www.breeam.org/page.jsp?id=21

document applicable to most new, and non-domestic buildings[1] (exclude multi-residential buildings can assess under BREEAM New construction scheme).[2] A separate, similar scheme is available for refurbishing existing buildings such as **BREEAM In-Use** and **BREEAM refurbishment domestic buildings**.

In May 2014 BREEAM launched the latest update of **BREEAM UK New Construction**. In 2014 version, BREEAM also has launched a new scheme **BREEAM UK refurbishment and fit-out** for refurbishment works of non-domestic buildings in the UK.

Aims of BREEAM [3]

- To mitigate the life cycle impacts of buildings on the environment
- To enable buildings to be recognized according to their environmental benefits
- To provide a credible, environmental label for buildings
- To stimulate demand for sustainable buildings

BREEAM Schemes:

According to BREEAM 2014, there are five schemes (rating systems) that address multiple project types:

- **BREEAM New construction.** For all new non-domestic buildings.
- **BREEAM code of sustainable homes.** For all new UK homes.
- **BREEAM communities.** For new cities and neighborhoods projects.
- **BREEAN In-Use.** For existing non-residential buildings.
- **BREEAM non-domestic refurbishment and fit-out.** For non-residential projects in the UK only.
- **BREEAM domestic Refurbishment.** For residential existing buildings.

BREEAM has international versions such as **BREEAM international New Construction** which is a BREEAM standard using for assessing the sustainability of new non-residential and residential buildings in the countries around the world, except for the UK.

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[1] Non-domestic buildings means non-residential buildings exclude multi-residential buildings can assess under BREEAM New construction scheme)

[2] http://www.steelconstruction.info/BREEAM

[3] BREEAM refurbishment domestic buildings, technical manual SD5077-2014-1.0, page 2.

National Scheme Operators

Several countries in Europe working with BREEAM to develop country-specific BREEAM schemes that are operated by **N**ational **S**cheme **O**perators (NSOs) that are affiliated to BREEAM in:

- **The Netherlands** – the Dutch Green Building Council operates **BREEAM NL.**
- **Spain** – the Instituto Tecnológico de Galicia operates **BREEAM ES.**
- **Norway** – the Norwegian Green Building Council operates **BREEAM NOR**.
- **Sweden** – the Swedish Green Building Council operates **BREEAM SE**.
- **Germany** – the German Institute for Sustainable Real Estate (DIFNI) is operating **BREEAM DE.**
- **Austria** – DIFNI is operating **BREEAM AT**.
- **Switzerland** – DIFNI is adapting **BREEAM CH**.
- **Luxembourg** – DIFNI is adapting **BREEAM LU.**

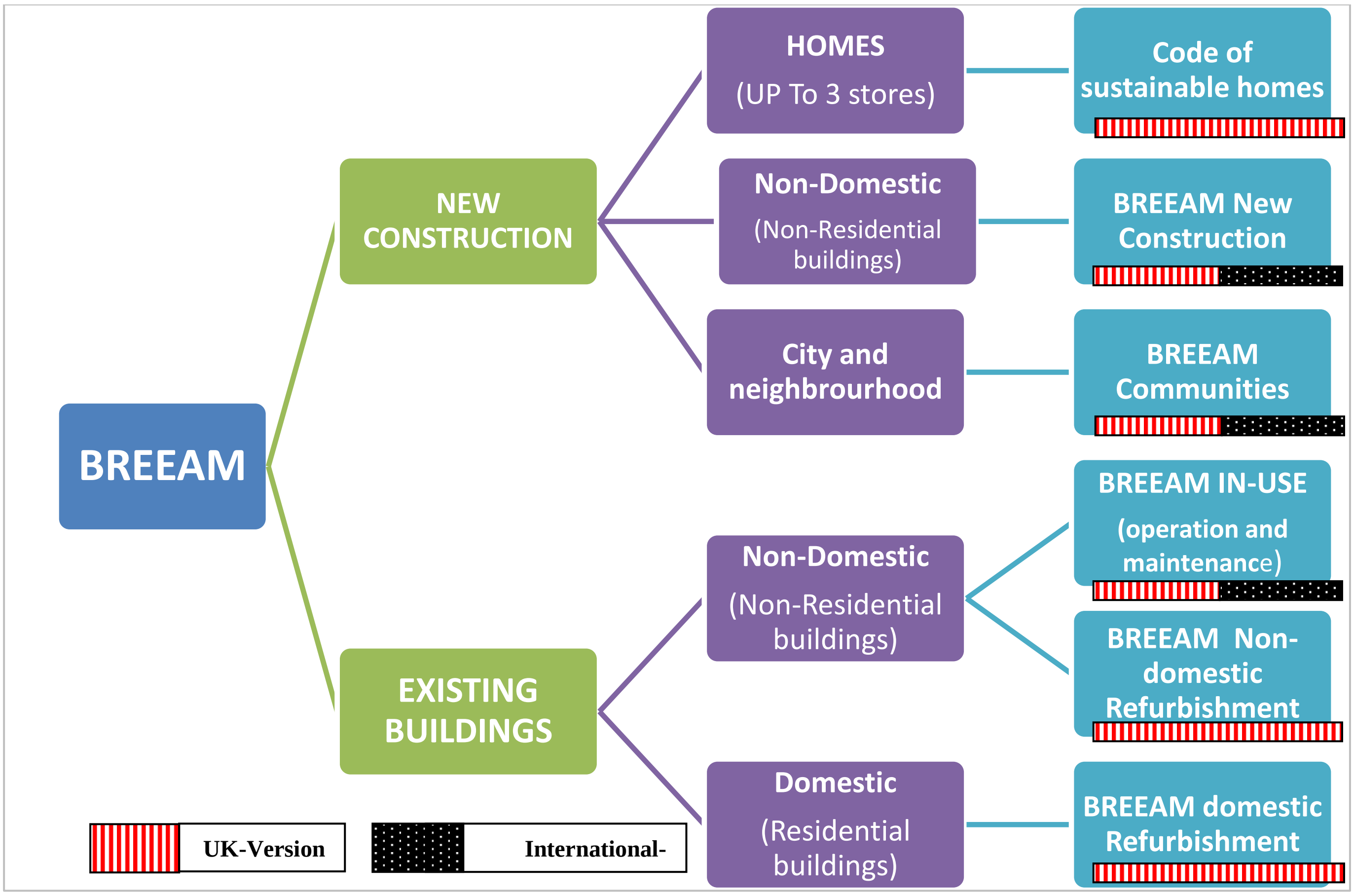


Fig (2-20). The schemes of BREEAM 2014.
Source: (Researcher)

BRE Global Ltd:

BRE Global Limited (part of the BRE Group) is an independent third party approvals body that offering certification of security, fire and sustainability products and services to an international market.

BRE Global Limited's mission is to Protect People, Property and the Planet[1]

BREEAM Categories

BREEAM recognizing performance of building into nine main credit categories: Table (2-3)[2,3]

Management, Health and Wellbeing, Energy, Transport, Water, Materials, Waste, Land use and Ecology, and Pollution plus additional bonus credit categories **Innovation**.

BREEAN Communities scheme has different credit categories**: Governance, Social and economic wellbeing, Resource and energy, Land use and ecology, and Transport and movement.**

Table (2-3). The categories/sections of BREEAM rating system

The Main credit categories of BREEAM schemes (rating systems) exclude BREEAM Communities scheme.[4]	
	**Management**: This category aims to encourage the adoption of sustainable management practices in design, construction, handover and aftercare activities, and commissioning to ensure that robust sustainability objectives are set and followed through into the operation of the building.
	**Health and Wellbeing** : This category aims to encourage the increased comfort, ensure achieve the requirements rate for health and safety of building occupants, visitors and others in the vicinity, that includes visual comfort, thermal comfort, meets appropriate performance standards, and ensures safety and security of the building.
	**Energy:** This category aim to encourage the design and incorporation of energy efficient building, systems, solutions and equipment that adopt the sustainable use of energy in the building and using sustainable management in the building's operation, such as: Reduction of energy use and CO2, sub-metering, and control external lighting.
	**Transport:** This category aims to encourage better access to sustainable means of transport for building users, by ensuring the proximity to good public transport networks, encouraging use cycles, and limiting car parking capacity to reduce emissions.

Source : BREEAM UK New construction (2014)

[1] BREEAM UK Refurbishment Domestic Buildings, Technical Manual, SD5077- 2014 - 1.0 ,Issue date: 30/10/2014, page ii

[2] Fouad, Faten Fares (2012). Pages 23,24.

[3] http://www.usgbc.org/LEED#credits access(Feb.2015).

[4] BREEAM UK New construction (2014), technical manual, SD5076:2.-2014, www.breeam.org

Table (2-3) continued. The catogeries/sections of BREEAM rating system

	Water: This category adopts the sustainable water use in the operation of the building and its site by reducing the water consumption, using water metering, reducing water wastage, and using the water-efficient equipment.
	Materials: This category aims to reduce the impact of construction materials through design, construction, maintenance and repair, by using materials that are sourced locally and have a low embodied impact over their life during extraction, processing and manufacture and recycling.
	Waste: This category encourages the sustainable management of construction, operational waste and waste through future maintenance and repairs associated with the building structure. By encouraging good design and construction practices.
	Land use and ecology: This category supports sustainable land use, habitat protection and creation, and improvement of long-term biodiversity for the building's site and surrounding land
	Pollution: This category addresses the prevention and control of pollution and surface water run-off associated with the building's location and use as well as controlling light pollution and noise pollution.
Additional bonus credits category for most of BREEAM schemes.	
	Innovation: This category includes exemplary performance credits, for where the building achieve the exemplary performance levels of the catogeries' credits. This credit also includes innovative products and processes for which an innovation credit can be claimed, where they have been approved by BRE Global Ltd.

Source : BREEAM UK New construction (2014)

Each BREEAM schemes has different weighting of its categories, some of schemes that using for assess more than types of buildings under the same scheme such as "BREEAM New construction" has different weighting for each type of new buildings, for example, Management category has 12% for fully fit-outs building, 12.5% for shell buildings, 11% for shell & core buildings.[1]

[1] BREEAM UK New construction (2014).

Certification levels:

The BREEAM rating benchmarks for all projects assessed using BREEAM rating system are as follows:

Table (2-4). BREEAM rating benchmarks

BREEAM Rating	% score
Outstanding	≥85
Excellent	≥70
Very good	≥55
Good	≥45
Pass	≥30
Unclassified	<30

Source : BREEAM UK New construction (2014)

Calculating a building's BREEAM rating

The process of calculating a BREEAM rating is outlined below:

1. For each of BREEAM's category the number of credits awarded must be determined by the BREEAM Assessor in accordance with the criteria of each assessment issue (as detailed in the technical/manual documents of each scheme).
2. Calculate the percentage of credits achieved for each category.
3. the percentage of credits achieved in each category is then multiplied by the corresponding category weighting. This gives the overall category score.
4. The category scores are summation to give the overall BREEAM score.
5. The overall score is then compared to the BREEAM rating benchmark levels.

The following table is an example calculation of new building has assessed under BREEAM New construction version 2014, other schemes may have different calculating methods.[1]

Table (2-5). Example BREEAM New construction scheme Rating calculation.

BREEAM category	Credits acheived	Credits avaliable	% of credits acheived	Category weighting	Category score
Managment	10	21	42.62%	0.12	5.71%
Health and wellbeing	17	21	80.95%	0.15	12.14%
Energy	16	31	51.61%	0.15	7.74%
Transport	5	12	41.67%	0.09	3.75%
Water	5	9	55.56%	0.07	3.09%

Source : BREEAM UK New construction (2014)

[1] BREEAM UK New construction (2014), page 26.

Table (2-5) continued. Example BREEAM New construction scheme Rating calculation.

Materials	10	14	71.43%	0.135	9.64%
Waste	3	9	33.33%	0.005	2.03%
Land use bad Ecology	5	10	50.00%	0.10	5.00%
Pollution	5	13	30.46%	0.1	3.05%
Innovation	2	10	20.00%	0.1	2.00%
Final BREAM Score				56.56%	
BREAM Rating				VeryGood	

Source : BREEAM UK New construction (2014)

To certify a building project outside United Kingdom, the project team can register their project under the international version of BREEAM, or register it under local versions of BREEAM, if it is located at a country developing its own adapted version of BREEAM such as Netherland, Spain, Sweden, Germany, Norway, Austria, Switzerland, and Luxembourg.

2-5-3. Green Pyramid rating system:

In the last two decades, there is increasing evidence from the countries toward the green buildings. The Housing and Building National Research Center in Egypt has launched the Green Pyramid Rating System In response to the needs for produce an Egyptian green building assessment system, and with the utlization of the experiences of early-adopters in other countries that had their green rating systems[1]

The Green Pyramid Rating System (GPRS) is a national environmental rating system for buildings. It provides definitive criteria that can evaluate the environmental credentials of buildings, and the buildings themselves can be rated. Additionally, the System could assist building designers, constructors and developers to make reasoned choices based on the environmental impact of their decisions.[2]

The Green Pyramid Rating System aims:

- to provide a benchmark for good practice that enables buildings in Egypt to be assessed for their green credentials through a credible, challenging and transparent environmental rating system;
- to enable building designers, constructors and developers to make reasoned choices based on the environmental impact of their decisions;

[1] The Egyptian Green Building Council (April 2011), page 6.
[2] Ibid.

- to stimulate awareness of, and demand for sustainable green buildings;
- to encourage the design and construction of sustainable green buildings, and contribute significantly to a better, more sustainable building stock for the Nation.

In order to achieve these aims, the following objectives have been set[1]:

- to produce rating criteria that reinforce and enhance National standard regulations;
- to promote a rating system that is understandable and achievable yet challenging;
- to raise awareness of resource scarcity and ways to mitigate demand for these resources;
- to raise awareness of best environmental practice in the design, construction and use of buildings;
- to minimize the environmental impact of buildings whilst maintaining their function and the comfort, health and well-being of their occupants and of the community;
- to encourage innovative solutions that minimize environmental impact;
- to raise the awareness of the benefits of buildings with reduced impact on the environment.

Philosophy of the GPRS Logo Design:

The logo was designed around the symbolic meaning of the green pyramid which is the oldest green structure in the world. It is the historical Egyptian pyramid with the lotus flower which represents its connection with the local environment. The external circular green frame symbolizes the focus of the Egyptian Council on preserving environmental equilibrium and sustainability. The philosophy of green building expresses the fact that once a building is completed, it becomes an indivisible part of the environment around it.[2]

Fig(2-21).*Green Pyramid rating system logo.*
Source : http://www.egypt-gbc.gov.eg/img/logo.gif (access: 05 May. 2016)

[1] The Egyptian Green Building Council (April 2011), pages 6, 7.
[2] Ibid, page 7.

The New construction scheme of Green Pyramid Rating System is designed for using in new building works. The Rating can be used to assess at either or both of the following stages[1]:

- At Design Stage.
- At Post-Construction Stage.

- The current version of **The Green Pyramid Rating system for New construction scheme** is used for assessing the new building at the design stage.
- **The Green Pyramid Rating system for new buildings at post –occupancy stage** that aims to assessed the building during a specific period from first occupation of new building (for example, from 6 and 18 months from first occupation date), will be produced soon, it will require further modification of the scheme of New construction at design stage.
- **The Green Pyramid Rating system for refurbishment- only projects,** that will take place on an existing building, will be produced soon; it will require further modification of the scheme of New construction at the design stage.
- **The Green Pyramid Rating system for existing buildings** will also be produced soon.

Components of the Green Pyramid Rating System schemes[2]:

- The system comprises seven rating Categories, each of them contain sub-categories (numbered 1.1, 1.1.1, etc.).
- Credit points will be awarded based upon specific criteria, and some of the catogeries will have one or more Mandatory requirments, without achieving them, there are no further points will be obtainable.
- The project should meet all the Egyptiain national codes, and the minimum national statutory provisions for the design and constrction of buildings to become elligible of GPRS assessment.

Category weighting

The Green Pyramid for New construction scheme's Category Weights are as mentioned in the table (2-6).

[1] Ibid, page 8.
[2] The Egyptian Green Building Council (April 2011), page 8.

Table (2-6), **The Green Pyramid for New construction scheme's Category Weighting**

Green Pyramid Category	Category Weighting
1: Sustainable Site, Accessibility, Ecology	**15%**
2: Energy Efficiency	**25%**
3: Water Efficiency	**30%**
4: Materials and Resources	**10%**
5: Indoor Environmental Quality	**10%**
6: Management	**10%**
7: Innovation and Added Value	**Bonus**

Source: The Egyptian Green Building Council (April 2011).

Certification and levels of rating

A project must meet all the mandatory minimum requirements to award Green Pyramid certification. Unlike the other international rating systems, the highest level of certification is labeled "green" rather than platinum.[1]

Projects will be rated, based on total Credit Points calculated, according to the following rating system:

Table (2-7). Level of rating of Green Pyramid rating system.

Level of rating	Credits
GPRS Certified	40–49
Silver Pyramid	50–59
Gold Pyramid	60–79
Green Pyramid	Equal or greater than 80
Projects that awarded less than 40 credits will be classified as 'Uncertified'.	

Source : The Egyptian Green Building Council (April 2011).

Fig(2-22). Level of rating of Green Pyramid rating system.
Source : , http://www.egypt-gbc.gov.eg/ratings/index.html , (access 06 May 2016)

Assessment and Rating process[2]:

Head Committee for GPRS assessment:

The GPRS Head committee will direct all the processess of assessment, approval and certification. The chairman of the board of directors, Housing and Building National research center will estblish and direct this committee. The GPRS Head committee will pass all applications that received to one of the assement groups that could be formed for this purpose

[1]**The official site of Green Pyramid Rating system**, http://www.egypt-gbc.gov.eg/ratings/index.html , (access 06 May 2016)
[2] The Egyptian Green Building Council (April 2011), pages 31-33.

Standing Green Pyramid Assessment Groups:

Each Assessment Group will comprise a small number of experts from the Housing and Building National Research Center and outside, they should have the technical know which that is necessary to assess GPRS Applications.

GPRS Licensed Assessors

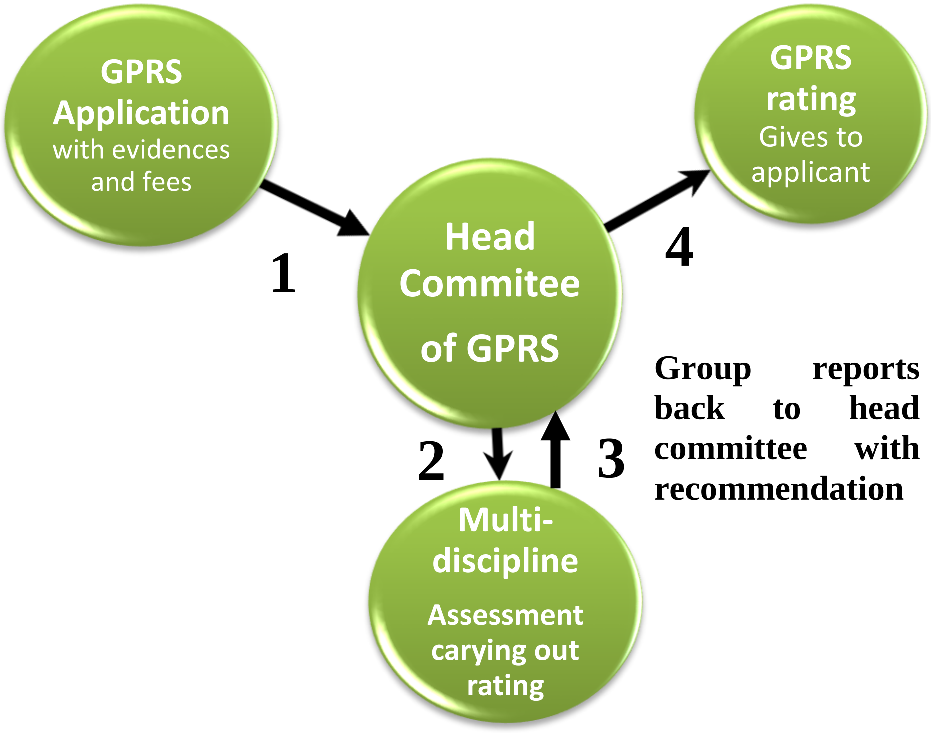
GPRS will qualify the nominees to be GPRS licensed assessors by training, and give them the sufficient expertise, and then they could carry out the assessments by them self individually.

Reporting and Responsibility

GPRS Certification is a matter for the GPRS Head Committee. Licensed Assessors of GPRS could issue certification under the System. They will send a report to the GPRS Head Committee with a recommendation, and then the GPRS Head Committee will issue the appropriate Green Pyramid certification.[1]

Application, assessment and rating process

The application, assessment and rating process is outlined in the following figure:



Fig(2-23). The GPRS assessment and rating process.
Source : The Egyptian Green Building Council (April 2011), pages 31.

[1] The Egyptian Green Building Council (April 2011), pages 31.

Process of Assessment[1]

The Licensed Assessor or the group of assessment will use the Green Pyramid Rating checklist. The process of assessment will be as follows:

1- The licensed assessor will determine the total achieved numbers of credits for each catogery according to the green building requiremets.
2- The catogery score calculated by determining the percentage of achieved credits is then multiblied by catogery weighting.
3- Summetion the scores of each catagery to give the overall score if green pyramid rating.

Results of assessment and certification[2]**:**

The assessment's result will be informed to the applicant within three months from the submitioin of the application.

The relevant certificate, if attained, will be issued to applicants by Housing and Building National Research Center.

Example: Example Green Pyramid Rating calculation

Table (2-8). Example Green Pyramid Rating calculation

	A		C = B/A * 100%	D	E= C * D
Green Pyramid Catrgory	**Credits Avaliable**		**% Credits Acheived**	**Category Weight**	**Category Score**
1. Sustainable Site, Accessibility, Ecology	**10**		**50%**	**15%**	**7.5**
2. Energy Efficiency	**50**		**80%**	**25%**	**20**
3. Water Efficicency	**70**		**50%**	**30%**	**15**
4. Materials and Resources	**20**		**75%**	**10%**	**5**
5. Indoor Enviromental Quality	**20**		**50%**	**10%**	**5**
6. Management	**20**		**50%**	**10%**	**5**
7. Innovation and Added Vlue	**10**		**0%**	**Bouns**	**0**
Total	**57.5**				
GREEN PYRAMID RATING	**Silver**				

Source : The Egyptian Green Building Council (April 2011), pages 31.

[1] Ibid.
[2] The Egyptian Green Building Council (April 2011), pages 31.

Conclusions

From the previous, the research can illustrate the followings:

- Since 2011, Egypt is severely suffering from the Energy crisis rather than the other countries due to rising demand, natural gas supply shortages, aging infrastructure, political instability, and inadequate generation and transmission capacity, that needs to adopt more efficient strategies to reduce the energy consumption, as well as water consumption, and material resources in the new and existing buildings in Egypt.
- The green Pyramid rating system (GPRS) is an initial step towards establishing a certified benchmark can assess the application of the green practices of the new and existing buildings in Egypt.
- Since 2011, the green pyramid rating system lunched one scheme "New construction rating system". Until June 2016, there are no projects was certified under GPRS. The Egyptian green rating system didn't launch the two expected rating systems" **"**The Green Pyramid Rating system for refurbishment- only projects, and The Green Pyramid Rating system for existing buildings" as it was mentioned in the manual of 2011
- The overviews of the green rating systems will be useful to select the international rating systems that assessed the green heritage buildings all over the world (**in chapter 3**), then the research will analyze them to produce the green heritage buildings in Egypt (**in chapter 5**).

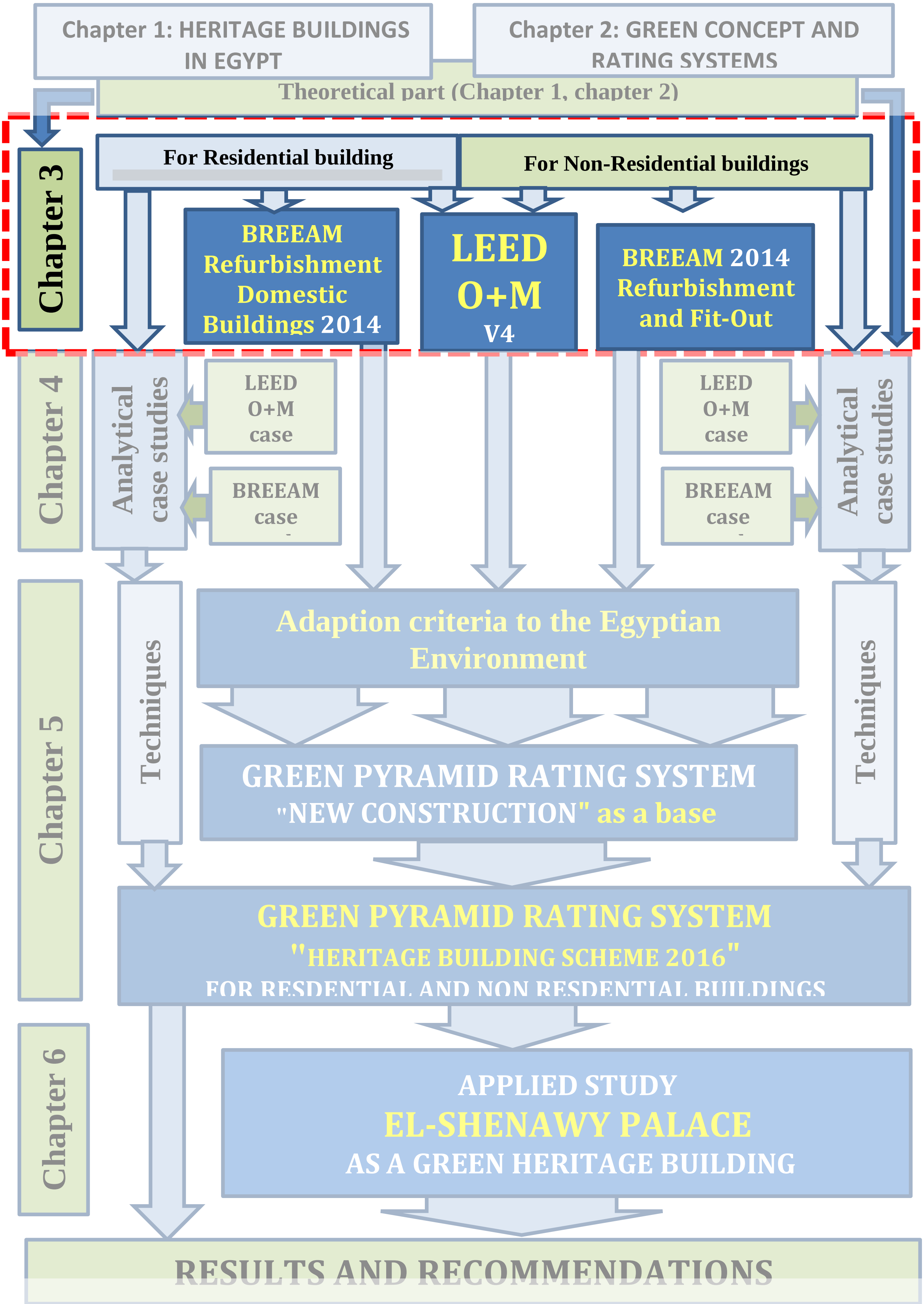
The research can set definition of the Green heritage building as:

- "It is a heritage building that has been refurbished and modified to be a green building without harming its heritage features or losing its values, or lead to be out of the list (if it has been listed by the national authority)".

CHAPTER

III

THE GREEN RATING SYSTEMS AND GREEN HERITAGE BUILDINGS


Chapter 1: HERITAGE BUILDINGS IN EGYPT
Chapter 2: GREEN CONCEPT AND RATING SYSTEMS
Theoretical part (Chapter 1, chapter 2)
Chapter 3
For Residential building
For Non-Residential buildings
BREEAM Refurbishment Domestic Buildings 2014
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APPLIED STUDY EL-SHENAWY PALACE AS A GREEN HERITAGE BUILDING
RESULTS AND RECOMMENDATIONS

Chapter III.

THE GREEN RATING SYSTEMS AND GREEN HERITAGE BUILDINGS

In this chapter, the research aims to demonstrate the international green rating systems that assess green heritage buildings. Item (3-1) presents the new rating system **"GBC historic building – V.1.0 2016**" that has launched in Italy in the beginning of 2016. Until June 2016, there is no heritage building has certified under this "pilot version".

According to the table (2-1), there are only two international rating systems (LEED and BREEAM) have certified several heritage buildings all over the world through their different schemes. Both of them also can be used to assess existing building in Egypt.

For that, the research will study in this chapter, **LEED O+M** , **BREEAM Domestic Refurbishment** for residential existing buildings**, BREEAM 2014 Refurbishment and fit-out** for non-residential existing buildings, , and making an overview of "**GBC historic building rating system**".

3-1. GBC Historic Building Rating System in Italy

The existing buildings in the Italy consist of more than 30% of buildings constructed before 1945: 18.3% were built before 1919 and 11.8% between 1919 and 1945, a total of 30.1% of all the Italian entire building stock, corresponding to 11,740,083 units.[1]

Sustainable development is "*development that meets the needs of the present without compromising the ability of future generations to meet their own* " the reference to the maintenance of the "potential" for the benefit of future generations must be read, in this case, in multiple interdependent dimensions: environmental, economic (long-term), social and, above all, cultural. The term "sustainability" is therefore further enhanced through a broader reading of the *triple bottom line* "biodiversity-resources-emissions", where cultural issues (which are closely connected and dependent on the context Social which is a manifestation of a civilization) play a significant role for the conservation and preservation the historic resource, which is an existing potential and that, therefore, must be passed down to the future. The latter variation, the culture, thus becomes the new - or, rather, rediscovered - the paradigm of sustainability, orienting the building process towards the preservation and development of all his past events, especially in view of the scarcity of future resources. [2]

The conservative interventions thus become "Actions" in itself sustainable and, therefore, can be evaluated through tools and methods relevant to this context and, above all, in view of a "metric" shared and comparable which is proper of building process contemporary sustainable.[3]

The LEED Italy launched GBC Historic Building rating system in the beginning of 2016 to assess the Green heritage buildings in Italy. The new rating system is derived seven categories of the total from the LEED new construction rating system, adding a new category named " Historical Valenza VS" that means in English " Historic Importance".

[1]The Manual of GBC Historic Building Rating system - V.1.0 2016, (2016), LEED Italia http://www.gbcitalia.org/uploads/8045_GBC_HB_Sistema_di_verifica_2016.pdf , page 18.
[2] Ibid.
[3] Ibid.

The categories of GBC historic building rating system [1]:

The evaluation system is organized in six environmental categories: **Historical Importance, Sustainability Site, Management Water, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality**.

An additional category, **Innovation in Design**, it is interested in the innovative practices aimed at sustainability and to untreated issues in the previous five categories. Finally, the category **Regional Priority** allows you to highlight the importance of local conditions in determining the best design and construction practices of sustainability.

In GBC Historic Building, the distribution of points between credits is rooted in the fact that every credit has the environment and human health than a set of impact categories.

The categories are defined as the environmental and human impact of the design, construction, operation and maintenance building, referring, for example, to greenhouse gases, the use of fossil fuels, toxic and carcinogenic agents, air and water pollution and indoor environment conditions. To quantify the importance the different categories of impact on each credit have been used a combination of approaches, including the energy modeling, assessment of the life cycle, the analysis of transport. With the certification, the credit scores of the system is based on the following criteria:

- All the credits are worth at least 1 point; the prerequisites are in fact required and do not give points;
- All credits have a positive integer value; not exist fractional or negative values;
- The evaluation system has six basic categories from a maximum of 100 points; IP categories (Innovation in Design) and PR (Regional Priority) to attain an additional 10 points, for a maximum total amount to 110.

[1] The Manual of GBC Historic Building Rating system, pages 18 and 19.

Category	Total points can be awarded	Weighting of the points from the total
Historical Importance.	**20**	**18%**
Sustainable sites	**13**	**12%**
Water management	**8**	**7%**
Energy and Atmosphere	**29**	**26%**
Materials and Resources	**14**	**13%**
Indoor Environmental quality	**16**	**15%**
Innovation in Design	**6**	**5%**
Regional Priority	**4**	**4%**
Total		**110**

Level of Certification[1]

The evaluation system of GBC Historic Building provides for a maximum score of 100 points associated with the categories basis; other 10 points can be obtained with the areas **Innovation in Design** and **Regional Priority** . The levels of certification adopt the LEED level of certification as a following:

- Certified: 40-49 points achieved;
- Silver: 50-59 points achieved;
- Gold: 60-79 points achieved;
- Platinum: 80 or more points earned.

The Credits affected by the phase of planning or construction

There are two phases of submitted credits to revision: Phase design (P) or Phase of Construction (C).[2]

The applicability of GBC Historic rating system:

The new rating system GBC for historic Building in Italy, was launched in 2016 and no building until now has certified under this scheme, and according to the manual of " GBC historic Building – V.1.0 2016", "**it is a pilot version**", *and* In the introduction of the GBC's manual there is *"invitation to report any problematic issues encountered in this new application via e-mail to take the observations of the users and researches into account through the further upgradation of the system*". [3]

[1] The Manual of GBC Historic Building Rating system, page 21.
[2] Ibid.
[3] Ibid, page 13.

For that, the research cannot incorporate this system into its study before becoming active and certifying real-cases in Italy.

3-2. LEED for Existing Buildings: Operation & Maintenance (O+M)

USGBC launched LEED-Existing Buildings (EB) in 2005, this rating system provides a benchmark for building owners, and assets' managers to measure improvements, operations and maintenance works of their assets.

LEED operation & maintenance can be used for existing buildings that already have been constructed, allow building's operators, owners, and managers to make their building more efficient from the operational side.

LEED operation & maintenance is more appropriate for project focuses on operation and maintenance works such as "processes, minor space-use changes, minor alterations, system upgrades", and doesn’t aim to make major renovation on the building design or structure. The alterations or additions that are executed on the existing building under LEED operation & maintenance rating system shouldn't effect on the original design character of the building such as new paint, flooring, ceiling, etc. Additions are add-ons to the building shouldn't be large enough to be a major renovation; they should be minor in scale compared to the building size.[1]

The **LEED O+M** rating system can be applied to both buildings seeking LEED certification for the first time, and the project that previously certified under **LEED Building Design and Construction** rating systems such as "LEED BD+C school, LEED BD+C new construction, and Major Renovation, LEED BD+C homes,…etc"

LEED operation & maintenance rating system divided into sub-rating systems according to the existing buildings types[2].

- **LEED O+M Retail:** apply on the existing building that used to conduct the retail sale of consumer product goods that include "show rooms and storage areas that support customer service".
- **LEED O+M Schools**: apply on the existing buildings that used for learning spaces in K-12[3] Schools, and used for higher education spaces and non-academic buildings on school campuses.

[1] Green building Education Services, LLC, "**LEED Green Associate Study Guide**", Revision 1.06, 1 September 2010, page 25.

[2] **LEED Reference Guide For Building Operation and Maintenance**, 2013 edition, ISBN #978-1-932444-20-9, pages 34,35.

[3] **K-12**: The expression is a shortening of kindergarten **(K)**{ for 4- to 6-year-olds} **To** twelfth grade **(12)** {for 17- to 19-year-olds}.

- **LEED O+M Hospitality:** apply on the existing buildings that used within the hospitality industry, such as hotels, motels, inns, and others that provide transitional or short-term stay with or without food.
- **LEED O+M Data Centers:** apply only on whole existing buildings that uses as data centers.
- **LEED O+M Warehouse and Distribution Centers**: apply on the existing buildings used to store goods, raw materials, manufactured products…etc.
- **LEED O+M Existing Buildings**: (the focus of this research)
  LEED defines **LEED O+M Existing buildings as** a **rating system** can apply on existing buildings don't primarily serve K-12 educational, retails, data centers, warehouses and distribution centers or hospitality uses**.** It can apply to all existing commercial and institutional buildings and residential buildings.

LEED require for the project need to assess under **LEED O+M** to be fully operational and occupied for at least one year. The project could be undergoing improvement work or little to no construction. The project also must include the entire building's gross floor area in the project.[1]

Environmental category weightings

LEED O+M Existing building rating system as the other rating systems has six main credit categories:

Location and Transportation, Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental quality, and Innovation in design, plus additional bonus credit categories **(Innovation in design**, and **Regional priority** that applies only to the projects inside the USA). Table (3.1), demonstrates the weights of points of environmental categories of (LEED O+M).

Table (3-1), The points of LEED O+M categories

No.	**Category**	**Points**
1	Location and Transportation	15
2	Sustainable sites	10
3	Water efficiency	12
4	Energy and atmosphere	38
5	Materials and resources	8
6	Indoor Environmental quality	17
Bonus	Innovation	6
Bonus	Regional Priority	4
	Totals	**100** + 10 Bonus

Source: (Researcher)

[1] http://www.usgbc.org/articles/rating-system-selection-guidance (accessed Sept. 2015).

Initial Certification and recertification:

Initial certification is any first-time application for LEED O+M certification. Recertification is the subsequent applications for certification after the project has taken an initial certification under any version of LEED O+M. The initially certified project can apply for recertification as frequently as each year. But it must be filed for recertification once every five years from the date of initial certification, if it is submitted to certify after the specified period (5 years), the application will be considered as an initial certification application. The project must recertify all prerequisites and the dropped previously earned credits or add new credits as desired.[1]

Building life cycle stages

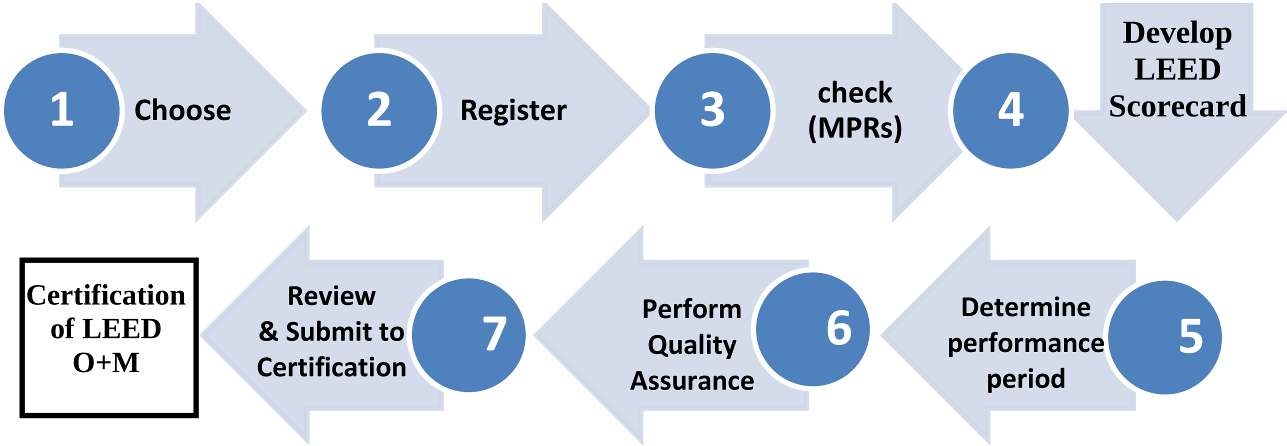


Fig (3-1), Building life cycle stages
Source: (Researcher)

1. **Choose:**
   First, team project select rating systems of (LEED O+M) depending on type building as mentioned to point (1-1).
2. **Register:**
   Registration is an important step that sets a contact with GBCI and provides access to software tools, errata, critical communications, and other essential information.
   The team project must first register the project with GBCI on the GBCI website (www.gbci.org). From the GBCI's website, team project can obtain all information about registration costs for USGBC national members as well as nonmembers.[2]

[1] U.S,Green Building Council, Inc (2009), LEED 2009 For Existing Buildings: Operation & Maintenance Rating System, USGBC Member Approved November 2008, page xvi
[2] U.S,Green Building Council, Inc (2009), LEED 2009 For Existing Buildings: Operation & Maintenance Rating System, USGBC Member Approved November 2008, page xvi.

3. Minimum program requirements (MPRs):

According to LEED v4, the LEED O+M has 3 of mandatory requirements that the project must comply with, to achieve certification, as the other rating systems of LEED. See minimum program requirement (MPRs) page 51.

4. LEED Scorecard:

The project team should establish the target of the level of LEED certification. Based on that, they identify the additional credits needed to achieve it. The team makes sure that all prerequisites can be met, and there is a buffer of several points above the minimum to ensure achieving the target in case changes during the performance period may make the credit denied.[1]

Following LEED (O+M) scorecard illustrates the perquisites and credits of all categories and the number of points of each of them.

LEED v4 for Operations & Maintenance: Existing Buildings
Project Checklist

Project Name:
Date:

Y	?	N			
0	**0**	**0**		**Location and Transportation**	**15**
			Credit	Alternative Transportation	15
0	**0**	**0**		**Sustainable Sites**	**10**
Y			Prereq	Site Management Policy	Required
			Credit	Site Development-Protect or Restore Habitat	2
			Credit	Rainwater Management	3
			Credit	Heat Island Reduction	2
			Credit	Light Pollution Reduction	1
			Credit	Site Management	1
			Credit	Site Improvement Plan	1
0	**0**	**0**		**Water Efficiency**	**12**
Y			Prereq	Indoor Water Use Reduction	Required
Y			Prereq	Building-Level Water Metering	Required
			Credit	Outdoor Water Use Reduction	2
			Credit	Indoor Water Use Reduction	5
			Credit	Cooling Tower Water Use	3
			Credit	Water Metering	2
0	**0**	**0**		**Energy and Atmosphere**	**38**
Y			Prereq	Energy Efficiency Best Management Practices	Required
Y			Prereq	Minimum Energy Performance	Required
Y			Prereq	Building-Level Energy Metering	Required
Y			Prereq	Fundamental Refrigerant Management	Required
			Credit	Existing Building Commissioning— Analysis	2
			Credit	Existing Building Commissioning—Implementation	2
			Credit	Ongoing Commissioning	3
			Credit	Optimize Energy Performance	20
			Credit	Advanced Energy Metering	2
			Credit	Demand Response	3
			Credit	Renewable Energy and Carbon Offsets	5
			Credit	Enhanced Refrigerant Management	1

Y	?	N			
0	**0**	**0**		**Materials and Resources**	**8**
Y			Prereq	Ongoing Purchasing and Waste Policy	Required
Y			Prereq	Facility Maintenance and Renovations Policy	Required
			Credit	Purchasing- Ongoing	1
			Credit	Purchasing- Lamps	1
			Credit	Purchasing- Facility Management and Renovation	2
			Credit	Solid Waste Management- Ongoing	2
			Credit	Solid Waste Management- Facility Management and Renovati	2
0	**0**	**0**		**Indoor Environmental Quality**	**17**
Y			Prereq	Minimum Indoor Air Quality Performance	Required
Y			Prereq	Environmental Tobacco Smoke Control	Required
Y			Prereq	Green Cleaning Policy	Required
			Credit	Indoor Air Quality Management Program	2
			Credit	Enhanced Indoor Air Quality Strategies	2
			Credit	Thermal Comfort	1
			Credit	Interior Lighting	2
			Credit	Daylight and Quality Views	4
			Credit	Green Cleaning- Custodial Effectiveness Assessment	1
			Credit	Green Cleaning- Products and Materials	1
			Credit	Green Cleaning- Equipment	1
			Credit	Integrated Pest Management	2
			Credit	Occupant Comfort Survey	1
0	**0**	**0**		**Innovation**	**6**
			Credit	Innovation	5
			Credit	LEED Accredited Professional	1
0	**0**	**0**		**Regional Priority**	**4**
			Credit	Regional Priority: Specific Credit	1
			Credit	Regional Priority: Specific Credit	1
			Credit	Regional Priority: Specific Credit	1
			Credit	Regional Priority: Specific Credit	1
0	**0**	**0**		**TOTALS** Possible Points:	**110**

Certified: 40-49 points, Silver: 50-59 points, Gold: 60-79 points, Platinum: 80+ points

Fig(3-2). The Score card of LEED V4 Operation & Maintenance
Source:
http://www.usgbc.org/LEED

5. Determine Performance period:

Determine a performance period schedule is necessary for compliance with most credits. LEED O+M rating system is largely depended on successful

[1] **LEED Reference Guide For Building Operation and Maintenance**, 2013 edition, page 14

outcomes during the performance period, for that many prerequisites and credits require the measurements of operation through "performance period" to be submitted as a part of certification documentation requirements.

Performance Period is defined as any period longer than one full week.

- **The performance period for initial certification:**

It is the most recent period of operations preceding the certification applications. **The performance period** of the achieved credits must be at least three months and no more 24 months, except as noted in the credit requirements.[1]

All performance periods of the project's credits must overlap within 30 days of each other; they also must end with the same 30 days interval.

LEED O+M provided that applications must be submitted to review within 60 calendar days starts from the day after the last day of the latest performance period.[2]

Table (3-2) demonstrates an example of performance periods of LEED O+M rating systems, the termination dates of all performance periods are in the same month "April 2015," there is overlap among all periods, as we as the least period is 3.5 months and the great period is 14 months. The project must be submitted for review within 60 days accounting from 27 April 2015.[3]

Table (3-2) example of performance periods by credits

Credit	Start	End	Duration
WE Credit Outdoor Water Use	February 22,2014	April 20,2015	14 months
SS Credit Rainwater Management	April 6, 2014	April 22, 2015	12.5 months
EA Perquisite Minimum Energy Performance	April 1, 2014	April 1, 2015	12 months
SS Credit Site Management	August 25, 2014	April 25, 2014	8 months
WE Perquisite Indoor Water use	January 12, 2015	April 26, 2015	3.5 months

Source: LEED Reference Guide for Building Operation and Maintenance, page 13

- **The performance period for recertification:**

The recertification performance period is the entire period that extends from the date of the previous certification to the date of new

[1] **LEED Reference Guide For Building Operation and Maintenance**, 2013 edition, ISBN #978-1-932444-20-9, page 13.

[2] Ibid.

[3] ibid

recertification application. If the team of project decides to add new credits that have performance periods, the rules of the initial performance periods should be applied in these new credits, unless otherwise noted in the credit requirements.

Project pursuing recertification is required to submit only performance documentation for review, not required to submit establishment documentation unless there have major changes that prompt review.[1]

6. **Perform Quality Assurance**

   A quality assurance review is an essential part of the work program, this check can improve the processes of the project and avoid errors that require more time and expense to correct later in the certification process.[2]

7. **Review and Certification**

   To earn certification under LEED O+M (as the other LEED rating systems), the team project must satisfy all prerequisites, Minimum program requirements, and earn a minimum number of points to be certified.

   There are four levels of LEED O+M certification (as the other LEED rating systems), see fig (2-17). The number of points that a project earns, determines the level of LEED certification the project will receive.

3-3. BREEAM Domestic Refurbishment scheme:

BREEAM Domestic Refurbishment Scheme describes an environmental performance standard for domestic (residential) refurbishment projects in the United Kingdom that can be assessed, rated and certified.

BREEAM Domestic Refurbishment is designed to help the owners of the building and it occupiers to save the operating costs of the building, reduce the environmental impacts of refurbishments works and to increase the sustainability of existing building stock. This scheme provides a methodology, software tool, and certification for those responsible for delivering sustainable refurbishment projects.[3]

BREEAM Domestic Refurbishment scheme can assess self-contained dwellings (houses) which may include a single dwelling[4] or multiple dwelling[5]

[1] **LEED Reference Guide For Building Operation and Maintenance** (2013), page 13

[2] [2] **LEED Reference Guide For Building Operation and Maintenance** (2013), page 15

[3] BREEAM Domestic Refurbishment, Technical Manual: Version: SD5077 – Issue: 1.0 – Issue Date: 30/10/2014 page iv

[4] **Single dwelling** :it is a **single-family detached home**, also called a **single-detached dwelling** or **separate house** is a free-standing residential building.

[5] **Multiple dwelling** : also known as **Multifamily residential** is a classification of housing where multiple separate housing units for residential inhabitants are contained within one building or several buildings within one complex.

within a street or block of flats. A self-contained house is defined as a unit designed to accommodate a single household.

Fig(3-3), Single dwelling/ house
Source:
http://www.itsoverflowing.com/2012/12/dreamy-dwelling-home-tour-gorgeous-estate/ , (access, May2016).

Fig(3-4). W. E. Sessions House (1878) as a multiple dwelling house
Source: http://historicbuildingsct.com/?cat=144&paged=2 , (access, May2016).

Non domestic buildings and residential buildings that have units other than dwellings such as rooms for residential purposes cannot be assessed under the Domestic Refurbishment Scheme including student halls of residence, sheltered housing and other multi-residential buildings which can be assessed under the BREEAM Multi-Residential Scheme, which is within BREEAM UK New Construction.[1]

Fig(3-5), The Crawford Mansions is a block of flats - London
Source: https://greatwarfiction.wordpress.com/tseliots-letter-to-the-nation/, (access, May 2016).

BREEAM Domestic Refurbishment categories and credits:

The BREEAM Domestic Refurbishment Scheme has eight main categories plus innovation category.

Environmental category weightings

The table below outlines the weightings for each of the eight environmental categories included in the BREEAM Domestic Refurbishment scheme.

Table (3-3), BREEAM Domestic environmental categories weightings

category	weighting
Management	12%
Health & wellbeing	17%
Energy	43%
water	11%
Materials	8%
waste	3%
pollution	6%
Total	100%
Innovation (Bonus)	10%

Source: (Researcher)

[1] BREEAM Domestic Refurbishment, page 16

Each of the above environmental categories consists of different numbers of assessment issues and BREEAM credits. As a result, each assessment issue and credit vary regarding its contribution to a building's overall score.

Table (3-4), BREEAM Domestic categories and their credits

Category	Credit	Category	Credit
Management	Home users guide	**Energy**	Drying space
	Resbonsible constrction practices		Lighting
	Constrction Site impacts		Display Energy Devices
	security		Cycle storage
	Protection and enhancement of ecological features		Home Office
Health and Welbeing	Daylighting	**Water**	Internal water consumption
	Sound Insulation		Water Meters
	Volatile Organic Componda (VOCs)		External water consumption
	Inclusive Design	**Materials**	Enviromental Impact of Materials
	Ventilation		Respponsible Sourcing
	Safety		
Energy	Improvement Energy Efficiency Rating Energy Efficency Rating post refurbishment		Insulation
		Waste	HouseHold waste
			Refurbishment Site Waste Management
	Primary Energy Demand	**Pollution**	Surface water Runoff
			Flooding
	Renewable Technolgies		Ntrogen Oxide Emissons
	Energy Labeled white Goods	**Innovation**	Exemplary Performance

Source: BREEAM Domestic Refurbishment

Certification under BREEAM Domestic Refurbishment

Certification of the BREEAM certified building has been awarded through licensed BREEAM Domestic Refurbishment assessors. They enable to be obtained the interim certification at the design stage (pre-refurbishment) and final certification at refurbishment stage through BRE Global Ltd.[1]

[1] BREEAM Domestic Refurbishment, page 6.

Building lifecycle stages

BREEAM Domestic Refurbishment scheme could be used to assess and rate the environmental impacts arising from a refurbished residential building at the following life cycle stages:

Design Stage (DS) – that lead to an Interim BREEAM certified rating
Post Refurbishment Stage (PRS) – that lead to a Final BREEAM certified rating

- **Design stage (DS):**
  - The Design Stage Assessment provides a rating of the refurbishment as the interim rating, it is labeled as "interim" as it doesn’t represent the dwellings BREEAM Domestic Refurbishment rating as refurbished.
  - To complete an assessment at this stage the design must be advanced to a point where the relevant design information is available to enable the BREEAM Assessor to evaluate and verify the building’s performance through the criteria of the manual document of this scheme.

- **Post refurbishment Stage (PRS)**
  - The PRS assessment and BREEAM rating confirms the final ‘as refurbished’ performance of the building at the refurbishment stage of the life cycle.
  - There are two approaches to assessment at the post refurbishment stage:

    1- **A post refurbishment review (PRR)** based on a completed interim design stage assessment, it confirms that the building "as refurbished" performance in accordance with the assessment certified at the interim design stage.

    2- **A post refurbishment assessment (PRA).** When an interim DS assessment has not been carried out at refurbishment stage, and a BREEAM assessment and rating is required, a **full** post refurbishment stage assessment can be conducted.[1]

[1]BREEAM Domestic Refurbishment, Technical Manual: Version: SD5077 – Issue: 1.0 – Issue Date: 30/10/2014, page 18.

Minimum standards of performance

To achieve a particular BREEAM rating, a project must earn the minimum overall percentage for the level desired and must satisfy the minimum standards that are defined for BREEAM Domestic Refurbishment scheme to that rating level complied with. Table (3-5) demonstrates the minimum standards should be applicable to the each rating level BREEAM Domestic Refurbishment scheme.[1]

Table (3-5), Minimum Domestic Refurbishment standards by rating level

BREEAM Category	Minimum Standards by rating level				
	Pass	**Good**	**Very good**	**Excellent**	**Outstanding**
Ene02: Energy Efficiency Rating Post refurbishment	0.5 credits	1 credit	2 credits	2.5 credits	3.5 credits
Wat01: Internal water use	-	-	1 credit	2 credits	3 credits
Hea05: Ventilation	1 credit	1 credit	1 credit	1 credit	1 credit
Hea06: Safety	1 credit	1 credit	1 credit	1 credit	1 credit
Pol03: Flooding	-	-	-	2 credits	2 credits
Mat02: responsible Sourcing of Materials	Criterion 1 only	Criterion 1 only	Criterion 1 only	Criterion 1 only	Criterion 1 only

Source: BREEAM Domestic Refurbishment

The BREEAM Domestic Refurbishment scheme sets minimum standards above that are considered to be achievable for the UK housing stock given current refurbishment practice.

The minimum standards of performance apply to all domestic building types including listed buildings and buildings within a conservation area, however in some cases of listed buildings and buildings within a conservation area, there are some Exceptions.

[1] BREEAM Domestic Refurbishment, Technical Manual: Version: SD5077 – Issue: 1.0 – Issue Date: 30/10/2014, page 22.

Minimum standards – listed buildings and buildings in a conservation area

The UK has great heritage assets; it is estimated to be over 500,000[1] listed buildings in the UK (including England, Wales, Scotland and Northern Ireland). There are also more than 10,000 conservation areas in the UK, where local planning authority defines additional controls, permits, conservation consents for executing any alteration or extension works on heritage buildings. [2]

For that, BREEAM domestic refurbishment scheme has committed the team of any heritage listed project to work with their local authority conservation officer to deliver **the minimum standards** as far as practically possible. This can be demonstrated by producing a **report with confirmation** from the Local Authority conservation officer that the work carried out goes as far as is practically possible within the restrictions of any statutory obligations.[3] In this context, BREEAM ensures that works have executed on heritage building under this scheme is compatible with its values as a heritage building, and don't conflict with them or result in the loss of these values, thus it becomes an unlisted building.

The Minimum standards of performance should be applied to all listed buildings in the UK if no statutory restrictions from local planning authority which prevent a building from achieving the minimum standards. (See table 3.6)

Table (3-6), the Minimum standards must be applied on the UK's listed domestic buildings

No. of credits	Category	The credit	Description
1	Health and well being	02.Sound Insulation	
2		05. Ventilation	

Source: BREEAM Domestic Refurbishment

Certification levels:

The BREEAM domestic refurbishment scheme has the same rating benchmarks that using in all BREEAM schemes.

Calculating a building's BREEAM rating: the project has been assessed under BREEAM domestic refurbishment scheme has the same calculating method of BREEAM new construction scheme.

[2] http://www.english-heritage.org.uk/professional/advice/hpg/generalintro/extentandnatureofhp/ (March 2015)
[3] BREEAM Domestic Refurbishment, Technical Manual: Version: SD5077 – Issue: 1.0 – Issue Date: 30/10/2014, page 23.

3-4. BREEAM Non-domestic Refurbishment and fit-out

The BREEAM Non-domestic Refurbishment and fit-out scheme assess the environmental life cycles impacts for existing non -domestic (non-residential) buildings at the refurbishment and fit-out stages.

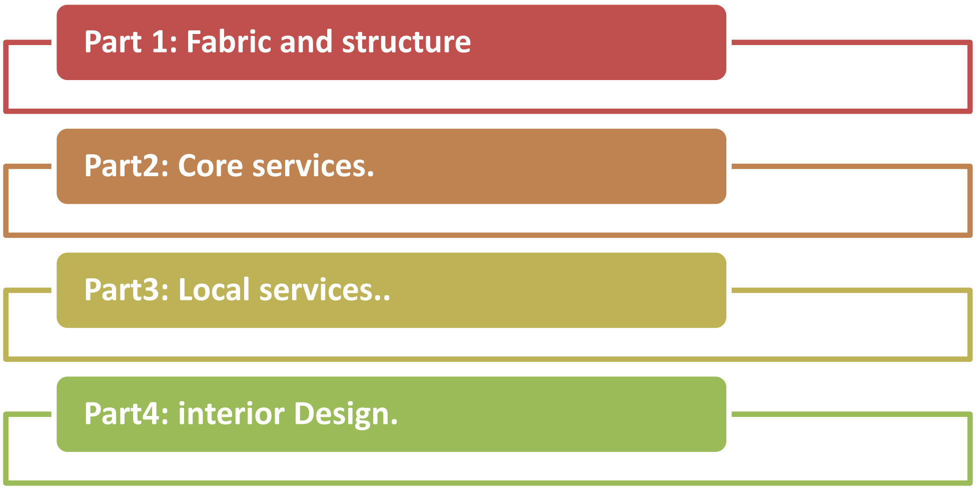
The scheme is applicable to the projects in the UK only. The both of definitions of refurbishment and fit-out include a wide range of works to improve the performance, function, and the overall condition of the existing building for (refurbishment), and from the first fit out of the newly constructed building to re-fitting an existing building for (fit-out).

The scheme set four parts to include this wide range of works. (fig 3-6) .Each non- domestic existing building in the UK can select the part/s of a scheme that can assess under it/them depending on the type of refurbishment works that project team decides for it. For example, interior finishes are typically replaced on 5-10 years, compared to the fabric and structure of the building that may need upgrade works after more than 60 years.

BREEAM UK non-domestic Refurbishment and Fit-out scheme is suitable for assessment the following types of buildings: commercial (offices, industrial, retail), Public (non-housing) such as (education, healthcare, prisons, law courts), multi-residential accommodation such as long term stay residential institutions, short term stay residential institutions such as (hotels, motels, hostels..etc), public buildings such as (gallery, library, museum, cinema, theatre, conference hall, sports halls), transport stations and other.[1]

The manual document of this scheme indicates the assessment parts that are applicable depending on the type of refurbishment project being undertaken. For example, part 1 is the only assessment part that is compatible with refurbishment shell projects. In the case of refurbishment both of shell and core, the project team can assess it under part1 and part2 only. In the case of change of building use, the project can be assessed under all parts of scheme depending on what the assessor and client identify which parts they wish to gain certification.[2]

[1] BREEAM UK Refurbishment and Fit-out 2014, Technical Manual: SD216 1.0-2014, Issue 0.1, Date of issue 18/07/2014, page 14,15.
2 BREEAM UK Refurbishment and Fit-out 2014, page 15.



Fig(3-6): the assessment parts for BREEAM refurbishment and fit-out scheme.
Source: Researcher depending on BREEAM Domestic Refurbishment.

- **Part 1:** Fabric and structure. This part is appropriate for the refurbishment project if it is includes one or more of the following alterations and the area that be renovated of building fabric greater than 50% of the surface (ex. 50% from the area of façade or the area of the roof) or greater than 25% of the total building envelope :
- Upgrade/refurbish building facades; install a new roof or significant changes in a roof structure or refurbish/replace roof coverings, replace/upgrade/refurbish of existing windows with new glazing.
- If the building fabric needs a minor alteration (less than 50% of the surface or 25% of total building envelopee), it would not require a part 1 assessment to be included.
- **Part2:** Core services. Core services are the services that supply multiple areas/ tenants. They are not focused on the needs of individual tenants except the single tenancy occupancy buildings, in this case, the systems services will be considered as core services that covering the whole of the building.
- This part is appropriate for the refurbishment project if at least two of the following are being installed or upgraded: central air handling unit, heating boiler, chiller plant, more than 50% of the heat distribution, water services (sanitary fitting in core), building management system, community heating system, and low and zero carbon technologies.

- The works comprise of (like for like)[1] component replacements, part 2 assessment may not be appropriate. E.g. replacement a fan motor of an air handling unit.
- **Part3:** Local services. Local services are services that supply a specific area in the building and may bee connected to core services within tenanted area.
- This part is appropriate for the refurbishment project if at least two of the following fixed local services are being installed or upgraded: replacement or new installation of local heating/cooling units, replacement of more than 50% of light fitting, system and controls, upgrade of zone controls, local ventilation, and point of use water heaters.
- **Part4:** Interior Design. This part is appropriate for the areas where refurbishment or fit-out works make changes to the internal spaces layout and/or redecoration them. Including:
- Remodeling/changes to interior spaces (alteration greater than 50% by area) including two or more the following: wall coverings, floor coverings, ceiling covering, partitions, raised floor system, and furniture and fittings.
- And at least one of the following: Local electrical installation (e.g. sub-metering), alteration greater than 50% of the sanitary fittings (e.g. kitchenette and washrooms), and equipment (e.g. display lighting display chillers/freezers).

Assessment the mix uses buildings under the BREEAM UK Refurbishment and Fit-out Scheme:

- If the site consists of some separate buildings with different uses, each building requires an assessment and certificate for each building.
- If a single building has a dominant use, but containing some other different uses, it can assess under a single certification according to dominate use. (such as: a retail building has restaurants and cinemas).
- If a single building has some dominant uses, i.e. mixed use. In this case, the building needs separate assessment and certifications for

[1] Any replacement component must be as per the original called (like for like).

each dominate use. For example, a building with one or more floors of offices space and retail units.[1]

Assessment the simple buildings under the BREEAM UK Refurbishment and Fit-out Scheme: the BREEAM UK Refurbishment and Fit-out Scheme provides a separate assessment for "simple" building by using the simple criteria set at the scheme. BREEAM defines the term "simple" as " the building where services and their relationship to the building fabric are "simple" not complex. BREEAM also defines the criteria for simple building in the scheme. The building would be simple if it hasn't contained one of the following services: air conditioning and refrigeration systems, mechanical ventilation, renewable energy resources (with the exception of on-site micro-generation technologies), laboratories, major water-consuming plant or functions such as swimming, research pool, irrigation systems or vehicle wash, escalators or traveling walkways. BREEAM made an exception for simple building from some credits. As a result the number of points may differ for the remaining credits under one category from simple to complex buildings. BREEAM also simplifies the criteria associated with achieving some credits compared with complex projects.[2]

Non-domestic heritage building refurbishment:

The scheme indicates that listed UK heritage non-domestic buildings can be assessed under the BREEAM UK Refurbishment and Fit-out through all parts (part1,2,3, and 4), depending on the scope of the refurbishment project.[3] BREEAM defines heritage buildings in the UK as a following:

- **Listed buildings** – Grade I, Grade II* and Grade II (England and Wales), Grade A, B and C (Scotland) and A, B1 and B2 (Northern Ireland)
- **Existing buildings situated in conservation areas** (where the existing building itself has conservation status and contributes to the status of the conservation area).
- **Existing buildings which are of architectural and historical interest** and which are referred to as a material consideration in a local authority's development plan

[1] BREEAM UK Refurbishment and Fit-out 2014, Technical Manual: SD216 1.0-2014, Issue 0.1, Date of issue 18/07/2014, page 19.
[2] BREEAM UK Refurbishment and Fit-out 2014, Technical Manual: SD216 1.0-2014, Issue 0.1, Date of issue 18/07/2014, pages 400-403.
[3] BREEAM UK Refurbishment and Fit-out 2014, Technical Manual: SD216 1.0-2014, Issue 0.1, Date of issue 18/07/2014, page 16.

- **Existing buildings designated as being of architectural and historic interest** within national parks, areas of outstanding natural beauty, and world heritage sites.

The BREEAM scheme set a number of compliance notes associated with some credits that related to how the credit can be achieved in the case of heritage buildings. The credits are as a follows:

Table (3-7), the Minimum standards must be applied on the UK's listed non-domestic buildings

No. of credits	Category	The credit
1	Health and well-being	01. Visual comfort
2		02. Indoor Environment quality
3		04.Thermal comfort
4		05. acoustic performance
5	Energy	01. Reduction of energy Use and carbon emissions
6		04.Low carbon design
7	Materials	05. Designing for durability and resilience
8	Management	02. Life cycle cost and service life planning,

Source: BREEAM UK Refurbishment and Fit-out 2014.

BREEAM UK Refurbishment and Fit-out Refurbishment categories and credits:

The BREEAM UK Refurbishment and Fit-out 2014 scheme has nine main categories plus innovation category.

Environmental category weightings

The table below outlines the weightings for each of the nine environmental categories included in the BREEAM UK Refurbishment and Fit-out scheme.

The first column (core weightings) is the weightings of categories if the project applied all parts. The other columns illustrate the categories weightings for other project types that not being assessed under all parts of the scheme.

Table (3-8), BREEAM environmental categories weights

Category	Core weighting	Part 1 only	Part 2 only	Part 3 only	Part 4 only	Parts 1 and 2	Parts 2 and 3	Parts 3 and 4
Management	12%	15%	16.7 %	16.5 %	20.0 %	13.0 %	16.5 %	14.1 %
Health and Wellbeing	15%	14.8 %	14.4 %	15.3 %	19.9 %	11%	15.3 %	15.9 %
Energy	19%	16.4 %	24.5 %	24.3 %	2.5%	18.8 %	24.3 %	22.5 %
Transport	8%	10%	11.2 %	11.1 %	13.4 %	8.6%	11.1 %	9.5%
Water	6%	0%	7.5%	7.4%	10.1 %	5.7%	7.4%	7.1%
Materials	12.5%	15.6 %	5.4%	5.3%	19.3 %	13.4 %	5.3%	13.7 %
Waste	7.5%	9.4%	9.3%	9.2%	11.2 %	8.1%	9.2%	7.9%
Land Use and Ecology	10%	12.5 %	0%	0%	0%	10.7 %	0%	0%
Pollution	10%	6.3%	11%	10.9 %	3.6%	10.7 %	10.9 %	9.3%
Total	100%	100%	100%	100%	100%	100%	100%	100%
Innovation	10%	10%	10%	10%	10%	10%	10%	10%

Source: BREEAM UK Refurbishment and Fit-out 2014

Each of the above environmental categories consists of a differing number of BREEAM credits. As a result, each credit vary regarding its contribution to a building's overall score.

Table (3-9), BREEAM environmental categories' credits

Managment	**Health and Wellbeing**
- Project brief and design - Life cycle cost and service life planning - Responsible construction practices - Commissioning and handover - Aftercare	- Visual comfort - Indoor air quality - Safe containment in laboratories - Thermal comfort - Acoustic performance - Safety and security

Source: BREEAM UK Refurbishment and Fit-out 2014

Table (3-9) continued . BREEAM environmental categories' credits

Energy	**Transport**
- Reduction of energy use and carbon emissions - Energy monitoring - External lighting - Low carbon design - Energy efficient cold storage - Energy efficient transportation systems - Energy efficient laboratory systems - Energy efficient equipment - Drying space	- Sustainable transport solutions - Proximity to amenities - Cyclist facilities - Maximum car parking capacity - Travel plan
Water	**Materials**
- Water consumption - Water monitoring - Water leak detection - Water efficient equipment -	- Environmental impact of materials - Hard landscaping and boundary protection - Responsible sourcing of materials - Insulation - Designing for durability and resilience - Material efficiency
Waste	**Land Use and Ecology**
- Project waste management - Recycled aggregates - Operational waste - Speculative floor and ceiling finishes - Adaptation to climate change - Functional adaptability	- Protection of ecological features - Enhancing site ecology - Long term impact on biodiversity
Pollution	**Innovation**
- Impact of refrigerants - NOx emissions - Flood risk management and reducing surface water runoff - Reduction of night time light pollution - Reduction of noise pollution	- Innovation

Source: BREEAM UK Refurbishment and Fit-out 2014

BREEAM UK Refurbishment and Fit-out scheme can be used to assess and rate the environmental impacts arising from a refurbishment and fit-out projects and ongoing operation of the building, at the following life cycle stages[1]:

Design Stage (DS) – that's lead to an Interim BREEAM certified rating
Post Construction Stage (PCS) – that lead to a Final BREEAM certified rating

[1] BREEAM UK Refurbishment and Fit-out 2014, page 22.

Design stage (DS)[1]:

The Design Stage assessment provides a rating of the building's refurbishment as an interim rating; it is labeled as "interim" as it doesn't represent the building's final BREEAM performance.

The design information must be available to enable the BREEAM Assessor to evaluate and verify the performance of the building through the criteria of the manual document of this scheme, to complete the assessment at this stage.

Post Construction Stage (PCS)[2]

The post construction stage assessment confirms that the final post refurbishment or fit-out at the final stage of the life cycle. A final post construction stage assessment is completed and certified after practical completion of the refurbishment or fit-out works.

The post construction stage has two approaches to assessment through:

1- **A post construction review (PCR)** based on a completed interim design stage assessment, it confirms that the building "as built" performance is compatible with the assessment certified at the interim design stage.

2- A post construction assessment (PCA). When an interim DS assessment has not been carried out at construction stage, and a BREEAM assessment and rating is required, a full post construction stage assessment can be conducted.[3]

Minimum standards of performance

To achieve the BREEAM rating, any project must earn the minimum overall percentage for the level desired and must satisfy the minimum standards that are defined for BREEAM UK Refurbishment and Fit-out scheme to that rating level complied with. The required minimum standards also vary depending upon the applicable assessment parts. In some credits, there are minimum standards specified to some project cases. The projects that assess under part2 and 3 only and the project team aim to gain a level "Excellent," they must gain one point for credit (Management 05: after-care)"[4] . Table (3-10) demonstrates the minimum standards should be applicable to the each rating level BREEAM scheme.

[1] BREEAM UK Refurbishment and Fit-out 2014, page 22.
[2] Ibid
[3] Ibid.
[4] Ibid , page25.

Table (3-10), Minimum standards of the BREEAM rating level

BREEAM Credit	Pass	Good	Very Good	Excellent	Outstanding
Man 03: Responsible construction practices	None	None	None	One credit (Considerate construction)	Two credits (Considerate construction)
Man 04: Commissioning and handover	None	None	None	Criterion 9 (Building User Guide)	Criterion 9 (Building User Guide)
Aftercare	None	None	None	Parts 2 and 3 only: One credit (Seasonal commissioning)	Parts 2 and 3 only: One credit (Seasonal commissioning)
Ene 01: Reduction of energy use and carbon emissions	None	None	None	Parts 1, 2, 3 and 4 (full assessments): Six credits, varies for other assessment types	Parts 1, 2, 3 and 4 (full assessments): Ten credits, varies for other assessment types
Ene 02: Energy monitoring	None	None	Parts 2, 3 and 4: One credit (First sub-metering credit)	Parts 2, 3 and 4: One credit (First sub-metering credit)	Parts 2, 3 and 4: One credit (First sub-metering credit)
Wat 01: Water consumption	None	One credit (where applicable)	One credit (where applicable)	One credit (where applicable)	Two credits (where applicable
Wat 02: Water monitoring	None	Part 2: Criterion 1 only	Part 2: Criterion 1 only	Part 2: Criterion 1 only	Part 2: Criterion 1 only
Mat 03: Responsible sourcing of materials	Criterion 1 only	Criterion 1 only	Criterion 1 only	Criterion 1 only	Criterion 1 only
Wst 01: Project waste management	None	None	None	None	One credit
Wst 03: Operational waste	None	None	None	One credit	One credit

Source: BREEAM UK Refurbishment and Fit-out 2014

Certification levels:

The BREEAM Refurbishment and Fit-out scheme has the same rating benchmarks that using in all BREEAM schemes.

Calculating a building's BREEAM rating: the project has been assessed under BREEAM UK Refurbishment and Fit-out scheme has the same calculating 1method of BREEAM new construction scheme.

Relation between BREEAM Refurbishment and BREEAM in-use

BREEAM refurbishment and fit-out assessment is based on predicted performance. Actual performance can only be measured and compared at the in-use life cycle stage once the building is occupied which can be assessed through the **BREEAM In-Use scheme**.

once clients have gained a certification for their building that has been assessed under BREEAM refurbishment and fit-out scheme, they are provided with a direct link to BREEAM In-Use rating, that allowing clients to gain a certification under BREEAM In-Use scheme in order to assess ongoing performance of their existing building, its operations, management of the activities in the building. BREEAM In-use enables rating and certification options (through three parts) for clients to assess one or more of the three, or a combination of the three parts.[1]

- **Part 1 (Asset):** the performance characteristics of the building based on its built form, construction, and services.
- **Part 2 (Building Management**): the management quality and practices related to the operation of the building.
- **Part3 (Occupier Management):** the understanding and implementation of management policies.
-

3-5. Comparison study among LEED O+M, BREEAM Domestic Refurbishment, and BREEAM 2014 Refurbishment and fit-out

From the previous study of the three rating systems LEED O+M, BREEAM Domestic Refurbishment, and BREEAM 2014 Refurbishment and fit-out, the following table demonstrates the difference among the three rating systems:

[1] BREEAM UK Refurbishment and Fit-out 2014, pages 29,30.

Table (3-11), Comparison study among LEED O+M, BREEAM Domestic Refurbishment, and BREEAM 2014 Refurbishment and fit-out

	LEED O+M	BREEAM Domestic Refurbishment	BREEAM 2014 Refurbishment
Apply on	All existing Buildings	Residential existing buildings	Non-residential exiting building
Minimum requirements for heritage buildings	No Minimum requirements related to heritage buildings	2 Minimum standards related to heritage buildings	8 Minimum standards related to heritage buildings
The type of operation could be assessed	Assess ongoing operation	Assess predicated operation	
The calculation of rating	Points	Weightings of categories	
Rating Level	Certified, Silver, Gold, platinum.	Pass, good, very good, outstanding	
The rating system categories	1) Location and Transportation 2) Sustainable sites 3) Water efficiency 4) Energy and Atmosphere 5) Materials and Resources 6) Indoor Environmental quality 7) Innovation	**1) <u>Management</u>** 2) Health and wellbeing 3) Energy 4) Water 5) Materials **6) <u>Waste</u>** **7) <u>Pollution</u>** 8) innovation	1) **<u>Managemen</u>**t 2) Health and wellbeing 3) Energy 4) Transport 5) Water 6) Materials **7) <u>Waste</u>** 8) Landuse and ecology **9) <u>Pollution</u>** 10) innovation

Source: (Researcher).

From the previous, the research illustrates the followings:

- LEED O+M assess all types of existing buildings under one rating systems, but BREEAM assess the existing buildings under two rating systm one for residential buildings and the other for non- residential buildings.
- The Two BREEAM rating system have the same categories of LEED O+M except three categories :
- The Management category that is additional category in two BREEAM Schemes,
- The waste and pollution also two additional categories exist in the two BREEAM schemes and don't exist in LEED O+M but some credits of them are incorporated in LEED's sustainable site category.
- LEED O+M assesses the ongoing operation, some credits need performance periods see table (3-2), but the two BREEAM rating system assess the predicated operation.
- The two BREEAM rating systems set minimum requirements must be meet when using them to assess heritage buildings, but LEED O+M don't have any requirements when using it to assess heritage buildings.

Conclusions:

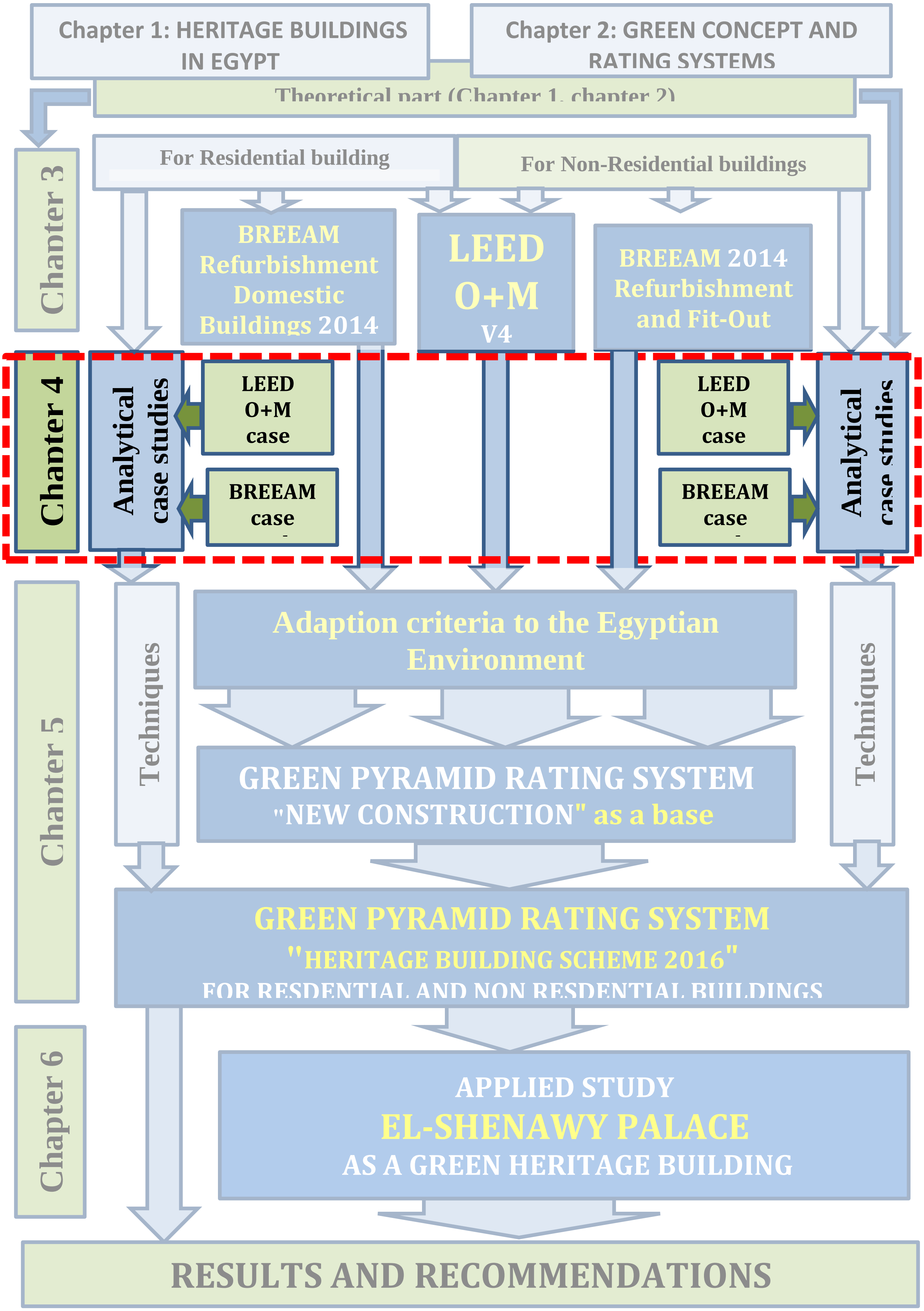
- The new rating system GBC for historic Building in Italy, was launched in 2016 and no building until now has certified under this scheme, and according to the manual of " GBC historic Building – V.1.0 2016", "**it is a pilot version**", For that, the research cannot incorporate this system into its study before becoming active and certifying real-cases in Italy.
- The research will utilize of the results of a comparison study of the three rating system in the analytical study of the three rating systems " **LEED O+M, BREEAM Domestic, BREEAM refurbishment and Fit-out**" to produce Green Heritage Building Rating system can assess heritage buildings in Egypt.

PART TWO

Analytical Studies

CHAPTER IV

ANALYTICAL STUDY OF INTERNATIONAL GREEN HERITAGE BUILDINGS


Chapter 1: HERITAGE BUILDINGS IN EGYPT
Chapter 2: GREEN CONCEPT AND RATING SYSTEMS
Theoretical part (Chapter 1, chapter 2)
Chapter 3
For Residential building
For Non-Residential buildings
BREEAM Refurbishment Domestic Buildings 2014
LEED O+M V4
BREEAM 2014 Refurbishment and Fit-Out
Chapter 4
Analytical case studies
LEED O+M case
BREEAM case
LEED O+M case
BREEAM case
Analytical case studies
Chapter 5
Techniques
Adaption criteria to the Egyptian Environment
GREEN PYRAMID RATING SYSTEM "NEW CONSTRUCTION" as a base
Techniques
GREEN PYRAMID RATING SYSTEM
"HERITAGE BUILDING SCHEME 2016"
FOR RESDENTIAL AND NON RESDENTIAL BUILDINGS
Chapter 6
APPLIED STUDY
EL-SHENAWY PALACE
AS A GREEN HERITAGE BUILDING
RESULTS AND RECOMMENDATIONS

Residential Green Heritage case Studies

4-1. Residential Green Heritage case Studies.

4-1-1. LEED certified Green Heritage Building.
Governor's Mansion/ New York State Executive Mansion

4-1-2 BREEAM certified Green Heritage Building.
The Building No. 29 Lansdowne Road- London

4-1. Residential Green Heritage case Studies.

This section of chapter 4 demonstrates two heritage residential buildings certified as green buildings, one under LEED rating system umbrella, and other under BREEAM rating system umbrella.

4-1-1. LEED certified Green Heritage Building.
Governor's Mansion/ New York State Executive Mansion

The building is located at 138 Eagle street in Albany- New York, it is the official residence of the governor of New York. It was built in 1856 as a simple Italian structure as a banker's private home. The state has purchased the building in 1877 after Samuel Tilden (the New York's governor) reside in it. Over the years, many governors have affected the building; each of them had his own style and created his own traditions that add value to the values of this unique house where has been the home of three men who become later president of United State of America (*Grover Cleveland, Theodore Roosevelt, and Franklin Roosevelt*) and other two *Theodore Roosevelt* had constructed a gymnasium during his stay in the building, *Franklin Roosevelt* constructed swimming pool, another governor had built a zoo, and other one had constructed tennis courts.[1]

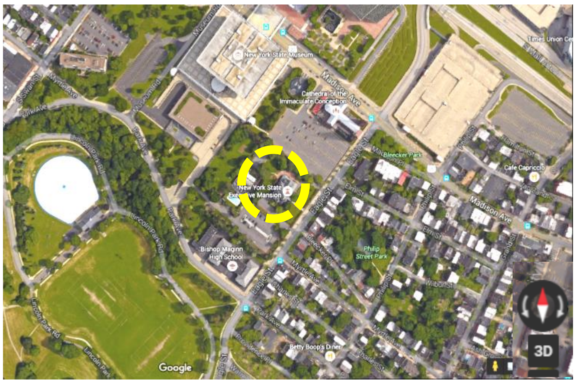


Fig (4-1). The Executive Mansion in Italian style , in 1956. **Source:** http://albanycvb.blogspot.com/2013/06/behind-gates-look-inside-executive.html

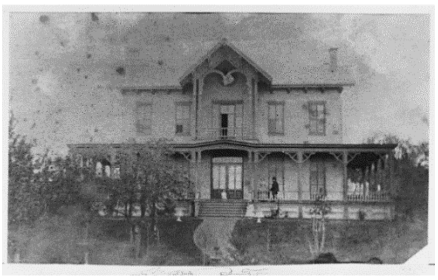


Fig (4-2). The Executive Mansion in Italian style , in 1956. **Source:** http://albanycvb.blogspot.com/2013/06/behind-gates-look-inside-executive.html

Fig (4-3). The Executive Mansion in Second Empire style , in 1860. **Source:** http://albanycvb.blogspot.com/2013/06/behind-gates-look-inside-executive.html

Fig (4-4). The Executive Mansion, in 1960. **Source:** http://albanycvb.blogspot.com/2013/06/behind-gates-look-inside-executive.html

[1] The official website of "Governor's Mansion": http://www.governor.ny.gov/explore-governors-mansion ,accessed (June 2015).

The building has witnessed many transformations during its history. In the 1860s, the simple Italian structure had renovated to a home acquired second Empire style's[1] details. As years passed, it has transformed from simple two- story house into Queen Anne style[2] building.[3]

For the high historical value of the house, the governor *Nelson Rockefeller* fought to restore the building after a fire in 1961, after efforts to relocate the house to the burbs.[4]

In 1971, the site of the Executive Mansion "the building and its ground" has listed in the National Historic Register.

In 1983, Mrs. Matilda Cuomo the wife of the New York's Governor at that time (Mario Cuomo) had executed a restoration process for the house to preserve its historic value. The process included the entire first and second floors with the help of the private funding, the effects of this restoration process on the house's fabric still visible until today.[5]

Fig (4-5). New York Governor's Mansion in 2010
Source
https://static01.nyt.com/images/2010/11/04/nyregion/MANSION1/MANSION1-jumbo.jpg

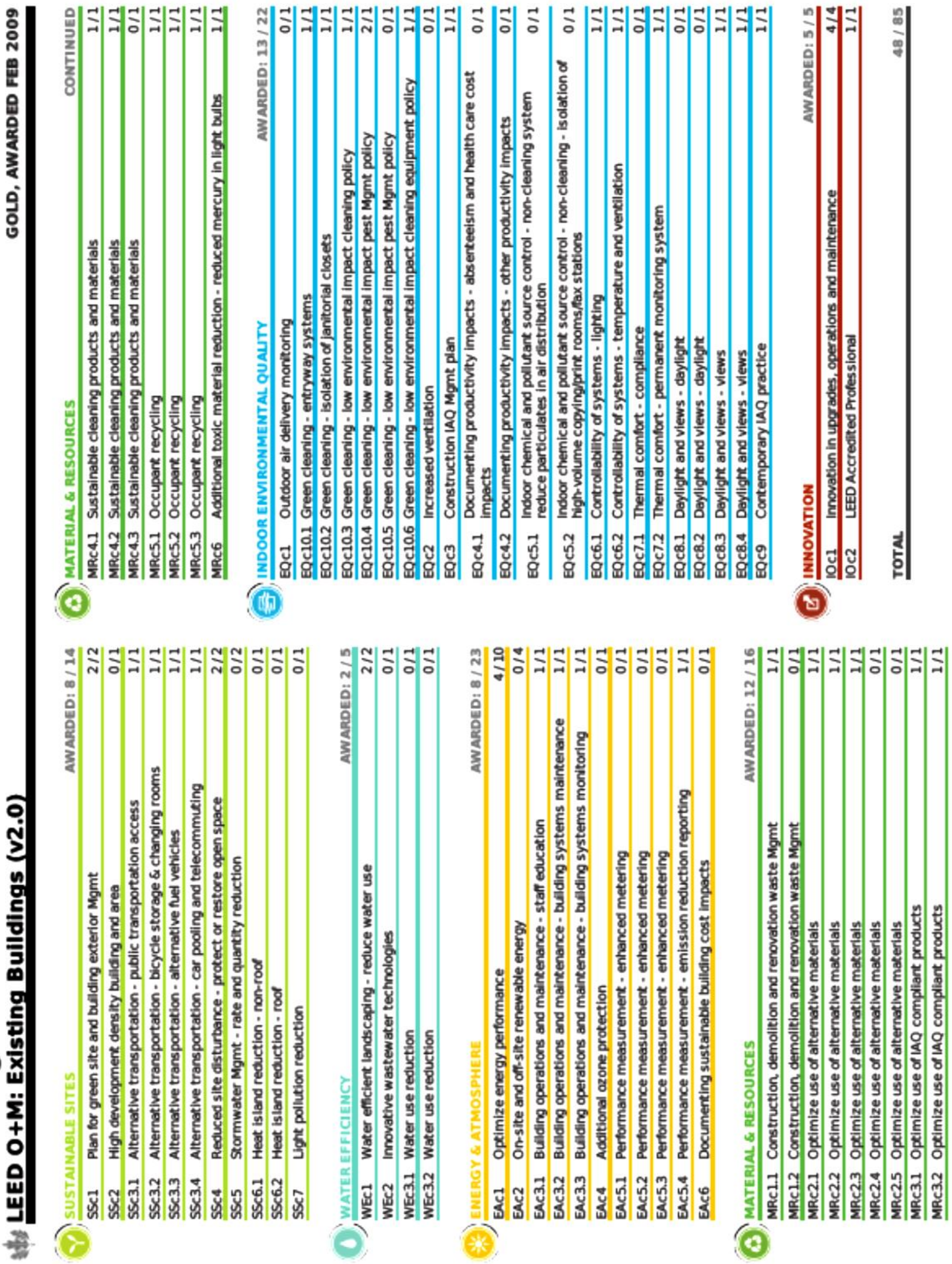
4-1-1-1. Greening the House:

Greening the Mansion program was initiated in 2007 under the supervision of executive chamber and the New York state office of General services, working with USGBC[6] , the green initiative aimed to[7]:

- Reducing the total energy usage.
- Using clean and renewable resources.

[1] **Second Empire architecture style**: it most popular between 1865 and 1880 during the era of the second French Empire, it is acquired an eclectic mix of the earlier European styles, most notably Baroque with mansard roof.
2 **Queen Anne architecture style**: it was called " English Baroque" in Britain in the reign of Queen Anne, it was popular from the last quarter of 19th century and the early decades of the 20th century.
[3]The official website of "Governor's Mansion".
[4]http://albanycvb.blogspot.com/2013/06/behind-gates-look-inside-executive.html
[5] The official website of "Governor's Mansion".
[6] **USGBC:** U.S. Green Building Council.
[7] The official website of "Governor's Mansion".

- Using sustainable practice in maintenance and operation of the building.
- Adopting green concepts in energy usage, using recycled products, energy-efficient appliances, recycle household, lawn irrigation using river water, use an alternative- fuel vehicles and whole building retro-commissioning.



0010087070, Albany, NY

Greening the NYS Governor's Mansion

LEED O+M: Existing Buildings (v2.0) — GOLD, AWARDED FEB 2009

SUSTAINABLE SITES		AWARDED: 8 / 14
SSc1	Plan for green site and building exterior Mgmt	2/2
SSc2	High development density building and area	0/1
SSc3.1	Alternative transportation - public transportation access	1/1
SSc3.2	Alternative transportation - bicycle storage & changing rooms	1/1
SSc3.3	Alternative transportation - alternative fuel vehicles	1/1
SSc3.4	Alternative transportation - car pooling and telecommuting	1/1
SSc4	Reduced site disturbance - protect or restore open space	2/2
SSc5	Stormwater Mgmt - rate and quantity reduction	0/2
SSc6.1	Heat island reduction - non-roof	0/1
SSc6.2	Heat island reduction - roof	0/1
SSc7	Light pollution reduction	0/1

WATER EFFICIENCY		AWARDED: 2 / 5
WEc1	Water efficient landscaping - reduce water use	2/2
WEc2	Innovative wastewater technologies	0/1
WEc3.1	Water use reduction	0/1
WEc3.2	Water use reduction	0/1

ENERGY & ATMOSPHERE		AWARDED: 8 / 23
EAc1	Optimize energy performance	4/10
EAc2	On-site and off-site renewable energy	0/4
EAc3.1	Building operations and maintenance - staff education	1/1
EAc3.2	Building operations and maintenance - building systems maintenance	1/1
EAc3.3	Building operations and maintenance - building systems monitoring	1/1
EAc4	Additional ozone protection	0/1
EAc5.1	Performance measurement - enhanced metering	0/1
EAc5.2	Performance measurement - enhanced metering	0/1
EAc5.3	Performance measurement - enhanced metering	0/1
EAc5.4	Performance measurement - emission reduction reporting	1/1
EAc6	Documenting sustainable building cost impacts	0/1

MATERIAL & RESOURCES		AWARDED: 12 / 16
MRc1.1	Construction, demolition and renovation waste Mgmt	1/1
MRc1.2	Construction, demolition and renovation waste Mgmt	0/1
MRc2.1	Optimize use of alternative materials	1/1
MRc2.2	Optimize use of alternative materials	1/1
MRc2.3	Optimize use of alternative materials	1/1
MRc2.4	Optimize use of alternative materials	0/1
MRc2.5	Optimize use of alternative materials	0/1
MRc3.1	Optimize use of IAQ compliant products	1/1
MRc3.2	Optimize use of IAQ compliant products	1/1

MATERIAL & RESOURCES		CONTINUED
MRc4.1	Sustainable cleaning products and materials	1/1
MRc4.2	Sustainable cleaning products and materials	1/1
MRc4.3	Sustainable cleaning products and materials	0/1
MRc5.1	Occupant recycling	1/1
MRc5.2	Occupant recycling	1/1
MRc5.3	Occupant recycling	1/1
MRc6	Additional toxic material reduction - reduced mercury in light bulbs	1/1

INDOOR ENVIRONMENTAL QUALITY		AWARDED: 13 / 22
EQc1	Outdoor air delivery monitoring	0/1
EQc10.1	Green cleaning - entryway systems	1/1
EQc10.2	Green cleaning - isolation of janitorial closets	1/1
EQc10.3	Green cleaning - low environmental impact cleaning policy	1/1
EQc10.4	Green cleaning - low environmental impact pest Mgmt policy	2/1
EQc10.5	Green cleaning - low environmental impact pest Mgmt policy	0/1
EQc10.6	Green cleaning - low environmental impact cleaning equipment policy	1/1
EQc2	Increased ventilation	0/1
EQc3	Construction IAQ Mgmt plan	1/1
EQc4.1	Documenting productivity impacts - absenteeism and health care cost impacts	0/1
EQc4.2	Documenting productivity impacts - other productivity impacts	0/1
EQc5.1	Indoor chemical and pollutant source control - non-cleaning system reduce particulates in air distribution	0/1
EQc5.2	Indoor chemical and pollutant source control - non-cleaning - isolation of high-volume copying/print rooms/fax stations	0/1
EQc6.1	Controllability of systems - lighting	1/1
EQc6.2	Controllability of systems - temperature and ventilation	1/1
EQc7.1	Thermal comfort - compliance	0/1
EQc7.2	Thermal comfort - permanent monitoring system	1/1
EQc8.1	Daylight and views - daylight	0/1
EQc8.2	Daylight and views - daylight	0/1
EQc8.3	Daylight and views - views	1/1
EQc8.4	Daylight and views - views	1/1
EQc9	Contemporary IAQ practice	1/1

INNOVATION		AWARDED: 5 / 5
IOc1	Innovation in upgrades, operations and maintenance	4/4
IOc2	LEED Accredited Professional	1/1

TOTAL		48 / 85

Fig (4-6). The LEED checklist of Governor's Mansion.

Source: http://www.usgbc.org/projects/greening-nys-governors-mansion?view=overview

The governor's mansion was awarded **Gold LEED certification** under **LEED (O+M) v.2** in Feb. 2009. The Mansion is the first Governor's residence in USA that has earned gold status using LEED O+M rating system.

4-1-1-1-1. Sustainable sites:

Governor's Mansion achieved 8 points from 14 possible points in the Sustainable sites category By[1]:

- Creating a plan for green site and building exterior management,

Fig (4-7),(4-8),and (4-9) preferred parking for hybrid vehicles only, protecting open spaces, Bicycle rack for Governor's Mansion.

Source: Paterson, David A. and Egan, John C. (June 2010)

- Providing various alternative transportation options for the Building's users and visitors, such as providing preferred parking for hybrid/vanpool vehicles, proximity to public transportation, creating bicycle storage.

- Protecting the open spaces by preserving the perennial gardens of the Mansion.

[1] Paterson, David A. and Egan, John C. (June 2010),"**Green Building Initiatives in New York State**", New York State Pollution Prevention Institute Workshop, Office of General Services, http://www.rit.edu/affiliate/nysp2i/sites/rit.edu.affiliate.nysp2i/files/training/acampas_pollprev.pdf

Table (4-1). The Sustainable Sites checklist of New York Governor's Mansion that has been assessed under LEED O+M v.2

	Credits	8/14
SSc1	**Plan for green site and building exterior Management**	**2/2**
SSC2	High development density building and area	0/1
SSC3.1	**Alternative transportation: public transportation access**	**1/1**
SSC 3.2	**Alternative transportation: Bicycle storage and changing rooms**	**1/1**
SSC 3.3	**Alternative transportation: alternative fuel vehicles**	**1/1**
SSC 3.4	**Alternative transportation: carpooling and telecommuting**	**1/1**
SSC 4	**Reduced site disturbance – protect or restore open space**	**2/2**
SSC 5	Storm management – rate and quantity reduction	0/2
SSC 6.1	Heat island reduction- non-roof	0/1
SSc6.2	Heat island reduction - roof	0/1
SSc7	Light pollution reduction	0/1

Source: USGBC's Official Website : http://www.usgbc.org, access (09.2015)

4-1-1-1-2._Water Efficiency

Governor's Mansion achieved 2 points from 5 possible points in the water efficiency category By[1]:

- Reducing water use for irrigation of landscape by 100% through using non-potable filtered water from nearby Hudson River.
- Acting improvements to plumbing fixtures include low flow nozzles and aerators for Kitchen and bathrooms. But these improvements did not Inadequate to achieve requirements and earn points at the credits of indoor water use reduction.

[1] Paterson, David A. and Egan, John C. (June 2010).

Fig (4-10). River water tubes of the Mansion
Source: Paterson, David A. and Egan, John C. (June 2010)

Table (4-2). The Water Efficiency checklist of New York Governor's Mansion that has been assessed under LEED O+M v.2

	Credits	2/5
WEc1	**Water efficient landscaping- reduce water**	**2/2**
WEC2	Innovation wastewater technologies	0/1
WE3.1	**Water use reduction**	**1/1**
WE3.2	**Water use reduction**	**1/1**

Source: USGBC's Official Website : http://www.usgbc.org, access (09.2015)

4-1-1-1-3._Energy & Atmosphere :

Governor's Mansion achieved 8 points from 23 possible points in the category **Energy and atmosphere** by[1]:

- Upgrading to the fan coil unit system.
- Increasing insulation in the attic spaces (using recycled jeans), ensuring consuming less energy in HVAC heating and cooling systems.
- Installing a solar pool canopy (3.5 kW Photovoltaic array) covers the indoor swimming pool.
- Using Energy star appliances & refrigerants.
- Whole building retro-commissioning.
- Lighting replacements and using photovoltaic panels optimizes the energy performance of the building. It expected energy saving of 25% over previous 3 years.

[1] Paterson, David A. and Egan, John C. (June 2010)

Fig (4-11) photovoltaic array covers the indoor swimming pool of Governor's Mansion

Source: Paterson, David A. and Egan, John C. (June 2010)

Fig (4-12) Recycled jeans insulation

Source: http://home.howstuffworks.com/denim-insulation.htm

Table (4-3). The Energy category's checklist of New York Governor's Mansion that has been assessed under LEED O+M v.2

	Credits	8/23
EAC1	**Optimize energy Performance**	**4/10**
EAC2	On-site and off-site renewable energy	0/4
EAC3.1	**Building Operation and maintenance – Staff education**	**1/1**
EAC3.2	**Building Operation and maintenance – Building systems maintenance**	**1/1**
EAC3.1	**Building Operation and maintenance – monitoring**	**1/1**
EAC4	Additional Ozone Protection	0/1
EAC5.1	Performance measurement – enhanced metering	0/1
EAC5.2	Performance measurement – enhanced metering	0/1
EAC5.3	Performance measurement – enhanced metering	0/1
EAC5.4	**Performance measurement – enhanced reduction reporting**	**1/1**
EAC6	Documenting sustainable building cost impacts	0/1

Source: USGBC's Official Website : http://www.usgbc.org, access (09.2015)

4-1-1-1-4._Material and Resources:

Governor's Mansion achieved 12 points from 16 possible points in the category Material and Resources by[1]:

- Creating a plan for managing the renovation waste.
- Using recycled products such as attic insulation from jeans and cellulose, bicycle rack, and office paper.

Fig (4-13). One of the rooms of Governor's Mansion
Source: Paterson, David A. and Egan, John C. (June 2010)

Table (4-4). The Materials and resources category's checklist of New York Governor's Mansion that has been assessed under LEED O+M v.2

	Credits	12/16
MRc1.1	**Construction, demolition and renovation waste management**	**1/1**
MRc1.2	Construction, demolition and renovation waste management	0/1
MRc2.1	**Optimize use of alternative materials**	**1/1**
MRc2.2	**Optimize use of alternative materials**	**1/1**
MRc2.3	**Optimize use of alternative materials**	**1/1**
MRc2.4	**Optimize use of alternative materials**	0/1
MRc2.5	**Optimize use of alternative materials**	0/1
MRc3.1	**Optimize use of IAQ compliant products**	1/1
MRc3.2	**Optimize use of IAQ compliant products**	1/1
MRc4.2	Sustainable cleaning products and materials	1/1
MRc4.3	Sustainable cleaning products and materials	**0/1**
MRc5.1	Occupant recycling	1/1
MRc5.2	Occupant recycling	1/1
MRc5.3	Occupant recycling	1/1
MRc6	Additional toxic material reduction – reduced mercury in light bulbs	1/1

Source: USGBC's Official Website : http://www.usgbc.org, access (09.2015)

Fig (4-14). walk-off entry mats.
Source: Paterson, David A. and Egan, John C. (June 2010)

[1]Paterson, David A. and Egan, John C. (June 2010).

- Using regional products such as the slate of bathroom flooring from a local quarry, as well as, cement and flagstone. Using rapidly products such as sisal and coco entry mats.
- Using low - VOC paints and sealants.
- Using sustainable and non-toxic cleaning products.
- Enhancing occupant recycling program to 88% rate.

4-1-1-1-5._Indoor Environmental Quality

Governor's Mansion achieved 13 points from 22 possible points in the Indoor Environmental Quality category by[1]:

- Non- smoking policy.
- Putting walk-off entry mats.
- Isolation janitorial closets.
- Green cleaning products & equipment policy.
- Integrated Pest Management Policy (IPM).
- Indoor air quality management plan during the renovation process.
- Occupant controllability of light, temperature and ventilation (individual controls).
- Daylights and views for the occupants of the Mansion.

Fig (4-15) and fig (4-16). NY Governor's mansion from inside.
Source: Paterson, David A. and Egan, John C. (June 2010)

[1]Paterson, David A. and Egan, John C. (June 2010).

Table (4-5). The Indoor Environmental Quality category's checklist of New York Governor's Mansion that has been assessed under LEED O+M v.2

	Credits			Credits	Awarded 13/22
EQc1	*Outdoor air delivery monitoring*	*0 / 1*	*EQc5.1*	*Indoor chemical and pollutant source control - non-cleaning system reduce particulates in air distribution*	*0 / 1*
EQc1.1	**Green cleaning - entryway systems**	*1 / 1*	*EQc5.2*	*Indoor chemical and pollutant source control - non-cleaning - isolation of high-volume copying/print rooms/fax stations*	*0 / 1*
EQc1.2	**Green cleaning - isolation of janitorial closets**	**1 / 1**	*EQc6.1*	**Controllability of systems - lighting**	**1 / 1**
EQc1.3	**Green cleaning - low environmental impact cleaning policy**	**1 / 1**	*EQc6.2*	**Controllability of systems - temperature and ventilation**	**1 / 1**
EQc1.4	**Green cleaning - low environmental impact pest Mgmt policy**	**2 / 1**	*EQc7.1*	*Thermal comfort - compliance*	*0 / 1*
EQc1.5	*Green cleaning - low environmental impact pest Mgmt policy*	*0 / 1*	*EQc7.2*	**Thermal comfort - permanent monitoring system**	**1 / 1**
EQc1.6	**Green cleaning - low environmental impact cleaning equipment policy**	**1 / 1**	*EQc8.1*	*Daylight and views - daylight*	*0 / 1*
EQc2	*Increased ventilation*	*0 / 1*	*EQc8.2*	*Daylight and views - daylight*	*0 / 1*
EQc3	**Construction IAQ Mgmt plan**	**1 / 1**	*EQc8.3*	**Daylight and views - views**	**1 / 1**
EQc4.1	*Documenting productivity impacts - absenteeism and health care cost*	*0 / 1*	*EQc8.4*	**Daylight and views - views**	**1 / 1**
EQc4.2	*Documenting productivity impacts - other productivity impacts*	*0 / 1*	*EQc9*	**Contemporary IAQ practice**	**1 / 1**

Source: USGBC's Official Website : http://www.usgbc.org, access (09.2015)

4-1-1-1-6._Innovation

Governor's Mansion achieved 5 extra points from 5 possible points in the innovation category[1]:

- Reducing mercury content in light bulbs, the average mercury content of all light bulbs in the Mansion become less than 60 picograms/lumen hour

[1]Paterson, David A. and Egan, John C. (June 2010).

- Expanding occupant recycling program (Exemplary performance). The recycle rate for 2008 became 88% of the total waste. The recycle program includes:
    - Yard waste
    - Compostable Food
    - Fluorescent Light Bulbs
    - Batteries
    - Ballasts
    - Carpet & carpet pad

Fig (4-17). One of student tours at New York Governor Mansion
Source: Paterson, David A. and Egan, John C. (June 2010)

- A green education program consisting of student tours and public outreach. See fig (4-17).
- A side-by-side comparison of the Governor's sustainability Executive Orders with the LEED-EB rating system.
- A LEED AP on the project team.

Table (4-6). The innovation category's checklist of New York Governor's Mansion that has been assessed under LEED O+M v.2

	Credits	Awarded 5/5
IOc1	*Innovation in upgrades, operations and maintenance*	**4 / 4**
IOc2	**LEED Accredited Professional**	**1 / 1**

Source: USGBC's Official Website : http://www.usgbc.org, access (09.2015)

Fig (4-18). Gold LEED certification of the New York Governor's Mansion
Source: Paterson, David A. and Egan, John C. (June 2010)

4-1-2. BREEAM Case study for residential heritage building
The Building No. 29 Lansdowne Road- London

The building no. 29 Lansdowne Road is one half of a semi-detached house; its style belongs to early 19th century townhouses with house No.31. It was built around the 1840's. The building has 5 floors "Basement, Ground Level, 1st, 2nd, and 3rd floor". The building is located in the Ladbroke conservation area".

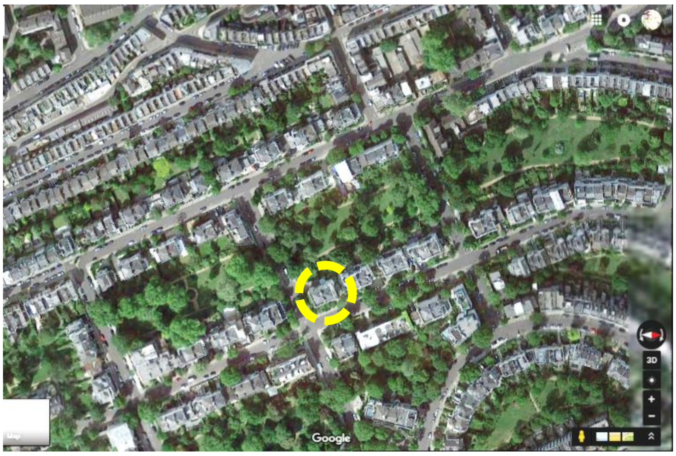


Fig (4-19). The location of a building no. 29 Lansdowne Road on the Ladbroke district google Map

Source: https://**maps.google**.com/, access (5-4-2016)

In 1984, it has been listed by English Heritage as **Grade II** with the building No.31.

The building was built as a single house, then, it was converted into a block of apartments in the first half of the 20th century. After 1962, it has been converted back to a single house. The basement floor level was extended to the back garden as a garage during the early post war period. But this extension was removed and rebuilt in April 2000 as a part of a plan of works including added a study room in the garden. From this date, no maintenance or repair works carried out in the building. That's caused more deteriorate of the physical statue of the building.[1]

Fig (4-20). 29th and 30th Lansdowne Road- London:

Source:

Application for listed Building consent for alterations to : 29 Lansdowne Rd, Notting Hill – London "Design & Access Statement" , October 2014

[1] Application for listed Building consent for alterations to : 29 Lansdowne Rd, Notting Hill – London "Design & Access Statement , October 2014, http://www.rbkc.gov.uk/idoxWAM/doc/Other-1336840.pdf?extension=.pdf&id=1336840&location=Volume2&contentType=application/pdf&pageCount=1

The building no. 29 Lansdowne has been listed on the national heritage list for England for its architecture, historic and group values, as a follows[1]:

Architecture value: It is one example of the classically designed, stock brick built and stuccoed paired townhouse that was developed in London across the country in the early of 19th century.

Historic value: the building is one of the houses built by the Ladbroke estate[2] that aimed to create a new high status residential for London in the early 19th century. This building also has represented the rapid growth of the middle or professional classes need to provide a new housing for them during the wider trend to expanding London.

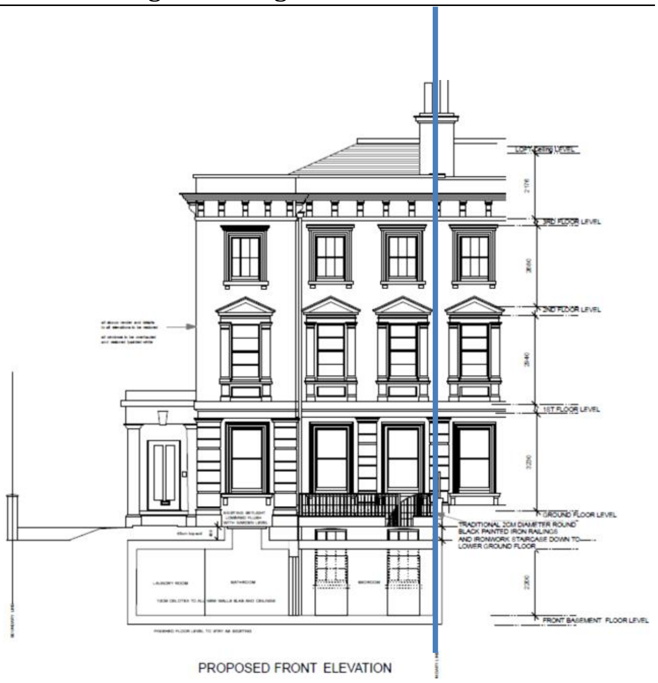


Fig (4-21). 29th and 30th Lansdowne Road- London:
Source:
Application for listed Building consent for alterations to : 29 Lansdowne Rd, Notting Hill – London "Design & Access Statement" , October 2014

Group value:

The list entry for listed building identifies the buildings No.29-47 as: "*a consecutive row of five contemporary and similarly classically designed paired villas along this side of Lansdowne Road*". It also mentioned that "*29 Lansdowne with 31 forms an integral element of much larger planned townscape scheme within the Ladbroke estate*".

4-1-2-1. Restoring and greening the building:

Restoring and greening the house's program was initiated in 2014 under the supervision of local planning authority officers, the program aimed to[3]:

- Improve the energy efficiency of the building as much as possible within its heritage fabric with the agreement of the conservation officer.

[1] Turley Heritage, (Sep.2014), "Heritage Impact Assessment to accompany BREEAM Pre-Assessment Report – 29 Lansdowne Road, Royal Borough of Kensington and Chelsea".
[2]**The Ladbroke estate**: was established by a number of different developers from 1840's to the end of 1860's, the estate owned a number of substantial parcels of land in Kensington, then a largely suburban area. The estate developed these areas including " Notting Hill" where 29 lansdowne is located. The areas have developed by Ladbroke estate is now a conservation area.
[33] Turley Heritage, (Sep.2014).

- All refurbishment and upgrading works have been achieved with the respecting the heritage important features and overall aesthetic of the building.
- The building has previously been refurbished with no regard to the original and heritage features. The project aims to Expose and carefully restore original features, and retain the original character and integrity of the listed building including roof repairs, brickwork repointing, rendering and windows refurbishment. All of these have been carried out using materials that match the old materials under the supervision of the recommendations of the conservation officer's.
- All the WC cisterns have been echo-flush and using the rainwater harvesting tanks that have been also used in the garden irrigation.

The building no. 29 Lansdowne awarded (Very Good) for BREEAM certification under **BREEAM refurbishment domestic buildings' scheme** in 2014.

Fig (4-22). 29th and 30th Lansdowne Road- London:
Source:
Application for listed Building consent for alterations to : 29 Lansdowne Rd, Notting Hill – London "Design & Access Statement" , October 2014

4-1-2-1-1. Management:

The building no.29 Lansdowne achieved 7 points from 11 possible points in the category Management by[1]:

- Provide a home user guide for the building users. The home guide contains all information about all features of the building and how the user can use them.
- Monitoring and assessing the refurbishment site impacts of the project.
- Appropriate project management procedures.

[1] Turley Heritage, (Sep.2014).

- The building no.29 Lansdowne can't achieve the requirements of (Man4), the original doors and windows cannot be replaced by new ones that can meet the security requirements, as well as the new door and windows will also be single glazed and framed to a traditional design, that's not harming or bad affecting the heritage value of the listed building.

Table (4-7). The Management category's checklist of 29 Lansdowne that has been assessed BREEAM refurbishment domestic buildings (2014).

	Credits	07/11
Man01	**Home Users Guide**	**3/3**
Man02	**Responsible Construction Practices**	**2/2**
Man03	**Construction Site impacts**	**1/1**
Man04	**Security**	**0/2**
Man05	**Protection and Enhancement of Ecological Features**	**0/1**
Man06	**Project Management**	**1/2**

Source based on Turley Heritage, (Sep.2014)

4-1-2-1-2. Health and wellbeing

The building no. 29 Lansdowne achieved 20 points from 29 possible points in the category **Health and wellbeing** by[1]:

- Achieving a good light level by the existing heritage windows (that didn't be replaced for their heritage value), and the new windows, French doors and roof light which their style compatible with the traditional style of the building.
- Achieving acceptable sound insulation standards without harming the values of the listed building. For that, non-upgrade for the sound insulation of internal, external walls and windows. The hush acoustic insulation has been installed between existing floor joists and overlaid with new boards (that have sound insulation and compatible with the traditional fabric of the building) on the all floor levels that have modern plywood floor boards, and no upgrade for the sound insulation for the

[1] Turley Heritage, (Sep.2014).

areas that have pine floorboards (that characterized by their heritage value) at all levels.

- Avoiding the use of VOCs for new materials.
- Carrying out an appropriate access statement, and Maintaining the existing accessibility if the building to avoid any new interventions to existing heritage features, such as the removal or alteration of entrance steps or change the internal circulation.

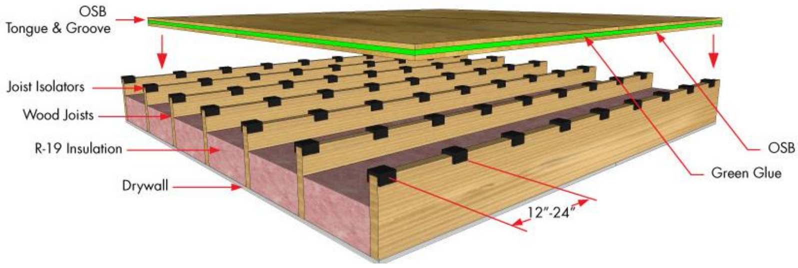


Fig (4-23). Install sound insulation between floor joints, then overlaid by new boards
Source: http://www.soundproofingcompany.com/wp-content/uploads/joist-isolators-on-joists-floor-diagram.jpg

- About the ventilation requirements, the project team has decided to retain the heritage fabric and not removed any heritage object of the building to not harming or losing the building's values. The modern materials such as modern doors and new windows at basement level and third attic floor have met the ventilation requirements. This approach has minimized as possible the absorption of moisture and the level of air infiltration of the building without harming or losing the building's values.
- Install fire and CO detection and alarm system.

Table (4-8). The Health and wellbeing category's checklist of 29 Lansdowne that has been assessed BREEAM refurbishment domestic buildings (2014).

	Credits	20/29
Hea01	**Daylighting**	**1/2**
Hea02	**Sound Insulation**	**1/4**
Hea03	**Volatile organic compounds (VOCs)**	**1/1**
Hea04	**Inclusive Design**	**1/2**
Hea05	**Ventilation**	**1/2**
Hea06	**Safety**	**1/1**

Source based on
Turley Heritage, (Sep.2014)

4-1-2-1-2. Energy performance:

The building no. 29 Lansdowne has achieved a min EPC[1] of 70[2] that achieved 20 points from 29 possible points in the Energy category by the following strategies[3,4]:

- Installing of Celotex insulation to external walls and poly pipe under floor heating, upgrading modern doors, windows and skylights at basement floor where no heritage features.
- No upgrade the insulation of external walls and windows for the ground, first and second floors for their heritage features.
- The existing pair of heritage windows at basement level will be retained and not replaced for their values.
- Any broken panes of glass will be replaced with heritage accurate substitutes.
- The two existing (non-original) conservation roof skylights are to be replaced with argon filled double glazed, these skylights cannot be seen from the street.
- All lighting will be low energy dimmable LEDs.
- The project's team didn't use renewable technologies within the garden area of the building's site that could be caused affecting the quality and character of existing public or private views of listing building and surrounding conservation area.
- Using energy efficient white goods.
- Creating internal and external adequate and secure drying spaces.
- Upgrading the existing lighting objects that are modern with energy efficient lighting objects.
- Installing a complaint energy display device.
- Creating cycle storage with a secure covered location at the modern garden for not harm the features of heritage listed building.
- Creating an appropriate space for a home office within the modern garden study.

[1] EPC: Energy Performance Certificate
[2] "29 Lansdowne Road, London -BREEAM Pre-Assessment Report (September 2014)", Darren Evans Assessments, Bristol, UK.
[3] Application for listed Building consent for alterations. (October.2014).
[4] Turley Heritage, (Sep.2014).

Table (4-9). The Energy category's checklist of 29 Lansdowne that has been assessed BREEAM refurbishment domestic buildings (2014).

	Credits	20/29
Ene01	**Improvement in Energy Efficiency Rating**	**2/6**
Ene02	**Energy Efficiency Rating Post Refurbishment**	**2.5/4**
Ene03	**Primary Energy Demand**	**5.5/7**
Ene04	**Renewable Technologies**	**0/2**
Ene05	**Energy Labelled White Goods**	**2/2**
Ene06	**Drying Space**	**1/1**
Ene07	**Lighting**	**2/2**
Ene08	**Display Energy Devices**	**2/2**
Ene09	**Cycle Storage**	**2/2**
Ene10	**Home Office**	**1/1**

Source: based on
Turley Heritage, (Sep.2014)

4-1-2-1-3. Water:

The building no. 29 Lansdowne has achieved a maximum total water consumption of 139L/person/day[1] that achieved 4 points from 5 possible points in the water category by:

- Reducing the consumption of the internal water to by using echo flush at all WC cisterns, and fed via rainwater harvesting tanks below ground including garden irrigation that has awarded 2credits.[2]
- Installing a rainwater collection system (by below ground rainwater storage units) for both internal and external water use.
- Installing a water meter.[3]

Table (4-10). The Water category's checklist of 29 Lansdowne that has been assessed BREEAM refurbishment domestic buildings (2014).

	Credits	04/05
Wat01	**Internal water use**	**2/3**
Wat02	**External water use**	**1/1**
Wat03	**Water meter**	**1/1**

Source based on

[1] "29 Lansdowne Road, London -BREEAM Pre-Assessment Report (September 2014)", Darren Evans Assessments, Bristol, UK.
[2] Application for listed Building consent for alterations. (October.2014).
[3] Turley Heritage, (Sep.2014)

Turley Heritage, (Sep.2014)

4-1-2-1-4. Material:

The building no. 29 Lansdowne achieved 18 points from 45 possible points in the category Materials by[1]:

- Retention of existing materials or upgrade them, and using new materials that have low environmental impacts, that led to improve the thermal performance of roof, external walls, internal walls, floors and windows. The new materials must be compatible with the historic character and heritage fabric of the building.
- New materials will be sourced responsibly that has been achieved two credits only.
- Using insulation of external walls
- Installing of insulation to external walls at basement level within modern elements that have no heritage features and at roof level.

Table (4-11). The Material category's checklist of 29 Lansdowne that has been assessed BREEAM refurbishment domestic buildings (2014).

	Credits	18/45
Mat01	**Environmental Impact of Materials**	**8/25**
Mat02	**Responsible sourcing of Materials**	**2/12**
Mat03	**Insulation**	**8/8**

Source based on
Turley Heritage, (Sep.2014)

4-1-2-1-5. Waste:

The building no. 29 Lansdowne achieved 4 points from 5 possible points in the category waste by[2]:

- Creating internal and external spaces for household waste (recycling and composting facilities).
- Creating an appropriate site waste management plan during refurbishment process.

[1] Turley Heritage, (Sep.2014)
[2] Ibid.

Table (4-12). The waste category's checklist of 29 Lansdowne that has been assessed BREEAM refurbishment domestic buildings (2014)

	Credits	04/05
Was01	**Household waste**	**2/2**
Was02	**Refurbishment Site Waste Management**	**2/3**

Source based on
Turley Heritage, (Sep.2014)

4-1-2-1-6. Pollution:

The building no. 29 Lansdowne achieved 6 points from 8 possible points in the category pollution by[1]:

- Existing space for heating and hot water systems at the heritage building is modern and has achieved the requirements of the credit of NOx emissions.
- Implementing a flood resistance strategy after made a flood risk assessment for the building site.

Table (4-13). The Pollution category's checklist of 29 Lansdowne that has been assessed BREEAM refurbishment domestic buildings (2014).

	Credits	06/08
Pol01	**Nitrogen Oxide Emissions**	**3/3**
Pol02	**Surface water runoff**	**2/3**
Pol03	**Flooding**	**1/2**

Source based on
Turley Heritage, (Sep.2014)

4-1-2-1-7. Innovation:

- No approved innovations were approved as part of the proposals.

Table (4-14). The Innovation category's checklist of 29 Lansdowne that has been assessed BREEAM refurbishment domestic buildings (2014).

	Credits	0/10
Inn01	**Innovation**	**0/10**

Source based on
Turley Heritage, (Sep.2014)

[1]Turley Heritage, (Sep.2014)

Non-Residential Green Heritage Case Studies

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4-2. Non-residential Green Heritage case Studies.

4-2-1. LEED certified Green Heritage Building.
The jean Vollum Natural Capital Center (Ecotrust's Building), Portland, Oregon, USA.

4-2-2 BREEAM certified Green Heritage Building.
The Edinburgh Center for Carbon Innovation (ECCI)-Scotland -UK

4-2. Non-Residential Heritage Buildings

This section from chapter 4 demonstrates two heritage non-residential buildings certified as green buildings, one under LEED rating system umbrella, and other under BREEAM rating system umbrella.

4-2-1. LEED certified Green Heritage Building.

The jean Vollum Natural Capital Center (Ecotrust's Building), Portland, Oregon, USA

The jean Vollum Natural Capital Center is located in the Pearl district that is located in the northwest of Portland, at the state of Oregon where is located in the Pacific Northwest region of the United States. The Pearl district is an old industrial area of warehouses buildings and has 34 acres of rail yards. Fig(4-24).

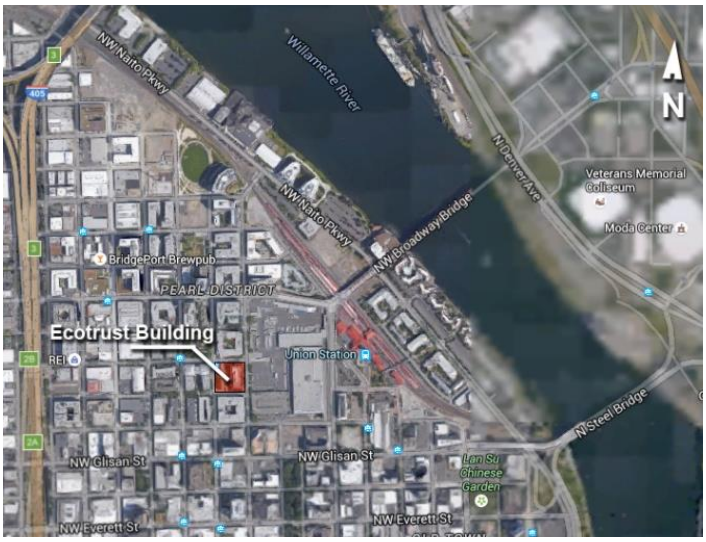

Fig (4-24). The location of Ecotrust building at the pearl district on the Portland google Map

Source: https://**maps.google**.com/, access (5-4-2016)

The building was built in 1895 as a Richardsonian Romanesque warehouse style by John McCraken of the McCraken company, a wholesale building supplies distributor. At that time, the city had an expansive development that aimed to improve the shipping capabilities of the city's port and growth the rails. The city became a center of transportation and distributions, for that the building was on site transportation consist of short rails which ran parallel to the building's loading docks. The buildings also had concrete ramps that allowed the horses to move through the building.[1]

[1] Bettina Von Hagen, Erin Kellogg, and Eugenie (2003)," Rebuilt Green: The Natural Capital Center and the Transformative power of Building",Ecotrust company publications, Portland, Oregon- USA, Pages 39-45.

Fig (4-25). Ecotrust building in beginning of the 20th century.
Source: http://www.ecotrust.org/media/ncc-historic-slideshow-011-1600x580.jpg access (5-4-2016)

In the early 1930s the warehouse was known as "the Central Trucks Terminal" and the building had 30 trucking companies. "Rapid Transfer and Storage Company" was the last owner which had occupied the warehouse until 1997, it used the building in storage activities as well as a studio for business and artists, the remaining of the area of the site was leased as a commercial parking.[1]

Fig (4-26). Ecotrust building in 1978.
Source: https://vintageportland.files.wordpress.com/2010/05/mccracken-building-ecotrust-1978.jpg , access (5-4-2016)

In 1998, Ecotrust, a non- profit conservation organization that was established in 1991 for creating a conservation economy along North America's coastal rainforest purchased the warehouse and contracted with Holst Architecture to redesign the building,[2]

[1] Bettina Von Hagen, Erin Kellogg, and Eugenie (2003). page 42.
[2]The Landscape Architect's Guide to PORTLAND, OREGON, American Society of Landscape architects https://www.asla.org/portland/site.aspx?id=43593

Fig (4-27). Ecotrust building
Source: http://media.bizj.us/view/img/1582751/b-corps-sbo-ecotrust-building-2*1200xx1000-563-0-51.jpg access (5-4-2016).

The ecotrust select the building to be its new headquarter for the following criteria[1,2]:

1. The building has a central location in the city that has maximum access to public transportation, and support the vitality of the city center.
2. The values of the building:
   - **The heritage value** due its age, and for being one of five buildings in the city that were built before 1900. Renovating heritage building will provide a cultural tie to the area.
   - **The architectural value**, the architectural style of the building belongs to Richardsonian Romanesque warehouse style.
3. The building has a large enough site to house a variety of non-profit and for-profit organization and retailers.
4. Preserving the heritage building instead of demolition and construct new one will achieve cost saving by using existing infrastructure of an old building that helping building values increase that will achieve **economic returns**, reuse of materials achieve will **environmental returns**, and the historic and cultural connectivity of the building to the district will achieve **social returns**.

Before greening project, the structure of the building was in good condition, but the building had many negative impacts had been resulted from

[1] Bettina Von Hagen, Erin Kellogg, and Eugenie (2003), page 48.
[2] Buddenborg, Jennifer Lynn (August 2006)," **Changing Mindsets: Sustainable Design in Historic Preservation**" , Master Thesis, Faculty of the Graduate School, Cornell University.

years of neglect and partial vacancy, such as peeling paint, boarded windows and damage from the water leakage.[1]

4-2-1-1. Renovation and greening project for Ecotrust Building:

The team of project adopted the passive design approach with retaining the heritage integrity of the building to green Ecotrust as opposed to a high-tech approach that could harm the heritage values of it. This concept also reduced costs, but in some elements, such as the heritage wood windows restoration is cost more than replacing them with new energy efficient windows, in spite of that, the project achieved saving in total cost by using other low-cost simple energy saving techniques such as the installation of an atrium to provide natural light.[2]

The team of the project didn't install wall insulation on the exposed interior wall bricks which would increase the energy efficiency of the building for not harming or bad affecting the heritage value of the interior of Ecotrust building.

The main goal of the project:

1. Using practical, low-tec, no tech solutions for green renovation for Ecotrust building.

The other goals that came later in the project process:

1. Earn the LEED certification (has earned gold certification). This decision was made after the greening design was already in place.

2. Apply for National register of historic places (NR) to list the building and receive the 20 percent rehabilitation tax credit.

The project renovated 79,000 square foot warehouse for a mix uses (office, retail and restaurant spaces). The project added 10,000 square foot as roof top and two external steel staircase that was constructed on the west side of the building to meet seismic codes. The project created addition space that using it as a parking lot and area for storm water management and a weekend market from the remaining half of 40,000 square foot from the demolition of an adjacent

[1] Buddenborg, Jennifer Lynn (August 2006).
[2] Bettina Von Hagen, Erin Kellogg, and Eugenie (2003), page 45.

building the had structural damage.[1] The project team decided to remain a part of heritage wall from the adjacent building that was located in the currently parking lot. Fig (4-28).

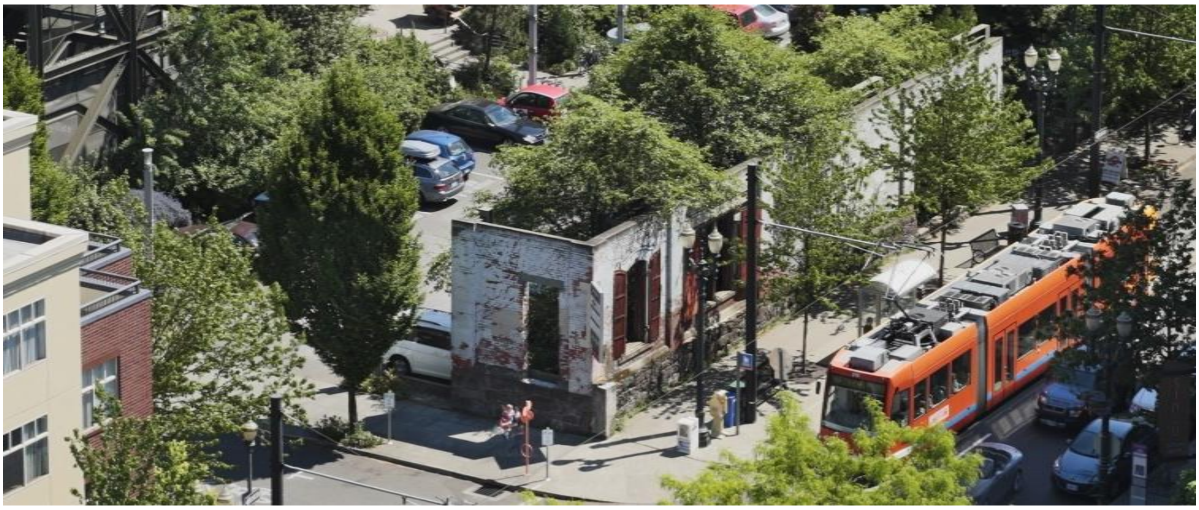

Fig (4-28). A remaining heritage wall of the adjacent building of Ecotrust building.
Source http://www.ecotrust.org/media/RS977_DTP_08_0509131-1600x580.jpg , access (5-4-2016)

The financial resources of the project:[2]

The renovation and greening project of Ecotrust amounted $12.8 million ($10.9 million for hard costs and $1.9 million for soft costs). The financing from grants, contributions, loans and tax incentives provided a large proportion of the total cost of the project:

1. the bank of America financed the project with $3.7 million through a construction loan,
2. $200,000 loan from the Portland development commission,
3. $2 million loan from the Ford Foundation,
4. $75,000 Eco-roof grant from the city of Portland Bureau of Environmental services,
5. $20,000 LEED grant from the Office of sustainable development.
6. The 10% Federal historic tax credit from National Register of Historic Places.

[1] Buddenborg, Jennifer Lynn (August 2006). Page 107.
[2]Ibid.

7. The LEED state tax credit through Oregon's office of Energy BETC program.

The Ecotrust project was began in February 2000, and the project was completed on 6 Sept. 2001 . the project earned **41 LEED points** under **the NC 2.0 version of LEED** that gained the building **the Gold certification**, at that time, it was the first heritage building in USA that received this level on LEED rating system.[1]

The rooftop addition, and external steel staircase that added to meet seismic codes were prevented the Ecotrust building from being listed in the National Register of Historic Places (NR), and earned only the 10% of federal tax credit that available for non-historic, non-commercial building that not listed on National register. The denial was occurred in spite of both of these addition were approved by the Oregon SHPO and Advisory Council prior to being sent to the National Park Service (that responsible for listing the heritage buildings in the USA) for review. The reasons of non-listing the building backed to that the two additions are clearly visible from the street and the steel staircase design is incompatible with the heritage style of the whole building. [2]

Fig (4-29). Steel tower seimic code upgrades
Source: Buddenborg, Jennifer Lynn (August 2006)

[1] I Buddenborg, Jennifer Lynn (August 2006). Page 109.
[2] Ibid, page 110.

Table (4-15). The earning points of categories of Ecotruct building

Point Category	Point Earned	Possible Points
Sustainable Sites	8	14
Water Efficiency	4	5
Energy & Atmosphere	5	17
Materials & Resources	10	13
Indoor Environmental Quality	9	15
Innovation & Design Process	5	5
Total	41	69

Source: Buddenborg, Jennifer Lynn (August 2006)

The green concept of the project aimed to:

- Incorporate a passive design of the greening project for the heritage building.
- Reuse the demolition waste of the adjacent building into the Ecotrust project.
- Reuse Materials on-site and off-site.
- Preserve the heritage character of Ecotrust in the processes of greening the building and meeting the LEED standard without harming the heritage value of the building or loss it, that exclude the addition of the third floor , and west side steel towers that were added for meet the seismic codes to make stair access among the three floors, these additions have a negative impact on the heritage value of the building according to the National Park Service as mentioned above.

Fig (4-30). Ecotrust's parking area for cars and bicycle racks

Source: http://plangreen.net/wp-content/uploads/2015/07/Ecotrust-Parking-Lot.jpg

4-2-1-1-1. Sustainable Sites:

Ecotrust building achieved 8 points from 14 possible points in the Sustainable sites category By[1]:

- The accessibility to public transit. The public buses of the city have stopped at Ecotruct building.
- Providing two hybrid cars parked on-site.
- Providing Two electric vehicle charging stations.
- Creating bicycle parking, a bicycle sharing program for tenants, a locker room and shower facilities.
- The management of storm water aims to divert 95% of storm water to the infiltrations areas at the parking lot which its design able to direct the storm water by a gradual landscape slope to four swales, and the materials of the parking lots are from permeable asphalt ,and small square concrete pavers that allow water to seep through the cracks between pavers and move naturally to groundwater.
- Creating an eco-roof on the exposed second story roof. The surface consists of two inches of soil under the native vegetation. The storm water of the roof by the roof slops goes to the ground level landscaping by the gutter.
- Providing bio-wales at the landscape areas of the ground level that acts as bio-filters that remove pollutants from the storm water before releasing it to watershed.

Table (4-16). The Sustainable site category's checklist of Ecotrust building that has been assessed under LEED NC v.2.

	Credits	8/14
SS.Pq1	**Erosion & sedimentation control**	**Mandatory**
SSC1	**Site Selection**	**1/1**
SSC2	**Urban Redevelopment**	**1/1**
SSC3	Brownfield redevelopment	0/1
SSC4.1	**Alternative transportation: Public Transportation Access**	**1/1**
SSC4.2	**Alternative transportation: Alternative Fuel**	**1/1**
SSC.4.3	**Alternative transportation: Bicycle Storage & changing rooms**	**1/1**

Source **Buddenborg, Jennifer Lynn (August 2006)**

[1] Bettina Von Hagen, Erin Kellogg, and Eugenie (2003), pages 78,79.

Table (4-16) continued. The Sustainable site category's checklist of Ecotrust building that has been assessed under LEED NC v.2.

SSC4.4	Alternative transportation: Parking Capacity.	0/1
SSC5.1	Reduced Site Disturbance: Protect or restore open space	0/1
SSC5.2	Reduced Site Disturbance: Development Footprint	0/1
SSC.6.1	**Stormwater Management: Rate and Density**	**1/1**
SSC6.1	**Stormwater Management: Treatment**	**1/1**
SSC7.1	**Landscape & exterior Design to Reduce Heat islands: Non-Roof**	**1/1**
SSC7.2	Landscape & exterior Design to Reduce Heat islands: Roof	0/1
SSC8	Light Pollution Reduction	0/1

Source **Buddenborg, Jennifer Lynn (August 2006)**

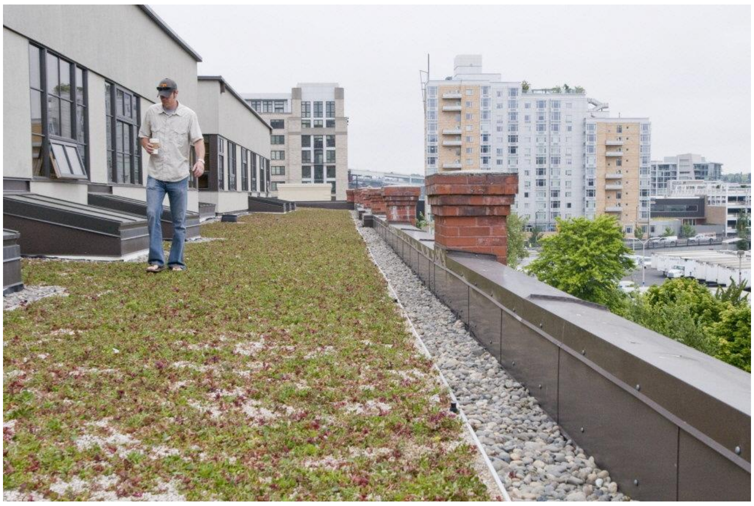

Fig (4-31). The eco-roof of Ecotrust building.

Source: http://media.oregonlive.com/pdxgreen/photo/ecoroofjpg-fba24b5107294002.jpg , access (5-4-2016)

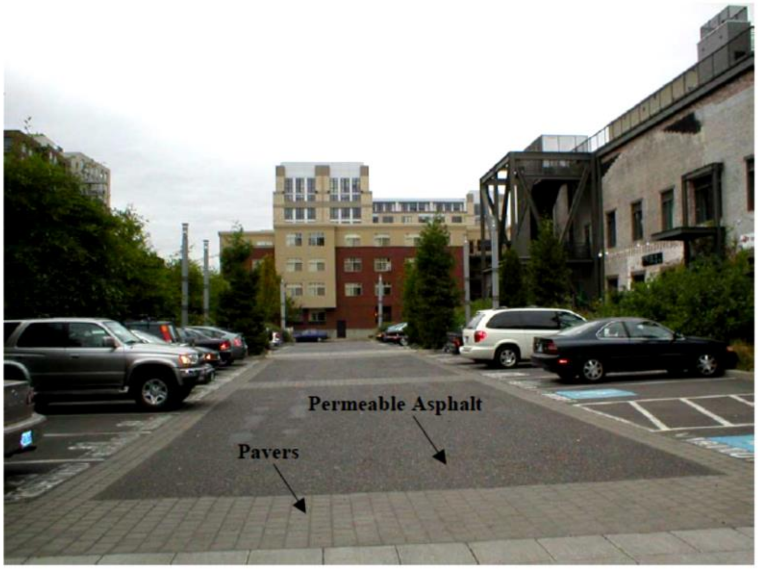

Fig (4-32). Ecotrust parking Lot

Source: Buddenborg, Jennifer Lynn (August 2006)

4-2-1-1-2. Water Efficiency:

Ecotrust Building achieved 4 points from 5 possible points in the water efficiency category By[1]:

- Reducing water use for irrigation of landscape by using native plants and utilize from the storm water of the roof and the ground level for landscape irrigation.
- Acting improvements to plumbing fixtures Kitchen and bathrooms to indoor water use reduction.

Table (4-17). The water efficiency category's checklist of Ecotrust Building that has been assessed under LEED NC v.2

	Credits	4/5
WAC1.1	**Water Efficient Landscaping: reduce by 50%**	**1/1**
WAC1.2	**Water Efficient Landscaping.**	**1/1**
WAC2	**Innovation Wastewater Technologies**	**0/1**
WAC3.1	**Water Use Reduction, 20%**	**1/1**
WAC3.2	**Water Use Reduction, 30%**	**1/1**

Source: Buddenborg, Jennifer Lynn (August 2006)

4-2-1-1-3. Energy and Atmosphere:

Ecotrust Building achieved 5 points from 17 possible points in the Energy and Atmosphere category By[2,3]:

- Using a computer modeling system to analyze the heating and cooling mechanisms and comparing their efficiency with their impact on the heritage value of the building.
- Installing a conventional HVAC system controlled by a computerized energy system which can bring 100 % of outside air for the cooling system.
- Weatherizing the windows with rubber-zinc interlock weather-strip used in conjunction to provide a tight seal to increase energy efficiency.
- Installing natural gas- fried warm-up boilers provide the heat cycle.
- Using T-5 high output bulbs.

[1]Buddenborg, Jennifer Lynn (August 2006).
[2] Buddenborg, Jennifer Lynn (August 2006).pages 115,116.
[3] Bettina Von Hagen, Erin Kellogg, and Eugenie (2003), pages 59-74.

- Using occupancy sensors that control light, heating, and cooling usage in hallways, W.Cs, and meeting rooms.
- Providing a voluntary initiative Greenhouse Gas reduction for tenants who allow them to purchase renewable energy and offsetting greenhouse gas emissions.
- Orienting all workspaces in the building to capture the natural light from windows.
- Installing a large skylight above the building's atrium and 24 smaller skylights on the roof of the second floor to provide daylighting.
- Sharing the kitchen appliances among tenants.
- Providing the Hot Lips Pizza shop that is located in the building with a unique heat exchanger oven that consumes half energy and transfers the waste of heat through a series of pipes that lead warm into the basement hot water heater that using in the restaurant for washing and cleaning.

Table (4-18). The Energy category's checklist of Ecotrust Building that has been assessed under LEED NC v.2

	Credits	5/17
EAPreq.1	**Fundamental building systems commissioning**	**Mandatory**
EAPreq.2	**Minimum Energy Performance**	**Mandatory**
EAPreq.3	**CFC Reduction in HVAC & R equipment.**	**Mandatory**
EAc1.1	**Optimize energy Performance 20% new : 10% Existing**	**2/2**
EAc1.2	**Optimize energy Performance 30% new : 20% Existing**	**2/2**
EAc1.3	Optimize energy Performance 40% new : 30% Existing	0/2
EAc1.4	Optimize energy Performance 50% new : 40% Existing	0/2
EAc1.5	Optimize energy Performance 60% new : 50% Existing	0/2
EAc2.1	Renewable Energy 5%	0/1
EAc2.2	Renewable Energy 10%	0/1
EAc2.3	Renewable Energy 20%	0/1
EAc3.0	Additional Commissioning	0/1
EAc4	Ozone Depletion	0/1
EAc5	**Measurement & Verification**	**1/1**
EAc6	Green Power	0/1

Source: Buddenborg, Jennifer Lynn (August 200

4-2-1-1-4. Materials and Resources:

Ecotrust Building achieved 10 points from 13 possible points in the Material and resource category, the concept of the project in this category was : given priority to use and purchased the materials that were salvaged from the site and adjacent demolition site, using materials that has high recycled content, and the materials that were regional, certified as sustainable, that was achieved by[1,2]::

- Reducing the use of new materials by leaving pipes, wires, and mechanical equipment exposed that also allowing the heritage interior to remain intact.
- Salvaging the materials from the demolition and debris of the adjacent onsite building to be used in the Ecotrust restoration. Most of the third floor addition was constructed from those salvage materials. Recycling the salvaged wood, wire and old furniture to make decorations, benches, and chairs by furniture makers. The salvaged wood was used also in the restoration and repairs many of windows sashes.
- Purchasing offsite salvaged materials such as old doors were used as partitions, desks were used in offices, granite curbs of sidewalks of NW Johnson Street were reused as engraved benches.
- Reusing the building offers the most efficient means to conserving materials and resources, such as the original windows that were restore with their original 1895 glass panes.
- Refinishing the high valued wooden floor on the first floor with environmentally safe floor finish.
- installing plywood flooring for the second floor was overlain with interlocking rubber tiles made from post-consumer recycles rubber tires that don't need to adhesive to hold together.
- The interior paint comes from a latex paint recycled program to avoid releasing VOCs.
- Using FSC certified flooring on the third floor.

[1]Buddenborg, Jennifer Lynn (August 2006).pages 116-119.
[2] Bettina Von Hagen, Erin Kellogg, and Eugenie (2003), pages 89-102.

Fig (4-33). The interior spaces of Ecotrust building.
Source http://www.soljagadesigngroup.com/images/ECOTRUS2.jpg , access (5-4-2016)

Table (4-19). The Materials & Resources category's checklist of Ecotrust Building that has been assessed under LEED NC v.2

	Credits	10/13
MRpreq.1	**Storage & Collection of Recyclables**	**Mandatory**
MRc1.1	**Building Reuse, Maintain 75% of Existing shell.**	**1/1**
MRc1.2	Building Reuse, Maintain 100% of Existing shell.	0/1
MRc1.3	Building Reuse, Maintain 100% of Existing shell & 50% non-shell	0/1
MRc2.1	**Construction Waste Management. 50%**	**1/1**
MRc 2.2	**Construction Waste Management. 75%**	**1/1**
MRc 3.1	**Resource Reuse, Specify 5%**	**1/1**
MRc 3.2	**Resource Reuse, Specify 5%**	**1/1**
MRc 4.1	**Recycled Content, Specify 25%**	**1/1**
MRc 4.2	**Recycled Content, Specify 50%**	**1/1**
MRc 5.1	**Local Regional Materials, 20% Manufactured locally.**	**1/1**
MRc 5.2	**Local Regional Materials, of 20% above, 50% Harvest Locally.**	**1/1**
MRc 6	Rapidly Renewable Materials	0/1
MRc 7	**Certified Wood**	**1/1**

Source: Buddenborg, Jennifer Lynn (August 2006)

4-2-1-1-5. Indoor environmental quality :

Ecotrust Building achieved 9 points from 15 possible points in the Indoor Environmental Quality category By[1,2]:

- Providing ample daylight, views and natural ventilation by the restored windows and new skylights.
- Using low-VOC[3] emitting materials in flooring, furnishing, paints and walls.
- All installation processes of marbles in the building are natural, non-toxic components.
- Using recycled paint with low-VOC.
- Monitoring CO2 levels and controlling the demand of ventilation for providing a healthy environment.

Table (4-20). The Indoor Environmental Quality category's checklist of Ecotrust Building that has been assessed under LEED NC v.2.

	Credits	9/15
EQpreq.1	**Minimum IAQ Performance**	**Mandatory**
EQpreq.2	**Environmental Tobacco Smoke Control**	**Mandatory**
EQc1	**Carbon Dioxide (CO2) Monitoring**	**1/1**
EQc2	Increase Ventilation Effectiveness.	0/1
EQc3.1	**Construction IAQ Management Plan, during Construction**	**1/1**
EQc 3.2	**Construction IAQ Management Plan, Before Occupancy**	**1/1**
EQc 4.1	**Low Emitting Materials, Adhesives & sealants.**	**1/1**
EQc 4.2	**Low Emitting Materials, Paints**	**1/1**
EQc 4.3	**Low Emitting Materials, Carpet.**	**1/1**
EQc 4.4	**Low Emitting Materials, Composite Wood.**	**1/1**
EQc 5	**Indoor Chemical & Pollutant Source Control**	**1/1**
EQc 6.1	Controllability of systems, Perimeter	0/1
EQc 6.2	Controllability of systems, Non-Perimeter	0/1
EQc 7.1	Thermal comfort, comply with ASHRAE S5-1992	0/1
EQc 7.2	Thermal comfort, Permanent Monitoring Systems	0/1
EQc 8.1	**Daylight & Views, Daylight 75% of spaces**	**1/1**
EQc 8.2	**Daylight & View, view for 50% of spaces**	**1/1**

Source: Buddenborg, Jennifer Lynn (August 2006)

[1] Buddenborg, Jennifer Lynn (August 2006), pages 115,116.
[2] Bettina Von Hagen, Erin Kellogg, and Eugenie (2003), pages 59-74.
[3] **VOC** : volatile organic compound emissions.

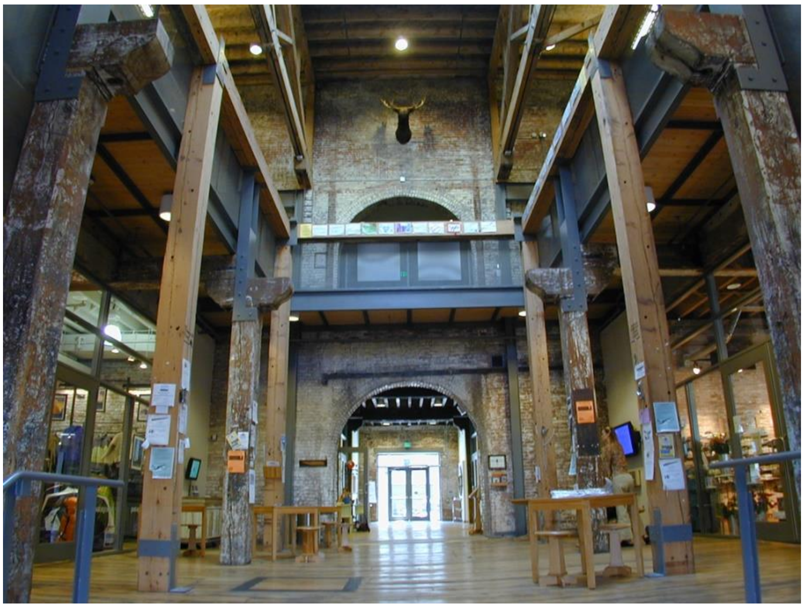

Fig (4-34). The main hall of Ecotrust building.
Source https://c2.staticflickr.com/4/3084/2794213316_fa75f79625_b.jpg , access (5-4-2016)

4-2-1-1-6. Innovation and Design Process:

Ecotrust Building achieved 5 points from 5 possible points in the innovation and design process category By[1,2]:

- Earning one point for gained greater percentage than the required standard of diverted construction waste.
- Earning one point for gained greater percentage than the required standard of recycled content.
- Earning one point for reuse heritage building showing the benefits for preserving the cultural value of the building not only the embodied energy of it. This point not be gained for all historic building, it depends on a case-by –case basis, another heritage building "S.T. Dana Building of the University of Michigan" applied for gained the same credit but it was denied by LEED.
- Earning one point for the educational program for tenants and visitors, the building is open to visitors to explore with a field guide.

[1]Buddenborg, Jennifer Lynn (August 2006), pages 115,116.
[2] Bettina Von Hagen, Erin Kellogg, and Eugenie (2003), pages 59-74.

- Earning one point for having LEED Accredited professional member in the project team

Table (4-21). The Innovation & Design process category's checklist of Ecotrust Building that has been assessed under LEED NC v.2

	Credits	5/5
IOc1.1	Innovation in Design: Construction waste Management	1/1
IOc1.2	Innovation in Design: Recycled Content 100%	1/1
IOc1.3	Innovation in Design: Reuse	1/1
IOc1.4	Innovation in Design: Green Building Demonstration Project	1/1
IOc2	LEED Accredited Professional	1/1

Source: Buddenborg, Jennifer Lynn (August 2006)

Fig (4-35). A social activity was held at parking lot of Ecotrust building

Source: http://assets.inhabitat.com/wp-content/blogs.dir/1/files/2013/03/Holst-Ecotrust-5.jpg , access (5-4-2016)

Fig (4-36). Renting the roof of Ecotrust building as a place for holding events and parties

Source: http://www.ecotrust.org/media/6852191400_7d2be6dbf1_o-1600x580.jpg , access (5-4-2016)

4-2-2. BREEAM certified Green Heritage Building.

The Edinburgh Center for Carbon Innovation (ECCI)- Scotland -UK

The Edinburgh Center for Carbon Innovation (ECCI) is located in the city of Edinburgh, Scotland, UK. It is affiliated with the University of Edinburgh that is considered as one of the Scotland's old universities. Many of the buildings are located in the historic center of Edinburgh are belonging to the University. One of those is the ECCI building that is located at 15 South College St, University of Edinburgh. The ECCI aims to create a low carbon economy through the knowledge, innovation and skills. [1]

Fig (4-37). The side façade of ECCI building.
Source: *http://www.skyscrapercity.com/showthread.php?t=1658818 (accessed May 2016)*

The ECCI is a Grade II Listed Building; It has become the first heritage refurbished building in the UK that awarded a BREEAM rating of "Outstanding" with a score **87.5%**.[2]

According to English Heritage, the grade II listed buildings have tight regulations. The external appearance of the building cannot be changed, such as make modifications on the heritage facades or install solar panels on their sloped roofs, but the improved insulation, make internal redevelopments, rainwater harvesting can be introduced with minimum impact to the original external appearance of the heritage building. These works can be carried out after obtaining permissions from the local planning authority.[3]

[1] The Edinburgh Centre for Carbon Innovation brief document, http://www.retrofitscotland.org/media/22645/ecci.pdf

[2] ECCI Building Achieves BREEAM Outstanding Rating , https://www.graham.co.uk/ecci-building-achieves-breeam-outstanding-rating

[3] "**Old Meets New the Sustainable Listed Building**", Breathing buildings' website, http://www.breathingbuildings.com/news/natural-ventilation-news/old-meets-new-the-sustainable-listed--building , (accessed 20 May 2016).

4-2-2-1. The History of the ECCI Building.

The site of the ECCI building has a historical value and has gone through many interactions. In 1230, there was a Monastery on the site; the Monastery was destroyed by the mob. (Recently, the murdered body of the Queen Mary's husband was discovered with the remains of the Monastery building). In 1578, a high school was built on the monastery site.The old building of the school was played its role as an educational building until 1774 when the demolation decision was taken to the building for the incapability of the school to accommodate the increased number of the students, to replace with a larger school building with is currently known as "Old High school."[1]

In 1832, the usage of the building was transformed into a surgical hospital that the University of Edinburgh held its anatomy classes. The Hospital then formed part of the Edinburgh Royal Infirmary. By the latter decades of the 19th Century, the old hospital was reaching the end of its useful life. During the 20th century, the University used the Old High School building to house some different educational uses and activities, including Engineering and Science, Geography and the Dental School.[2]

6


Fig (4-38). The Front façade of ECCI building.
Source: http://www.skyscrapercity.com/showthread.php?t=1658818 (accessed May 2016)

[1] http://edinburghcentre.org/History-of-the-site.html
[2] The Edinburgh Centre for Carbon Innovation brief document, http://www.retrofitscotland.org/media/22645/ecci.pdf

The administrative offices and departments of the Dental faculty occupied the building until their closure in 1994. The Department of Archaeology used the building from 1995 to 2011 when demolition, restoration and the greening project began on what will become the Edinburgh Centre for Carbon Innovation.[1]

Fig (4-39). The Ground Floor of ECCI building.
Source: : A guide to access and facilities ", Edinburgh Centre for Carbon Innovation

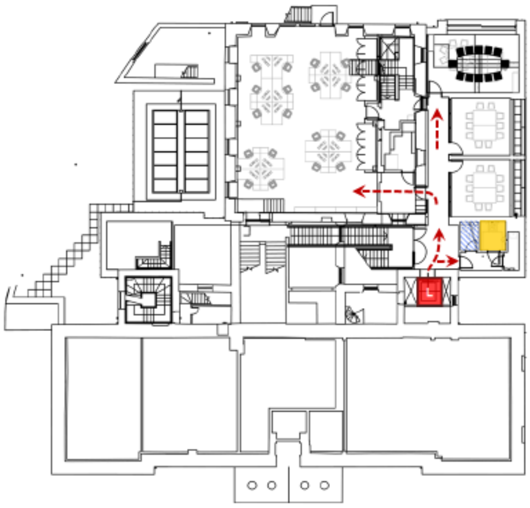

Fig (4-40). The first Floor of ECCI building.
Source: : A guide to access and facilities ", Edinburgh Centre for Carbon Innovation

Fig (4-41). The vertical section of the ECCI building through north- south direction.
Source: http://www.bdonline.co.uk/Pictures/web/n/m/q/diagram_635.jpg (accessed May 2016)

[1] The official site of the Edinburgh center, http://edinburghcentre.org/What-makes-it-green.html , (accessed May 2016).

4-2-2-2. The Greening project of ECCI:

The ECCI project of greening the old high school aimed to achieve a low energy demand for the listed Building, and achieves the BREEAM Outstanding certification to be the first listed building in the UK awarded the highest BREEAM certification (outstanding rating). - The ECCI involved a major alteration and extension of old High School building taken into account preserving the heritage value of the building especially the exterior facades, but the inside spaces of the old building was demolished and reconstructed new design (after obtaining approval from conservation officer) using recyclable and renewable materials, the new adaptive reuse design achieves the new needs of the ECCI center.[1]

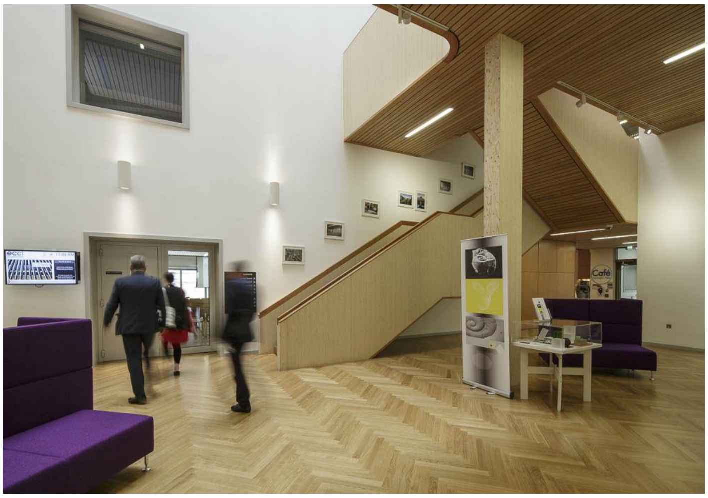

Fig (4-42). One of the internal spaces of the ECCI building. **Source**: *http://wildfirecomms-images.co.uk/img/macneill_14070-89-w1302-h1256-1462533341.jpg (accessed May 2016)*

The project began in Feb 2012; and it was completed in June 2013.

The project aimed to[2,3]:

- Balance between the green practices, and the conservation restrictions and regulations,
- Carefully consideration to work with the historic fabric of Grade II listed building,
- Adopt the passive design methods such as solar gain, external microclimate, solar shading, daylighting and thermal comfort.
- Incorporate the requirements that needed for the new activities that will be accommodated in the building, such as lecture and teaching spaces, breakout spaces, café, and multi-uses areas which can be used for conferences and exhibitions, the project added an innovation center for

[1] The Edinburgh Centre for Carbon Innovation brief document.
[2] Ibid
[3] The official site of the Edinburgh center, http://edinburghcentre.org/What-makes-it-green.html , (accessed May 2016).

small business and created a masters hub quiet study. All sharing spaces have connected by a central atrium.[1]

4-2-2-2-1. Management Category[2]:

ECCI has achieved high scoring in Management category with 95%[3] of the total credits' points achieving the security, commissioning, and reduction the restoration site impacts.

ECCI through its management strategy integrated the citizens and users discussions and comments fed back into design, it allows for the children and families visits after the project completion.

4-2-2-2-2. Health and wellbeing category[4]:

- The project set a ventilation strategy depended on passive natural ventilation and mix- mode systems (mechanically and naturally) that connected to an air source heat exchanger for high occupancy rooms.
- The project using wood finishes that have low VOC at the internal floors, ceilings and, many wooden walls, and using paint finishes are water-based and have low VOC.
- Maximize natural light and reduce areas of summer overheating.

4-2-2-2-3. Energy category:

The project set a strategy for reducing the energy consumption of the heritage building by 30% through the followings practices[5]:

- Install photovoltaic panels have area 30m2 on the roof creating a 2% CO2 reduction and meeting 1% of energy demand.
- Using energy efficient lighting using infra-red sensor and dimmable controls.

[1] Oakman, Hannah (09 May 2016) " Outstanding BREEAM result for Edinburgh", an article, http://edquarter.com/Article/breeam-result-for-edinburgh (accesses 21 May 2016).
[2] The Edinburgh Centre for Carbon Innovation brief document,
[3] Oakman, Hannah (09 May 2016)
[4] Ibid.
[5] The Edinburgh Centre for Carbon Innovation brief document.

- Retaining, and repaired the existing sash windows with high additional proofing and insulation of slim line glazed units.
- Connecting with the nearby combined heat and power that is allowing a 38% decreasing in CO_2 emissions and meeting 56% energy demand.
- Install energy smart monitors that allowing in-depth analysis and reporting.

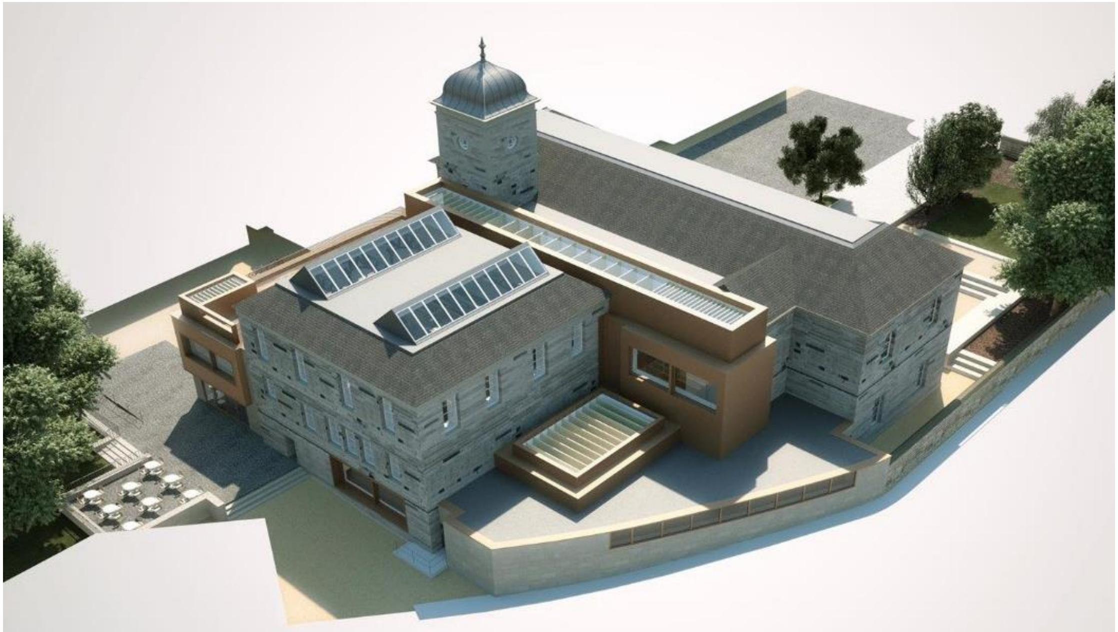

Fig (4-43). The 3d model of ECCI building
Source: http://www.skyscrapercity.com/showthread.php?t=1658818 (accessed May 2016)

4-2-2-2-4. Land use and transport categories:

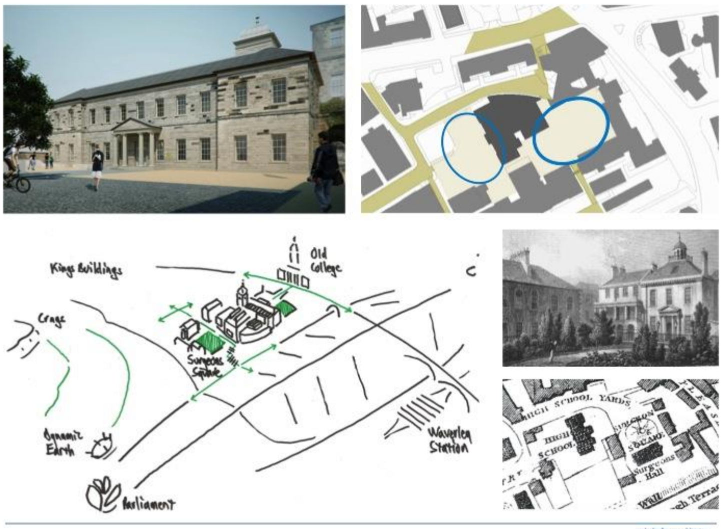

Fig (4-44). ECCI linking to the city
Source: *http://edinburghcentre.org/What-makes-it-green.html (accessed May 2016)*

The heritage building is located in the old city center of Edinburgh city. The reuse of the existing building achieves the walkability to the amenities, famous city's buildings and squares, that provides connectivity to the public transportation. The project also open up the routes that connect to the city center that improving the connectivity of the city that is a key aspect of sustainability that the project aims to achieve it.[1]

- The university provides a shuttle bus for staff and students to the central area of the city.
- ECCI provides two electric vehicles charging plugs located to the front of ECCI building, there are parking areas for wheelchair users, and these are located on a smooth surface which is suitable.
- ECCI has a number of the bicycles racks and two secured bicycle storages.[2]

Fig (4-45). The bicycles racks in the front of ECCI bulding
Source: http://edquarter.com/Article/breeam-result-for-edinburgh (accessed May 2016)

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Fig (4-46). The bicycles racks in the front of ECCI bulding
Source: A guide to access and facilities ", Edinburgh Centre for Carbon Innovation.

Fig (4-47). The two electric vehicles charging plugs of ECCI.
Source: http://edquarter.com/Article/breeam-result-for-edinburgh (accessed May 2016)

[1] The official site of the Edinburgh center, http://edinburghcentre.org/What-makes-it-green.html , (accessed May 2016).
[2] Ibid.

4-2-2-2-5. Water category:

Fig (4-48). Ground Floor accessible toilet
Source: *" A guide to access and facilities ", Edinburgh Centre for Carbon Innovation , Old High School Yards, http://www.eif.co.uk/sites/default/files/images/ecci_-_access_guide.pdf*

ECCI aims to reduce the total water consumption by[1]:

- Using high efficient water fixtures, such as " dual flush and effective flush toilets.
- Using lavatory fixtures that self-closing and consuming low flow rate 6 liters per minute that have controlled by level handles.
- Install high efficient showers with a flow rate of less than 9 liters/ minutes.
- Install rainwater harvesting system that collects rainwater from the building's roof, and reusing for flushing WCs of the building for reducing the amount of potable water that the building consumes.
- Install urinals with sensors.
- Install a water meter and leakage detection system to reduce the water wastage.
- Using the recyclable water in the irrigation.

4-2-2-2-5. Materials category:

ECCI set a strategy for achieving points in the Materials category taken into account the heritage value of the Building's materials by[2]:

- Using an innovation solution by inserting a cross laminated wood frame structure within the atrium of existing building and new construction.

[1]Balson, Kiruthiga. Summerson, Gavin. And Thorne, Andrew (2014)"**Sustainable Refurbishment of heritage Buildings**", Briefing Paper, BREEAM, BRE Global Ltd.
[2] The Edinburgh Centre for Carbon Innovation brief document.

- The old steel structure of the existing building was removed and be reused in the new building design structure after were assessed by the structural engineer.
- Repairing conservatively the existing cullaloe and Balaxter stone.
- Using local sourced stone for external landscaping.
- Using the local and natural materials that extracted and manufactured locally. These materials have low energy and durable material that can be repairable and recyclable.

Fig (4-49). Bronze cladding of the new extension building.
Source: http://www.myplaceawards.org.uk/galleries/2014-gallery-of-entrants/edinburgh-centre-of-carbon-innovation-(ecci).aspx

- Use sustainable materials and achieve low energy demand.
- Using bronze cladding of the new extension of the heritage existing building from recycled copper (that made from 80% of the telephone wires and 20% tin). It is a durable and recyclable material.
- All wood using in the project is a Forest Stewardship Council (FSC) certified wood.

4-3. Comparison study between the four case studies

This section of chapter 4 aims to illustrate conclusions and recommendations that could be resulted from the comparison study between the four previous case studies that will be useful to set credits of the different environmental categories of the proposed "Green Heritage Building rating system".

The comparison study is carried out in the following items:

- The general characteristics of the four projects.
- Sustainable sites category.
- Energy efficiency category.
- Water efficiency category.
- Materials category.
- Indoor Environmental quality category.
- Management, waste and pollution categories.

4-3-1. The general characteristics of the four projects.

Table (4-22). The general characteristics of the four projects

	Residential Heritage Green Buildings		**Non-Residential Heritage Green Buildings**	
	LEED's certified project Governor's Mansion	**BREEAM's certified Project 29Lansdowne Road- London**	**LEED's certified project Ecotrust's Building**	**BREEAM's certified Project (ECCI)**
Location	New York – the USA	London - UK	Portland, Oregon, USA	Edinburgh city- Scotland -UK
The date of construction	1877	1840s	1895	1777
Listing Grade	Listed	Listed Grade II building	Non- Listed	Listed Grade II building
Green Certification Level	**Gold** Second ranked level	**Very Good** Second ranked level	**Gold** Second ranked level	**Outstanding** Highest level
Conservation type	Restoration and refurbishment	Restoration and refurbishment	Renovation and adaptive reuse for internal areas and restoration for external facades	Renovation and adaptive reuse for internal areas and restoration for external facades
Compatibility with heritage regulation	Under the supervision of executive chamber and the New York state office of General services	the supervision of local planning authority officers	-	the supervision of local planning authority officers
The Building usage	Residential house	Governor's house	Cultural	Educational center

Source: (Researcher).

4-3-2. Sustainable sites category:

Table (4-23). The comparison study among the four projects in sustainable sites category.

		Residential Heritage Green Buildings		**Non-Residential Heritage Green Buildings**	
		LEED's certified project Governor's Mansion	**BREEAM's certified Project 29 Lansdowne Road- London**	**LEED's certified project Ecotrust's Building**	**BREEAM's certified Project ECCI)(**
Sustainable sites, ecology and land use	Strategies and techniques	▪ Landscape's plan ▪ Alternative transportation and bicycle storage	▪ Bicycle storage at the modern garden.	▪ The accessibility of public transit. ▪ Two electric vehicle charging. ▪ Bicycle storage & shower room. ▪ Managing storm water. ▪ Eco-roof with native plants. ▪ Bio-wales. ▪ Permeable asphalt at parking areas.	▪ Alternate transportation. ▪ Shuttle bus. ▪ Two electric charging plugs. ▪ Bicycle racks and storages.
	Achievable credits	▪ Alternative transportation credits ▪ Restore open space ▪ Plan for greening the site.	▪ Bicycle storage. ▪ Protection the ecological features	▪ Site selection ▪ Urban development ▪ Alternative transportation. ▪ Bicycle storage. ▪ Storm water management. ▪ Heat island non-roof.	▪ Public transport network connectivity ▪ Pedestrian and cyclist facilities. ▪ Access to amenities. ▪ Protection the ecological features

Source: (Researcher).

Table (4-23) continued. The comparison study among the four projects in sustainable sites category.

		Residential Heritage Green Buildings		Non-Residential Heritage Green Buildings	
		LEED's certified project Governor's Mansion	**BREEAM's certified Project 29 Lansdowne Road-London**	**LEED's certified project Ecotrust's Building**	BREEAM's certified Project ECCI
Sustainable sites, ecology and land use	Non- achievable credits	▪ Heat island ▪ Light pollution ▪ High density area.	▪ Protection ecological site.	▪ Brownfield redevelopment. ▪ Parking capacity. ▪ Development foot print. ▪ Heat island roof. ▪ Light pollution reduction.	-------

Recommendations form the previous analysis

Recommended credits	▪ Alternative transportation credits including urban density and proximity to amenities. ▪ Bicycle storages and showers. ▪ Protection the ecological features **are mutually achievable credits between the** four case studies, **the research highly recommends** to incorporate these credits in the **Sustainable sites category** green heritage building rating system.
Less important credits	▪ Parking capacity reduction, development foot print and brownfield redevelopment are not achievable credits in the four case studies but they don't have negative impacts on the values of the heritage buildings if they will be achieved.
other credits recommended from the researcher's view	▪ **Heat island effect – Non Roof** this credit has a great effect on reducing the energy consumption of buildings. ▪ **Heat Island Effect – Roof**, this credit has an urban heat island impact due to reflections of heat from the roofs of the surrounding buildings.

Source: (Researcher).

Table (4-23) continued. The comparison study among the four projects in sustainable sites category.

Recommended techniques	▪ Providing accessibility to public transit, via shuttle bus. ▪ Providing electric plugs for electric vehicles. ▪ Providing cycle racks and secure bicycle's storages and shower facilities. ▪ Accessibility to amenities. ▪ Set a landscape plan to protect the ecological features.

Source: (Researcher).

4-3-3. Energy Efficiency Category:

Table (4-24). The comparison study among the four projects in sustainable sites category.

		Residential Heritage Green Buildings		Non-Residential Heritage Green Buildings	
		LEED's certified project Governor's Mansion	**BREEAM's certified Project 29Lansdowne Road- London**	**LEED's certified project Ecotrust's Building**	**BREEAM's certified Project (ECCI)**
Energy Efficiency	Strategies and techniques	▪ Increase insulation. ▪ Install Photovoltaic, but the total reduction of total energy could not meet the minimum reduction required from the credit. ▪ High efficient appliances.	▪ Install insulation for external walls. ▪ Upgrading modern doors, windows, and skylight. ▪ Using LEDs. ▪ Energy display device.	▪ Using a computer modelling to calculate energy consumption. ▪ Weatherizing the windows. ▪ Using T5 bulbs. ▪ Occupancy sensors. ▪ Orienting all workspaces to capture more daylight. ▪ Install skylights.	▪ Install photovoltaic panels on the flat roof. ▪ Install high insulation for heritage windows. ▪ Smart monitors reporting

Source: (Researcher).

Table (4-24) continued. The comparison study among the four projects in Energy efficiency category.

		Residential Heritage Green Buildings		**Non-Residential Heritage Green Buildings**	
		LEED's certified project Governor's Mansion	**BREEAM's certified Project 29Lansdowne Road- London**	**LEED's certified project Ecotrust's Building**	**BREEAM's certified Project (ECCI)**
Energy Efficiency	Achievable credits	▪ Optimize energy performance ▪ Metering and monitoring ▪ Building maintenance	▪ Improvement energy efficiency. ▪ Primary energy demand. ▪ Energy labelled white goods. ▪ Drying spaces. ▪ Lighting. ▪ Home office. ▪ Display energy devices.	▪ Fundament commissioning ▪ CFC reduction. ▪ Minimum and Optimize energy performance. ▪ Measurement and verification.	▪ Low or zero carbon technologies ▪ Energy Sub Metering. ▪ Energy efficient building systems.
	Non- achievable credits	▪ On-site and off-site renewable energy ▪ Enhancing metering. ▪ Cost impacts	▪ Renewable technologies	▪ Renewable energy. ▪ Additional commissioning. ▪ Reduce more Ozone depletion. ▪ Green power.	-------------

Conclusions from previous analysis

- The option for using the photovoltaic panels on the roofs was ruled out in the three projects that have a sloped roof, it will harm the heritage features of the heritage buildings, that will affect the quality and character of existing public views. Mansion governor project installed Photovoltaic panels on the swimming pool canopy and ECCI project install Photovoltaic panels on the flat roofs, they are hidden parts that don't appear to the public from the street level and haven't negative impacts on the heritage value of the heritage buildings.

Source: (Researcher).

Table (4-24) continued. The comparison study among the four projects in Energy efficiency category.

- LEED O+M reduce using chlorofluorocarbons (CFCs) and others ozone depleting substances that have been used in refrigerants through two credits, one of them is mandatory (the project will be denied if doesn't achieve its requirements) and the other has 1 point. BREEAM two schemes don't have any credit for this context.
- The preservation of heritage glasses and doors has a priority than achieving the requirements of energy efficiency performance as installing more efficient doors or double glazed windows.
- The old modifications and extensions that had been carried out without respect the original and heritage features of the heritage building may be an approach to improve the energy efficiency of the building such as use insulation at the non-heritage external walls in the heritage buildings.

Recommendations from previous analysis

Recommended credits	▪ Enhanced energy performance and optimize energy performance credits. ▪ Energy Metering. ▪ Energy efficient appliances and systems are mutually achievable credits in the four case studies; **the research highly recommends** to incorporate these credits in the **Energy category** of green heritage building rating system. ▪ Using photovoltaic panels on the flat roof of heritage buildings or the hidden parts that don't effect of the public view of the heritage buildings.
Less important credits	▪ Additional commissioning ▪ Enhancing metering. ▪ Green powers.
Recommended techniques	▪ Using a computer modelling to calculate energy consumption. ▪ Using high efficient appliance and systems. ▪ Using LEDs in Lighting. ▪ Using renewable technologies that don't have a negative impact on the heritage value of the buildings. ▪ Using energy metering. ▪ Insulate and increase the efficiency of the heritage windows and doors without harming or losing their values. ▪ Using occupancy sensors. ▪ Capturing more daylight if that is possible.

Source: (Researcher).

4-3-4. Water category:

Table (4-25). The comparison study among the four projects in Water efficiency category.

		Residential Heritage Green Buildings		**Non-Residential Heritage Green Buildings**	
		LEED's certified project Governor's Mansion	**BREEAM's certified Project 29Lansdowne Road- London**	**LEED's certified project Ecotrust's Building**	**BREEAM's certified Project ECCI**
Water Efficiency	Strategies and techniques	▪ Using non-potable water for irrigation ▪ Use high efficient fixtures in WCs and Kitchen but these cannot meet the credits	▪ Using high efficient fixtures (eco-flush). ▪ Rainwater collection system for internal and external water use. ▪ Water meter	▪ Using native plants to reduce water for irrigation. ▪ Use high efficient sanitary fixtures	▪ Use high efficient water fixtures. ▪ Install rainwater harvesting system. ▪ Install urinals with sensors. ▪ Install water meter and leakage detection.
	Achievable credits	▪ Water efficient landscaping.	▪ Internal water use. ▪ External water use. ▪ Water meter.	▪ Water efficient landscaping. ▪ Water use reduction. .	▪ Water consumptio n ▪ Leak detection.
	Non- achievable credits	▪ Water indoor use reduction	-------------.	▪ Innovation wastewater technologies	-------------.

Conclusions from previous analysis

- The four projects depended mainly on using high efficient water fixtures to reduce the total water consumption.
- Using harvesting rainwater or recycled gray water to reduce using potable water in irrigation.
- Native plants in landscaping consume less water than other plants.

Source: (Researcher).

Table (4-25) continued. The comparison study among the four projects in Water efficiency category.

Recommendations from previous analysis	
Recommended credits	▪ Internal water use reductions, ▪ External water use reduction, ▪ Water meter, are the most mutual credits in the case studies, **the research highly recommends** to incorporate these credits in the **water category** of green heritage building rating system.
Recommended techniques	▪ Use high efficient water fixtures in WCs, baths, and kitchens. ▪ Recycle gray water and using it for irrigation and for toilet flushes if that is possible. ▪ Use native plants in landscaping to reduce the water consumption in irrigation. ▪ Collect rainwater in tanks and recycle and reuse it in irrigation and toilet flushes. ▪ Use water sensors.

4-3-5. Materials category:

Table (4-26). The comparison study among the four projects in Materials category.

		Residential Heritage Green Buildings		Non-Residential Heritage Green Buildings	
		LEED's certified project Governor's Mansion	**BREEAM's certified Project 29Lansdowne Road- London**	**LEED's certified project Ecotrust's Building**	**BREEAM's certified Project ECCI**
Materials category	Strategies and techniques	▪ Plan for renovation waste. ▪ Using regional products. ▪ Use rapidly products.	▪ Retention of exiting materials or upgrade them. ▪ New materials with low environmental impacts. ▪ Regionally materials. ▪ Insulation on the modern objects.	▪ Salvaged the materials from demolition debris ▪ Purchasing off site salvaged materials. ▪ Purchase post-consumer materials. ▪ Using FSCs wood.	▪ Reuse the old steel. ▪ Using regionally sourced materials. ▪ Using sustainable materials with low energy demand. ▪ Use recycled copper cladding. ▪ Use FSC certified wood.

Source: (Researcher).

Table (4-26) continued. The comparison study among the four projects in Materials category.

		Residential Heritage Green Buildings		Non-Residential Heritage Green Buildings	
		LEED's certified project Governor's Mansion	**BREEAM's certified Project 29Lansdowne Road- London**	**LEED's certified project Ecotrust's Building**	**BREEAM's certified Project ECCI.**
Materials category	Achievable credits	▪ Renovation waste management ▪ Optimize use of Use alternative materials	▪ Environment impact of materials. ▪ Responsible sourcing of materials. ▪ Insulation.	▪ Storage collection of recyclables. ▪ Building reuse. ▪ Resource reuse. ▪ Recycle reuse. ▪ Local regional materials ▪ Certified wood.	▪ Materials – re-use. ▪ Responsible sourcing. ▪ Embodied life cycle impact of materials
	Non- achievable credits	▪ Sustainable cleaning products	-------	▪ Rapidly renewable materials.	---------

conclusions from previous analysis

- The four case studies mainly used regional materials to reduce the impacts related to transportation and CO2 emissions for importing the new materials.
- Used the recycled materials instead using new materials that reduce the consumption of resources and the amount of disposal to landfill.
- ECCI reused the old steel structures in the new design.
- Most of these projects set a strategy in purchasing new materials, they must be sustainable materials that have low environmental impacts.

Recommendations from previous analysis

Table (4-25) continued. **The comparison study among the four projects in Materials category.**

Recommended credits	▪ Environment impact of materials, ▪ Local regional materials. ▪ Materials reuse is the most mutual credits in the case studies, **<u>the research highly recommends</u>** to incorporate these credits in the **Materials category** of green heritage building rating system.
Recommended techniques	▪ Using salvaged materials from the renovation waste. ▪ Using recycle materials and products. ▪ Using the local materials as a priority in purchasing the new materials. ▪ Purchasing the materials that have low environmental impacts.

Source: (Researcher).

4-3-6. Indoor Environmental quality category:

Table (4-26). The comparison study among the four projects in Indoor Environmental quality category.

		Residential Heritage Green Buildings		**Non-Residential Heritage Green Buildings**	
		LEED's certified project Governor's Mansion	**BREEAM's certified Project 29Lansdowne Road- London**	**LEED's certified project Ecotrust's Building**	**BREEAM's certified Project (ECCI)**
Indoor Environmental quality	Strategies and techniques	▪ No-smoking policy. ▪ Walk-off entry matts. ▪ Indoor air quality plan. ▪ Occupant control of light ▪ Daylight and views ▪ Low VOC paints	▪ Achieving a good level of daylight. ▪ Sound insulation. ▪ Avoid VOCs for new materials ▪ Enhancing the ventilation partially via new doors and windows at basement level and third attic floor. ▪ Install fire and CO2 detection and alarm system.	▪ Providing natural daylight and views, and natural ventilation by restored windows and new skylights. ▪ Using recycle paint with low-VOC. ▪ Monitor CO2.	▪ Set a ventilation strategy, natural ventilation and mix-mode ventilation systems. ▪ Wood finishes with low VOCs. ▪ Maximum natural light.

Source: (Researcher).

Table (4-26) continued. The comparison study among the four projects in Indoor Environmental quality category.

		Residential Heritage Green Buildings		**Non-Residential Heritage Green Buildings**	
		LEED's certified project Governor's Mansion	**BREEAM's certified Project 29Lansdowne Road- London**	**LEED's certified project Ecotrust's Building**	**BREEAM's certified Project (ECCI)**
Indoor Environmental quality	Achievable credits	▪ Green cleaning entryways ▪ Green cleaning policy ▪ Controllability of light, ventilation and temp, ▪ Daylights and view	▪ Daylighting ▪ Sound insulation. ▪ Reduce VOCs ▪ Inclusive design. ▪ Ventilation ▪ Safety.	▪ Minimum indoor air quality. ▪ Smoke control. ▪ CO2 monitor ▪ Construction IAQ management plan. ▪ Low emitting materials. ▪ Indoor pollutant source control.	▪ Daylight. ▪ Thermal comfort. ▪ Indoor air quality. ▪ Lighting.
	Non- achievable credits	▪ Thermal comfort ▪ Outdoor air monitoring. ▪ Increased ventilation.	----------	▪ Increase ventilation effectiveness. ▪ Controllability of systems.	----------

Conclusions from previous analysis

- All of the projects aim to enhance the indoor air quality via new doors and windows at basement level and third attic floor.
- All the projects using low VOCs finishes and paints.
- Three of four projects set a strategy for increasing the natural daylight via existing and new windows and roof light. And orienting the spaces to capture more daylight.
- 29 Lansdowne Road and Ecotrust building install CO2 monitor and alarm system.
- Sound insulation is installed in the recent modifications and new addition parts without harming heritage parts as external walls.

Source: (Researcher).

Table (4-26) continued. The comparison study among the four projects in Indoor Environmental quality category.

Recommendations from previous analysis	
Recommended credits	▪ Minimum indoor air quality, ▪ Reduce VOCs ▪ Daylighting ▪ CO2 monitor**,** are the most mutual credits in the case studies, **the research highly recommends** to incorporate these credits in the **Indoor Environmental quality category** of green heritage building rating system in chapter 5.
Recommended techniques	▪ Using materials finished and paints that have low VOC. ▪ Enhancing the indoor air quality by natural ventilation or mechanical systems or mix-modes . ▪ Increasing the daylights via by restored windows and new skylights if that is possible. ▪ Install fire alarm system, and CO2 monitor and alarm system.

Source: (Researcher).

4-3-7. Management, waste and pollution categories:

Table (4-27). The comparison study among the four projects in Management, waste and pollution categories.

		Residential Heritage Green Buildings		**Non-Residential Heritage Green Buildings**	
		LEED's certified project Governor's Mansion	**BREEAM's certified Project 29Lansdowne Road- London**	**LEED's certified project Ecotrust's Building**	**BREEAM's certified Project (ECCI)**
Management , waste and pollution	Strategies and techniques	--------	▪ Provide home user guide. ▪ Assess the refurbishment site impacts ▪ Creating internal and external spaces for household waste. ▪ Plan for waste management during the project.	▪ Construction waste management.	▪ Reduction restoration site impacts. ▪ Public participation in the design. ▪ Public visits

Source: (Researcher).

Table (4-27) continued. The comparison study among the four projects in Management, waste and pollution categories.

		Residential Heritage Green Buildings		**Non-Residential Heritage Green Buildings**	
		LEED's certified project Governor's Mansion	**BREEAM's certified Project 29Lansdowne Road- London**	**LEED's certified project Ecotrust's Building**	**BREEAM's certified Project ECCI)(**
Management , waste and pollution	Strategies and techniques	----------	▪ Provide home user guide. ▪ Assess the refurbishment site impacts ▪ Creating internal and external spaces for household waste. ▪ Plan for waste management during the project.	▪ Construction waste management.	▪ Reduction restoration site impacts. ▪ Public participation in the design. ▪ Public visits
	Achievable credits	▪ Occupant recycling ▪ Toxic materials reduction	▪ Project management ▪ Home users guide. ▪ Construction site impacts. ▪ Responsible construction practices. ▪ Household waste. ▪ Refurbishment waste management ▪ No2 Emissions ▪ Surface water runoff ▪ flooding	▪ Construction waste management.	▪ Construction waste management.
	Non- achievable credits	▪ Storm water	▪ Security (cannot be done for heritage door and windows)	----------	---------

Source: (Researcher).

Table (4-27) continued. The comparison study among the four projects in Management, waste and pollution categories.

Conclusions
- Most of the case studies have set strategy for managing the project waste to recycling it and reduce negative impacts on the site. - Most of the case studies set strategy for managing operation waste after occupancy, through recyclable colors bins and containers. - 29Lansdowne Road has achieved the storm water credit, but the governor Mansion was not achieved the requirements of the same credit. - 29Lansdowne Road didn't meet the requirement of the "Security" credit, for the values of the heritage doors and windows, that cannot be replaced.
Recommendations for chapter 5.

Recommended credits	▪ Construction waste management, ▪ Recycling occupancy waste, are the most mutual credits in the case studies, **the research highly recommends** to incorporate these credits in the Management, Waste, and pollution category of green heritage building rating system in chapter 5.
other credits recommended from the researcher's view	▪ **Storm water design- Quantity and Quality Control.** This credit is important in managing the rainfall to avoid the surface water run-off and flooding.
Recommended techniques	▪ Set a plan for managing and recycling project waste management. ▪ Provide operation waste bins or containers that have different colors for collect recyclable waste.

Source: (Researcher).

4-3-8. The general conclusions and recommendation from of the comparison study between the four case studies :

Table (4-28). The general conclusions and recommendation from of the comparison study between the four case studies.

Conclusions
▪ Three of the four case studies have the second highest rank under green rating systems (gold / very good) , while, the ECCI project have the highest rank of the BREEAM certification (outstanding), it considerate as the first heritage building has been awarded this level in the UK

Source: (Researcher).

Table (4-28) continued. The general conclusions and recommendation from of the comparison study between the four case studies.

Conclusions

- Three projects are heritage listed buildings according to the local laws in their countries, while Ecotrust building was prevented to be listed on the national register of historic places for the adding of external steel staircases to meet the seismic codes. These staircases are not compatible with the heritage fabric of the building. That is backed to not conduct a comprehensive study during the design process about the regulations related to the listed building and the other regulations as seismic codes to define the conflictions between them, to set alternative designs that meet both of them before beginning of the project.
- The two BREEAM projects were supervised mandatorily under the local authorities, and all works of the projects were carried out after the approvals of conservation officers, while the LEED certified project was carried out under the supervision of executive chamber and the New York state office of General service based on the request of the owner of Governor Mansion to ensure that the greening works of the Mansion didn't have any negative impacts on the Mansion's heritage value.
- The non- residential projects need more renovation, modifications and adaptive reuse for the original building's design, they need flexibility in the internal spaces to meet the needs of the new activities, these modifications of the original design need obtaining the approval from the conservation officers.

Recommendations

- The project team should carry out a study for all the local regulations related to the conservation of the heritage buildings, and the restriction regulation for the listed heritage buildings in Egypt.
- The project team must obtain the approval of the urban harmony organization or the Ministry of the project about the greening and restoration plan of the heritage building in Egypt. (as a mandatory request)
- The conservation officer (or the alternative person or authority) has a great role to ensure the compatibility of the project works with the heritage value of the heritage building.

Source: (Researcher).

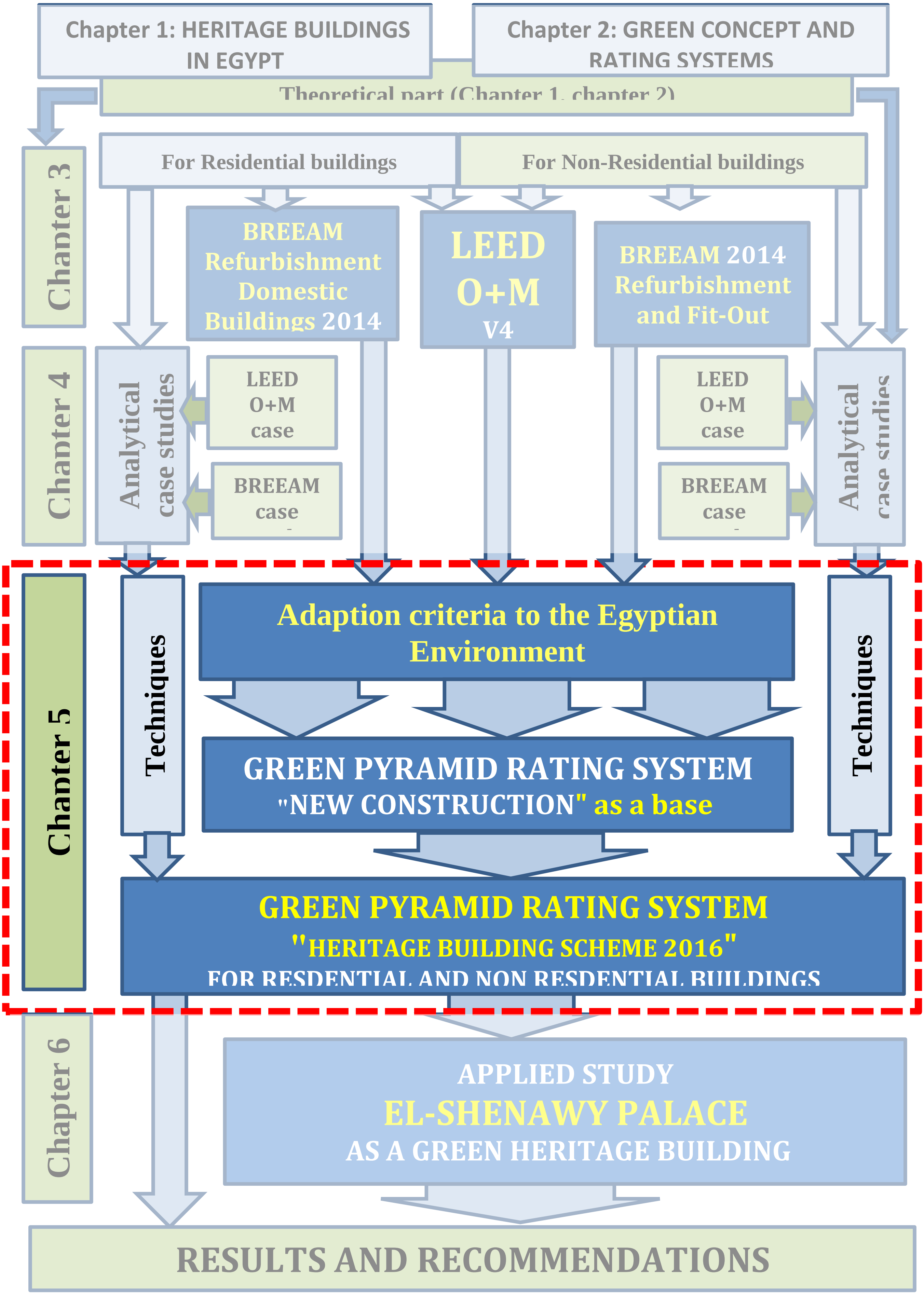
Conclusions of Chapter 4:

The general conclusions and recommendations, and recommended credits and techniques for each environmental category of the comparison study of the four case studies of chapter 4 (item: 4-3), will be useful to produce a Green Heritage Building Rating system in Egypt.

CHAPTER
V

ANALYSIS OF THE INTERNATIONAL GREEN RATING SYSTEMS FOR PRODUCE A GREEN HERITAGE RATING SYSTEM -GPRS[1]

[1] GPRS: Green Pyramid rating system.



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Chapter V.

ANALYSIS THE INTERNATIONAL RATING SYSTEMS TO PRODUCE A GREEN HERITAGE BUILDINGS RATING SYSTEM SCHEME -GPRS

In Chapter five, the research adopts the qualitative method in analyzing the green building rating systems depending on conclusions and recommended credits and techniques for each environmental category of the comparison study of the four case studies of chapter 4 (item : 4-3), and the studying of the different rating systems that have used to assess the heritage building internationally in chapter 3. Analyzing these rating systems mainly aims to produce a Green Heritage Building Rating system of GPRS that can be used to assess the green heritage buildings in Egypt.

5-1. The concept of the Green Heritage Building rating system tool

BREEAM refurbishment and fit-out and **BREEAM Domestic refurbishment** schemes are based on predicted performance , **LEED O+M** based on ongoing operation performance (Some credits required measurements through specific operation period after the building occupation).

The proposal of **Green heritage buildings rating system** is based on the predicated performance as BREEAM schemes, the research recommends launching another scheme that can assess ongoing performance of the heritage building, and its operations.

BREEAM has launched two schemes for residential and non-residential buildings, the research will incorporate the credits for residential and non-residential buildings into one rating system scheme, for that, the points of some credits may differ between them and therefore the total points in such categories, but the weighting of each category is the same for both.

The research will use the New-construction scheme of GPRS as a base for producing the Green Heritage Building rating system.

The research adopted the same seven categories of the GPRS, and its levels of certifications. The category weights will be modified according to the current challenges that are facing the Egyptian state, and the characteristics of heritage building case.

In each category, the research will analysis the aims, and the requirements of the credits of the three rating systems " LEED O+M, BREEAM Refurbishment and fit-out, and BREEAM Domestic", then compared them with the credits of the base, to avoid credits, add new credits, modified the credits of the New construction –GPRS to be compatible with the Egyptian heritage buildings.

The research added to the each credit the techniques that can be used to achieve the credit, these techniques are derived from the analysis of the case studies in chapter 4.

Each category of the scheme has the following items:

- The avoided credits from the category.
- The modified or maintained credits from the category.
- The new added credit.
- The Methodology for setting credits of the category.
- Set the points of each credit.
- Details of credit points.

5-2. Category weights

The research made some modifications in the category weights in this scheme, the category weights of the new construction scheme of GPRS was set before five years ago, during these last years, there are critical crises faced the Egyptian State,

- Crisis in the Energy sector due to the high consumption of electricity use and the reduction of the local fossil fuels production, that needs more rationalization of energy uses.
- Crisis in the water sector, there is near-rational expectations that in the near future, there will be a steep decline in the Egypt's share of the Nile water as a result of the construction of the Ethiopian dam". That needs more rationalization of water uses.
- Crisis in the Egypt's balance of Payments, due to the increasing of imports and decline in the exports, that's need to encourage the local manufactured products and materials.

According to the previous, the research will increase the weights of both categories **the energy efficiency** and **water efficiency** by 5% of each category, and decrease the both categories of **Materials** and **Sustainable Sites** by 5%, both of them have less importance in the assessment of heritage buildings for the following reasons:

- **Sustainable Site, Accessibility, and Ecology category** have a low impact on the existing building compared with new buildings

- **Materials and resources category**, the regulations of the heritage buildings set a limitation on made modifications on the building's materials to preserve the values of the buildings.

Table (5-1). The Green Pyramid for Heritage Building scheme's Category Weights

GPRS- New-Construction Category	Category Weighting
1: Sustainable Site, Accessibility, Ecology	10%
2: Energy Efficiency	25%
3: Water Efficiency	30%
4: Materials and Resources	10%
5: Indoor Environmental Quality	10%
6: Management	10%
7: Innovation and Added Value	Bonus

GPRS- Green Heritage Building Category	Category Weighting
1: Sustainable Site, Accessibility, Ecology	5%
2: Energy Efficiency	30%
3: Water Efficiency	35%
4: Materials and Resources	5%
5: Indoor Environmental Quality	10%
6: Management, Waster , and Pollutions	10%
7: Innovation	Bonus

Source of table: **(Researcher)**

5-3. The conception of the credit rebalancing in the Green Heritage Building rating system in GPRS :

- The conception of exclusion credits depends on their incompliance with the Egyptian buildings conditions, environment, social features and the local regulations.

- The conception of the adding credits depends on the adoption of the recommended credits that have resulted from the comparison study of chapter 4 in the proposed Green Heritage Building Rating system see item (4-3). The research carrying out some modifications in the Credits' requirements and names according to the green pyramid rating systems and the Egyptian heritage building conditions. See table (5-2).

Table (5-2). The recommended credits resulted from chapter 4.

The category	The Recommended credits
Sustainable sites category	Alternative transportation credits including urban density and proximity to amenities
	Cycle storages and showers
	Protection the ecological features
	Heat island effect – Non Roof
	Heat Island Effect – Roof
Energy Category	Enhanced energy performance
	optimize energy performance
	Energy efficient appliances
	Using photovoltaic panels on the flat roof of the heritage buildings
Water Category	Internal water use reductions
	External water use reduction
	Water meter
Materials category	Environment impact of materials
	Local regional materials
	Materials reuse
Indoor Environmental quality	Minimum indoor air quality
	Reduce VOCs
	Daylighting
	CO2 monitor
Management, Pollution and waste	Construction waste management,
	Recycling occupancy waste
	Storm water design- Quantity and Quality Control.

Source of table: (Researcher)

- The conception of exclusion credits of the New construction rating system which will be <u>the base</u> of the proposed Green Heritage Building rating system depends on if these credits are related to new –constructions buildings' case only, and cannot be applicable to existing buildings' case.

5-4. How to set the points of each credit:

For the new added credits or those that exist in the new – construction scheme of GPRS, setting the points for each credit depends on the importance of the credit for a heritage building. See table (5-3).

The research has defined the importance of the credit according to the previous studies of the international rating systems in chapter 3 and the results of analytical international case studies.

Table (5-3). How to set the points of each credit.

For new added credits to category	
Credit has **low importance** for green heritage building case	1 – 2 points
Credit has **medium importance** for green heritage building case	3-4 points
Credit has **high importance** for green heritage building case	More than 4 points
For maintained credits	
No change in the points.	0
Increasing or decreasing the points	According to the importance of the credit for green heritage building

Source of table: (Researcher)

GREEN HERITAGE RATING SYSTEM SCHEME

GREEN PYRAMID RATING SYSTEM (GPRS)

SUSTAINABLE SITES, ACCESSIBILITY AND ECOLOGY CATEGORY

WEIGHT 5%

Table (5-4). Comparing between the four rating systems in the sustainable sites category

Applied for Heritage Buildings									New- Buildings		
Residential uses			**All uses**			**Non-residential uses**			**New construction**		
BREEAM refurbishment domestic buildings (2014			**LEED O+M**			**BREEAM 2014 Refurbishment and Fit-Out**			**Green Pyramid rating system- New construction**		
- Energy - landuse			- Sustainable Sites - Location and Transportation			- Transport - Land Use and Ecology			- SUSTAINABLE SITE, ACCESSIBILITY AND ECOLOGY		
Sustainable sites											
			Heat Island Reduction	2	√√				Site selection in desert areas to encourage development in the desert outside the Nile Valley.	1	
			Site Management Policy	M	×				Redeveloping informal areas.	1	
			Site Management	1	×				Redeveloping Brownfield sites.	1	
			Site Improvement Plan	1	×						
Location and Transportation Accessibility											
Cycle Storage[1]	2	√√	Alternative Transportation	15	√√	Sustainable transport solutions	5	√√	Transport infrastructure connection.	1	√√
-			-			Proximity to amenities	2	√√	Catering for remote sites.	1	√

Source of table: (Researcher)

[1] "Cycle Storage" credit is founded in the (Energy category) in **BREEAM refurbishment domestic buildings (2014)**.

Incompatible with Heritage Buildings | Incompatible with Egyptian buildings conditions × | Recommended Credits √√ | Compatible with heritage building √

Table (5-4) continued . Comparing between the four rating systems in the sustainable sites

BREEAM refurbishment domestic buildings (2014			LEED O+M			BREEAM 2014 Refurbishment and Fit-Out			Green Pyramid rating system- New construction		
-			-			Cyclist facilities	2	√√	Alternative methods of transport.	1	√√
-			-			Maximum car parking capacity	2	×			
						Travel plan	1	×			
Ecological and cultural interest											
Protection and Enhancement of Ecological Features	1	√√	Site Development-Protect or Restore Habitat	2	√√	Protection of ecological features	1	√√	Protection of habitat.	1	√
						Enhancing site ecology	2	√√	Respect for sites of historic or cultural interest.	1	√
						Long term impact on biodiversity	2	×			

Source of table: (Researcher)

Incompatible with Heritage Buildings | Incompatible with Egyptian buildings conditions × | Recommended Credits √√ | Compatible with heritage building √

5-5. The Credit points in category 1: Sustainable sites, Accessibility and Ecology.

5-5-1. Recommended credits can be added to this category

According to the recommendations of the comparison study of chapter 4, and the recommended credit of Item (4-3-2) ,the followings credits will be added to green Heritage scheme of GPRS:

Table (5-5). The recommended credits from the Sustainable Sites category.

The Source	Credits	Actions to the base (New construction rating system of GPRS)
The Recommendations of analytical study of chapter 4	**Alternative transportation credits including urban density and proximity to amenities.**	Modified credits
	Bicycle storage and changing room	New added credit
	Protection the ecological features	Modified credit.
	Heat Island Effect – Non Roof and Roof	New added credit

Source of table: (Researcher)

5-5-2. The avoided credits from the category:

Table (5-6). The avoided credits from the Sustainable Sites category.

Credit ID	avoided credits	Reasons
GPRS – New construction scheme		
1.1.1.	**Site selection in desert areas to encourage development in the desert outside the Nile Valley.**	This credit is not compatible with existing buildings rating system.
1.1.2.	**Redeveloping informal areas.**	This credit is not compatible with existing buildings rating system.
1.1.2.	**Redeveloping Brownfield sites.**	This credit is not compatible with existing buildings rating system.

Source of table: (Researcher)

Table (5-6). The avoided credits from the Sustainable Sites

Credit ID	avoided credits	Reasons
LEED O+M		
SS.M1.	**Site Management Policy**	This research has two credits that related to improve ecological of the site and reduce the negative impacts of project on site " **Protection and Enhancement of Ecological Features and Habitat.",** and **"Minimizing Pollution during restoration and greening project "**
SS5.	**Site Management**	
SS6.	**Site Improvement Plan**	
BREEAM 2014 refurbishment		
Tra 04	**Maximum car parking capacity**	Set a limitation for parking capacity could not be applicable in Egypt in the case of the existing buildings that have already specific limited area for parking , this credit can be applied in the new construction buildings.
Tra 05	**Travel plan**	It is not compatible with the Egyptian environment.
LE 05	**Long term impact on biodiversity**	It is not compatible with the Egyptian environment.

Source of table: (Researcher)

5-5-3. The Modified credits in the category:

Table (5-7). The modified or maintained credits in the Sustainable Sites category.

Credit ID	The name of credit after modification	Reasons
1.2.	**Transport infrastructure connection.**	- It is a recommended credit according to table (5-5). - Customize this credit to be applicable for mix-uses and non-residential buildings only, the users and visitors of these building need a frequently connection to mass transit if the building is located far from bus stops or Metro stations.

Source of table: (Researcher)

Table (5-7) continued. The modified or maintained credits in the Sustainable Sites

Credit ID	The name of credit after modification	Reasons
1.3.	**Proximity to amenities**	- It is a recommended credit according to table (5-5). - Change the name of credit from "**catering for remote sites**" to "**proximity to amenities** "as **BREEAM 2014 Refurbishment and Fit-Out.** The aims of both credits are Similar, but the name of the second is more Cleary than the credit of GPRS.
1.4.	**Alternative methods of transport.**	- It is a recommended credit according to table (5-5). - The name of credit did not change. - This credit exists in the **LEED O+M (alternative transportation)** and **BREEAM 2014 refurbishment (sustainable transport solution)** under different names but similar aim. - Customize this credit to be applicable for mix-uses and non-residential buildings only, the users and visitors of these building can use car-share programs.
1.6.	**Protection and Enhancement of Ecological Features and Habitat.**	- It is a recommended credit according to table (5-5). - This credit exists in the **LEED O+M (site development-protect or restore habitat), BREEAM domestic (protection and enhancement of ecological features)** and **BREEAM 2014 refurbishment (protection of ecological features, and Enhancing site ecology)** under different names but similar aim. - Changed the name of credit and modified the aim from "**Protection of habitat**" to "**Protection and Enhancement of Ecological Features and Habitat**" to be more comprehensive concept (during and after restoration project).

Source of table: (Researcher)

Table (5-7) continued. The modified or maintained credits in the sustainable sites category.

Credit ID	The name of credit after modification	Reasons
1.7.	**Respect for sites of historic or cultural interest.**	- Maintain the name of the credit with no change. - Raise the number of points from 1 to 5, because the comprehensive conservation and development strategy that includes the urban site of heritage building "heritage environment" is one of the pillars of sustainable development of urban heritage sites

Source of table: (Researcher)

5-5-4. The new added credits:

Table (5-8). The new added credits to the sustainable sites.

Credit ID	New added credits	Reasons
1.1.	**Heat island reduction**	- It is a recommended credit according to table (5-5). - The requirement of this credit was derived from the heat island roof and heat island non-roof credits of LEED O+M.
1.5.	**Cycle Storage**	- It is a recommended credit according to table (5-5). - This credit exists in **BREEAM domestic (Cycle storage)** and **BREEAM 2014 refurbishment (cycle facilities)** under different names but have the same aim. - The research follows the standard in setting the required number of the racks of cycles and showers from **LEED new construction scheme v4.** - Showers are required for non-residential buildings only, there is an extra credit for showers for the non-residential buildings.

Source of table : (Researcher)

5-5-5. The Methodology for set credits of " SUSTAINABLE SITE, ACCESSIBILITY AND ECOLOGY " category:

- There is no change in the name of this category than the same credit in the New construction scheme of GPRS in this scheme.
- There are no mandatory credits in this category.
- The category was avoided three credit " **Site selection in desert areas to encourage development in the desert outside the Nile Valley, Redeveloping informal areas,** and **Redeveloping Brownfield sites.** " from the New construction scheme of GPRS in this scheme. These credits are related to new constructions only.
- There are three credits was shifted to Management category in this scheme after made modification in their name, **"Presentation of a Project Design and Implementation Plan, Compatibility with National Development Plan,** and **Minimizing Pollution during construction**".
- "**Cycle storage**" and "**Heat island Reduction**" are new added credits in this scheme.
- There are some modifications in the names and requirements of the other credits to be compatible with the heritage buildings.

5-5-6. Set the points of each credit:

Table (5-9). credit points of the Sustainable Site, Accessibility, and Ecology of the Green Heritage scheme of GPRS

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System						
CATEGORY 1: Sustainable Site, Accessibility, and Ecology weight is 5% of the total						
Credit ID	The name of credit	Old Points In NC-GPRS	action	Points Residential	Points Non-Residential	Reasons
1.1.	**Heat Island Reduction.**	**0**	**+2**	**2**	**2**	Has a medium important
1.2.	**Transport infrastructure connection.**	**1**	**-**	**0**	**1**	-
1.3.	**Proximity to amenities**	**1**	-	**1**	**1**	-

Table (5-9)continued. credit points of the Sustainable Site, Accessibility, and Ecology of the Green Heritage scheme of GPRS

Credit ID	The name of credit	Old Points In NC-GPRS	action	Points Residential	Points Non-Residential	Reasons
1.4.	**Alternative methods of transport**	**1**	**-**	**0**	**1**	-
1.5.	**Cycle Storage**	**0**	**+2**	**1**	**2**	Has a medium importance
1.6.	**Protection and Enhancement of Ecological Features and Habitat.**	**1**	-	**1**	**1**	-
1.7.	**Respect for sites of historic or cultural interest.**	**1**	**+4**	**5**	**5**	Has a high importance for urban heritage sites
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 1: Sustainable Site, Accessibility, and Ecology		**10**	**-**	**10**	**13**	five avoided Credits from the category have 5 points

Source: (Researcher).

5-5-7. Details of credit points::

Table (5-10). the category Sustainable Site, Accessibility and Ecology of the Green Heritage scheme of GPRS

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System			
CATEGORY 1: Sustainable Site, Accessibility, and Ecology weight is 5% of the total			
Credit ID	Credit	**Residential**	**Non-Residential**
Sustainable Site		**points**	**points**
1.1.	**Heat Island Reduction (Max, 2 credits)**		
Description	**Reducing heat islands by implement one of the followings options:** - **Option 1 (Non-Roof).** - **Option 2 (Roof)** - **Option 3 (Non-Roof and Roof)** **The team of the project should obtain an agreement from the urban harmony organization or its representative committees or the Ministry of Antiquities in the Egyptian governorates about the Heat Island Reduction plan for the heritage building evaluated.	**1** **1** **2**	**1** **1** **2**

Source: (Researcher).

Table (5-10) continued. the category Sustainable Site, and Ecology of the Green Heritage scheme of GPRS

Techniques	**Option 1 (Non-Roof).: use any combination of the following strategies for a minimum of 50% of the site paving:** - Use the existing plant or install plants that provide shade over paving areas including playgrounds on the site within 10 years of planting, plants must be in place at the time of certification. - Provide shade with structures that compatible with the heritage style of the building, that covers by solar thermal collectors or photovoltaics, the shades put in areas cannot abstract the public views of the heritage building. - Provide shade with vegetated structure. - Using new paving materials (if that will be allowable) with solar reflectance index (SRI) value of at least 0.33. - Use an open-grid pavement system (at least 50% of the site area). **Option 2 (Roof)** Using roofing materials with SRI equal or greater than 82 for a minimum of 75% of the roof area or a vegetated roof for a minimum of 50% of the roof area, or both. **Option 3 (Non-Roof and Roof)** Use the strategies for each of the two options mentioned above.		
Location and Transportation Accessibility			
1.2.	**Transport infrastructure connection.** (for non-residential buildings and mix-uses' buildings)**	**0**	**1**
Description	A credit point is obtainable for demonstrating a suitable connection with existing public transport systems.		
Techniques	If the building doesn't locat near mass transportation lines such as buses or Metro stations consider a shuttle service to help employees reach public transportation. An example is a company provides a shuttle every 30 minutes to a mass transit hub a few miles away.		
1.3.	**Proximity to amenities**	**1**	**1**
Description	Presenting a suitable method for connecting the site with the nearest urban area (that has amenities and services).		
Techniques	Accessibility to amenities via safe pedestrian routes, e.g. pavements/paths and safe crossing points or, where provided, dedicated pedestrian crossing points.		
1.4.	**Alternative methods of transport** (for non-residential buildings, and mix-uses' buildings)**		
Description	A credit point is obtainable for demonstrating strategies to reduce reliance on private automobile use and encourage the use of greener methods of transport.	**0**	**1**
Techniques	Carpool and Vanpool share program.		

Source: (Researcher).

Table (5-10) continued. the category Sustainable Site, and Ecology of the Green Heritage scheme of GPRS

1.5.	**Cycle Storage**		
Description	Encourage occupants/ users to use cycles by providing adequate and secure cycle storage facilities, thus reducing the need for short car journeys. Providing showers facilities for non-residential buildings **The team of the project should obtain an agreement from the urban harmony organization or its representative committees in the Egyptian governorates about the cycle storage plan for the heritage building evaluated.	**1** **0**	**1** **1**
Techniques	<u>**Bicycle racks:**</u> **For non-residential buildings** : Provided for 5% of all commercial, office and industrial occupants, with numerous secured racks throughout the site to allow for easy movement within the community. **For non-residential buildings** Bicycle racks will also be supplied one rack for each residential unit. **For Mix-residential buildings:** the total numbers of the required racks of Bicycle is equal the numbers of the required of residential units plus non-residential units.		
Techniques	The cycle storage must be nearest the entrance as possible without has negative impact on the public view for heritage building. <u>**the showers (non-residential buildings only)**</u> if total numbers of non-residential building users are equal or less than 100 , the required showers = 1 if total numbers of non-residential building users are greater than 100 , the required showers = 1+ (numb. of users – 100)/150		
Ecological and cultural interest			
1.6.	**Protection and Enhancement of Ecological Features and Habitat.**		
Description	Protect existing ecological features from substantial damage during refurbishment and enhance the ecological value of a site. **The team of the project should obtain an agreement from the urban harmony organization or its representative committees in the Egyptian governorates or the Ministry of Antiquities about the Protection and Enhancement of Ecological Features and Habitat plan for the heritage building evaluated.	**1**	**1**
Techniques	- Set a plan to how all existing ecological features on the site can be protected and maintained during restoration works. - Set a strategy to how restoring natural areas to provide habitat and promote biodiversity including enhancing the ecological features of the site by replanting trees and plants on site.		
1.7.	**Respect for sites of historic or cultural interest.**		
Description	- Three credit points are obtainable for demonstrating a suitable strategy for conserving and protecting the urban heritage site of the heritage building that is located, that could include (streets, squares, or alleyways) - Two additional credit points for demonstrating a suitable strategy for conserving and protecting the remains of heritage building or cultural interest that is part of or nearby the site.		

Source: (Researcher).

Table (5-10) continued. the category Sustainable Site, and Ecology of the Green Heritage scheme of GPRS

	** The team of the project should obtain an agreement from the urban harmony organization or its representative committees in the Egyptian governorates or the Ministry of Antiquities about the plan for achieving the requirements of this credit.	**5**	**5**
Techniques	- Set a plan for restoring one or more of the features of the urban heritage site where the heritage building located. - Set a plan for restoring one or more of other heritage buildings where are located nearby or adjacent the heritage building.		
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 1: SUSTAINABLE SITE		**10**	**13**

Source of table: (Researcher)

GREEN HERITAGE RATING SYSTEM SCHEME

GREEN PYRAMID RATING SYSTEM (GPRS)

ENERGY EFFICIENCY CATEGORY

WEIGHT 30%

Table (5-11). Comparing between the four rating systems in the Energy efficiency category

Applied for Heritage Buildings									New- Buildings		
Residential uses			All uses (Residential and non-residential Building)			Non-residential uses			New construction		
BREEAM refurbishment domestic buildings (2014			**LEED O+M**			**BREEAM 2014 Refurbishment and Fit-Out**			**Green Pyramid rating system- New construction**		
- **Energy**			- **Energy and Atmosphere**			- **Energy**			- **Energy Efficiency**		
Improvement in Energy Efficiency Rating (5-60)%.	**6**	√√	**Energy Efficiency Best Management Practices**	**M**	√	**Reduction of energy use and carbon emissions****	**15**	√√	**Minimum Energy Performance level-**" Min 10%".	**M**	√√
Primary Energy Demand	**7**	√	**Minimum Energy Performance-** "Min 25%".	**M**	√√	**Energy monitoring**	**2**	√√	**Energy Monitoring & Reporting**	**M**	√√
Renewable Technologies	**2**	√	**Building-Level Energy Metering**	**M**	√√	**External lighting**	**1**	√	**Ozone depletion avoidance**	**M**	√
Energy Labelled White Goods	**2**	√√	**Fundamental Refrigerant Management**	**M**	√	**Low carbon design****	**3**	√	**Energy Efficiency Improvement** From 20% to 60%	**10**	√√
Drying Space	**1**	×	**Existing Building Commissioning—Analysis**	2	×	**Energy efficient cold storage**	**2**	√	**Passive External Heat Gain Reduction from 5-50%**	**7**	
Display Energy Devices	**2**	√√	**Existing Building Commissioning—Implementation**	2	×	**Energy efficient transportation systems**	**3**	√	**Energy Efficient Appliances**	**3**	√√

Source of table: (Researcher)

Incompatible with Heritage Buildings (grey) **Incompatible with Egyptian buildings conditions** × **Recommended Credits** √√ **Compatible with heritage building** √

Table (5-11) continued. Comparing between the four rating systems in the Energy efficiency category

BREEAM refurbishment domestic buildings (2014			LEED O+M			BREEAM 2014 Refurbishment and Fit-Out			Green Pyramid rating system- New construction		
Home Office	1	×	Ongoing commissioning	3	×	Energy efficient laboratory system	5	×	Vertical Transporting Systems	3	√
			Optimize Energy Performance	20	√√	Energy efficient equipment	2	√√	Peak Load Reduction	6	√
-			Advanced Energy Metering	2	√√	Drying space	1	×	Renewable Energy Sources	1 2	√
-			Demand Response	3	√				Environmental Impact	4	√
-			Renewable Energy and Carbon Offsets	5	√				Operation and Maintenance	1	√
-			Enhanced Refrigerant Management	1	√				Optimized Balance of Energy and Performance	4	√
-			-						Energy and carbon Inventories	2	

Source of table: (Researcher)

Incompatible with Heritage Buildings ■ Incompatible with Egyptian buildings conditions × Recommended Credits √√ Compatible with heritage building √

5-6. The Credit points in category 2: Energy Efficiency

5-6-1. Recommended credits can be added to this category

According to the recommendations of the analytical study of chapter 4, ,the followings credits will be added to green Heritage scheme of GPRS:

Table (5-12). Recommended credits can be added to the Energy Efficiency category

The Source	Credits	Actions to the base (New construction rating system of GPRS)
The Recommendations of analytical study of chapter 4	▪ **Enhanced energy performance.**	Modified credits
	▪ **optimize energy performance**	New added credit
	▪ **Energy Metering,**	Modified credit.
	▪ **Energy efficient appliances**	Modified credit.

Source of table: (Researcher)

5-6-2. The avoided credits from the category:

Table (5-13). The avoided credits from the Energy Efficiency category.

Credit ID	Avoided credits	Reasons
	- GPRS – NEW construction scheme	
2.2.	**Passive External Heat Gain\loss Reduction:**	- This credit depends on adopting a passive design concept in the initial design of the new constructions through the orientation of the buildings, mass transit of building materials, the size of windows and the type of windows glazing, - For that, this credit is not compatible with existing buildings rating system.
2.10	**Energy and Carbon Inventories.**	- This credit depends on providing an inventory of energy and carbon for each mechanical, electrical and plumbing system. In the case of existing buildings where are several existing systems that will be difficult to get their inventory of energy and carbon.

Table (5-13) continued. The avoided credits from the Energy category.

Credit ID	Avoided credits	Reasons
	- **LEED O+M**	
EAC05	**Existing Building Commissioning - Analysis**	- Those Commissioning credits were ruled out from the GPRS New construction scheme for not compatibility for the buildings in Egypt . - The research is avoided using the credits of commissioning as the GPRS New construction scheme.
EAC06	**Existing Building Commissioning - Implementation**	
EAC07	**Ongoing Commissioning**	
- **BREEAM 2014 refurbishment and fit-out.**		
Ene 07.	**Energy efficient laboratory systems**	- This credit could be applied to the buildings that have laboratory spaces as hospitals, research centers, ..etc. - This credit is not useful to be added to the scheme of green heritage buildings, most of the heritage buildings in Egypt are residential buildings that don't have laboratory systems
Ene09	**Drying space**	- This credit is not useful to be added to the scheme of green heritage buildings for the different weather between Egypt and UK.
- **BREEAM domestic Refurbishment 2014 scheme**		
Ene06	**Dry spaces**	- This credit is not useful to be added to the scheme of green heritage buildings for the different weather between Egypt and UK.
Ene10	**Home office**	- This credit is not compatible with the Egyptian environment.

Source: (Researcher)

5-6-3. The Modified credits in the category:

Table (5-14). The modified or maintained credits in the Energy Efficiency category.

Credit ID	The name of credit after modification	Reasons
2M.1	**Minimum Energy Performance Level:**	- It is a recommended credit according to table (5-12). - The name of credit did not change from the new construction scheme of GPRS, as well as the level of 10% that would be the minimum requirement to achieve minimum energy performance for the building. - Improving the energy performance is a mutual credit among the four rating system with different names, "**Minimum energy performance**" in **LEED O+M** that is a mandatory credit with Minimum level 25% from baseline, "**Improvement in Energy Efficiency Rating** " ranged from 5% to 60% in **BREEAM domestic,** and **" Reduction of energy use and carbon emissions" in BREEAM 2014 refurbishment** that set a special criteria when evaluate heritage buildings.
2.M.2.	**Energy Monitoring & Reporting**	- It is a recommended credit according to table (5-12). - The name of credit did not change from the new construction scheme of GPRS. - This credit is also mandatory in the **LEED O+M** under the name "**Building- Level Energy Metering**" that can measure total energy consumption " electricity, gas, Fuel oil, etc", - The addition requirement added to the credit derived from the addition credit "**Advance Energy Metering**" in **LEED O+M** that measures the total energy consumption, and major end uses that represents 20% or more of the total energy consumption, as well as measuring the both of consumption and demand. - This credit also exists in two BREEAM schemes with the same aim, "**Primary Energy Demand**" in **BREEAM domestic,** and **"Energy Monitoring" in BREEAM 2014 refurbishment**.

Source: (Researcher)

Table (5-14) continued. The modified or maintained credits in the Energy Efficiency category.

Credit ID	The name of credit after modification	Reasons3
2.M.2.	**Ozone depletion avoidance**	- The research has ruled out the requirements of the "**Ozone depletion avoidance"** credit in new construction scheme in GPRS, because it depends mainly on installing new refrigerants in new constructions that cannot be compatible with existing buildings that targeted in this scheme. - The research will select the aims and requirements of credit "**Fundamental Refrigerant management**" in **LEED O+M** to set the requirements for this credit as follows: 1. In the case of having current refrigerants, it would be needed to set a phase out plan to replacement them with new ones don't contain chlorofluorocarbons (CFCs). 2. The research commits the project in the case of installing new refrigerants, to don't contain any CFCs. 3. Exemption the small HVAC systems as mentioned in the description of credit above. - The two BREEAM rating systems don't have any credits related to ozone depletion avoidance. - The credit "**Low carbon design** " in BREEAM Refurbishment aims to reduce the energy consumption by using passive design techniques and non- cooling system.
2.1.	**Energy Efficiency Improvement**	- It is a recommended credit according to table (5-12). - The research adopts the name and the aim of the same credit that exists in new construction scheme in GPRS. - The similar credit exists in **LEED O+M** "**Optimize energy performance**" that has at least 26% up to 45% better than energy efficiency performance of baseline, or awarded energy star program's scores above 75 ,up to 95 . - Each of two BREEAM rating systems has only one credit which is related to improve the energy efficient of the buildings.

Source: (Researcher)

Table (5-14) continued. The modified or maintained credits in the Energy Efficiency category.

Credit ID	The name of credit after modification	Reasons
2.2.	**Energy Efficient Appliances**	- It is a recommended credit according to table (5-12). - The research adopts the name and the aim of the same credit that exists in new construction scheme in GPRS. - The research added more detailed requirements in this credit such as set a minimum acceptable rate of energy efficient label for appliances and who the project team can deal with existing appliances. - These requirements have derived from the credit "**Energy Labelled white goods**" in **BREEAM domestic**, and "**Energy Efficient equipment** "in **BREEAM 2014 refurbishment**.
2.4.	**Vertical Transportation Systems**	- The research adopts the name and the aim of the same credit that exists in new construction scheme in GPRS. - The research made some modifications and addition to the credit to be compatible with the existing elevators and stairs of the heritage buildings. - In the case of purchasing new elevators, the research adopts the criteria of "**Energy efficient transportation systems**" in **BREEAM 2014 refurbishment.**
2.5.	**Peak Load Reduction**	- The research adopts the name and the aim of the same credit that exists in new construction scheme in GPRS. - The credit "**Demand response**" in **LEED O+M** has a similar aim to the credit " **Peak Load Reduction**" in **GPRS**. The research selected the requirements of the second for compatibility with Egyptian environment.
2.6.	**Renewable Energy Sources**	- The research adopts the name and the aim of the same credit that exists in new construction scheme in GPRS. - The credit "**Renewable Energy and Carbon offsets**" in **LEED O+M** and the credit "**Renewable Technologies**" in **BREEAM domestic**, have a similar aim to the credit " **Renewable Energy Sources** " in **GPRS**. The

Source: (Researcher)

Table (5-14) continued. The modified or maintained credits in the Energy Efficiency category.

Credit ID	The name of credit after modification	Reasons
2.6.	**Renewable Energy Sources**	research selected the requirements of the third credit for the ability to be applied to the existing building in Egypt. - From the analyses of case studies of this research, some criteria have been set to ensure that the renewable technologies don't have a negative impact on values of the heritage building.
2.7	**Environmental Impact:**	- The research adopts the name and the aim of the same credit that exists in new construction scheme in GPRS.

Source: (Researcher)

5-6-4. The new added credits:

Table (5-15). The new added credits in the Energy Efficiency category

The Number Of new add credit	New added credits	Reasons
2.3.	**Internal and External lighting**	- The lighting fittings have a reasonable proportion of the total energy consumption of the new and existing buildings. For that, the research added a new credit related to the internal and external lighting, its criteria meet the international standards that adopted by other rating systems. The credit adopted the following criteria as a follows: - The internal lighting exists in within the criteria of (**Energy efficient equipment) in BREEAM 2014 refurbishment**. - The external lighting exists in the credit (External lighting) in **BREEAM 2014 refurbishment**. - The research provided to obtain an agreement from related-authorities to ensure preserving the heritage value in achieving the requirement of this credit.

Source: (Researcher)

5-4-2-4. The Methodology for set credits of "Energy Efficiency" category:

- There is no change in the name of this category than the same credit in the New construction scheme of GPRS in this scheme.
- The category was avoided one credit " **Passive External Heat Gain Reduction**" from the New construction scheme of GPRS in this scheme.
- "**Internal and External lighting** " is a new added credit in this scheme.
- There are some modifications in the requirements of the other credits to be compatible with the heritage buildings.

5-6-5. Set the points of each credit:

Table (5-16) credit points of the Energy Efficiency of the Green Heritage scheme of GPRS

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System						
CATEGORY 2: Energy Efficiency weight is 30% of the total						
Credit ID	The name of credit	Old Points In NC-GPRS	action	Points Residential	Points Non-Residential	Reasons
2.M. 1	**Minimum Energy Performance Level:**	**M**	**-**	**M**	**M**	-
2.M. 2	**Energy Monitoring & Reporting**	**M**	**-**	**M**	**M**	
2.M. 3.	**Ozone depletion avoidance**	**M**	**-**	**M**	**M**	-
2.1.	**Energy Efficiency Improvement**	**10**	-	**10**	**10**	-
2.2.	**Energy Efficient Appliances**	**3**	-	**3**	**3**	-
2.3.	**Internal and external Lighting**	**-**	+3	**3**	**3**	-
2.4.	**Vertical Transportation Systems.**	**3**	-1	**2**	**2**	-
2.5.	**Peak Load Reduction:**	**6**	-5	**1**	**1**	-

Table (5-16) continued. credit points of the Energy Efficiency of the Green Heritage scheme of GPRS

Credit ID	The name of credit	Old Points In NC-GPRS	action	Points Residential	Points Non-Residential	Reasons
2.6.	**Renewable Energy Sources.**	**12**	-2	**10**	**10**	-
2.7	**Environmental Impact.**	**4**	-	**4**	**4**	-
2.8	**Operation and Maintenance.**	**1**	-	**1**	**1**	-
2.9	**Optimized balance of Energy and Performance.**	**4**	-1	**3**	**3**	-
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 2: Energy Efficiency		**50**	**-13**	**37**	**37**	One avoided Credit has 7 points

Source: (Researcher)

5-6-7. Details of credit points:

Table (5-17) the Energy Efficiency category of the Green Heritage scheme of GPRS

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System			
CATEGORY 1: Energy Efficiency weight is 30% of the total			
Credit ID	Credit	**Residential**	**Non-Residential**
2.M.1	**Minimum Energy Performance Level:**	**M**	**M**
Description	Demonstrate a Minimum Energy Performance Level 10% above an appropriate simulated base case model. The base case model is to be produced in accordance with the Egyptian Energy Efficiency Code and using the methods outlined in ANSI/ASHRAE/IESNA Standard 90.1-2007 (or equal approved standard). **The team of the project should obtain the agreement of the urban harmony organization or its representative committees in the Egyptian governorates or the Ministry of Antiquities about the energy performance plan for the heritage building evaluated.		

Source: (Researcher)

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Table (5-17) continued credit points of the Energy Efficiency of the Green Heritage scheme of GPRS

Techniques	− Using a simulation model to calculate the baseline of energy performance for the building evaluated. And then calculate the minimum reductions required after adding techniques that achieve more energy performance efficiency to the building without harming or lose the building heritage values. − The guide references are "the Egyptian Energy Efficiency Code, and ANSI/ASHRAE/IESNA Standard 90.1-2007 (or equal approved standard). − The team of the project should balance between the requirements to achieve minimum energy performance and preserve the heritage values of the buildings, any techniques could have a negative effect on the building values, the team should be ruled out. The following are techniques can be used to reduce the total energy consumption: ▪ Using a computer modelling to calculate energy consumption. ▪ Using high efficient appliance and systems. ▪ Using LEDs in Lighting. ▪ Using renewable technologies that don't have a negative impact on the heritage value of the buildings. ▪ Using energy metering. ▪ Insulate and increase the efficiency of the heritage windows and doors without harming or losing their values. ▪ Using occupancy sensors. Capturing more daylight if that is possible.	**M**	**M**
2.M.2.	**Energy Monitoring & Reporting**	**M**	**M**
Description	Demonstrate provision of accessible energy sub-meters, clearly labelled and with instructions, for all occupied areas. Sub-meters should enable monitoring and recording of a minimum of 90% of the estimated annual consumption of each fuel type, with separate meters for equipment that exceeds 10 kW.		
Techniques	− Install sub-meters for all occupied areas, − Install separate meters for any electrical equipment that exceeds 10 kW. if the building installs any types of renewable resources, advanced meters must be installed to measure both of the consumption of total energy and the supply of energy to the general electricity network.		

Source: (Researcher)

Table (5-17) continued credit points of the Energy Efficiency of the Green Heritage scheme of GPRS

2.M.3.	**Ozone depletion avoidance**		
Description	Demonstrate that all refrigerants and gaseous fire suppression agents within the Project have an Ozone Depletion Potential (ODP) near zero. Don't use new equipment that contains chlorofluorocarbon (CFC) refrigerants in heating, ventilation, air-conditioning, or third party audit make a plan for replacement or conversion of the refrigerant systems, or make CFC-phase out plan is in place. The phase out –plan should be scheduled for completion within 10 years. Small HVAC units, small water cooler and any other cooling equipment that contains less than 0.5 pounds of refrigerant are exempt. **The team of the project should obtain the agreement of the urban harmony organization or its representative committees in the Egyptian governorates or the Ministry of Antiquities about the ozone depletion plan.	**M**	**M**
Techniques	– Using refrigerants not contain (CFCs). – Or set a phase-out plan for replacement or conversion of the refrigerant systems.		
2.1.	**Energy Efficiency Improvement** (Max10 credits)		
Description	Energy Efficiency Improvement: A maximum 10 credit points are obtainable for demonstrating (using the methodology outlined in 2.M.1, above) further reductions in energy consumption from the base case determined in item 2.M.1 (above). **Points awarded are accumulative, and are shown opposite:** **Reduction** **%10-5** **%15-11** **%20-16** **%25-21** **%27-26** **%30-28** **%35-31** **%40-36** **%45-41** **%50-46**	 **1** **1** **1** **1** **1** **1** **1** **1** **1** **1**	 **1** **1** **1** **1** **1** **1** **1** **1** **1** **1**
Techniques	Using the same techniques that mentioned in item 2.M.1		

Source: (Researcher)

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Table (5-17) continued credit points of the Energy Efficiency of the Green Heritage scheme of GPRS

2.2.	**Energy Efficient Appliances**	3	3
Description	Credit points are obtainable for demonstrating that the building occupier will be provided with formal documentary guidelines on using of Energy Efficient Appliances for the building, with reference to rating schemes such as Energy Star (USA) or the Energy Efficiency Labelling Scheme (EU), or other international/local equalivant Energy Efficiency Labelling Schemes: For new purchased appliances: – The new purchased appliances must have **A+** rate or better under the EU Energy Labelling scheme or an equalivant rate under any international/local energy efficient labelling schemes. For any existing appliances: – For appliances less than 10years old can still be used if it has Energy Label. – For appliances greater than 10years, they are less efficient from 30-40% than the new A rated appliance, they will need to replace with new rated appliances. – If the age of equipment is unknown, they will need to replace with new rated appliances.		
Techniques	Using high energy efficient appliances have rated according to Energy Star (USA) or the Energy Efficiency Labelling Scheme (EU).		
2.3.	**Internal and external Lighting** (Max.3 credits)		
	Internal lighting (two credits) shall have a minimum luminaire efficacy of ≥ 60 luminaire lumens per circuit Watt. Internal lighting fittings shall also be controlled by a time switch to prevent operation after midnight (in the non-residential building) except where the area is open to the public, or controlled by motion sensors corridor light to switch off the lighting when there is no occupiers or users in the corridors of the residential/ non-residential buildings. This part of credit might be ruled out if it has a negative effect on the heritage lighting objects, heritage value of interior walls or/and celling.	2	**2**

Source: (Researcher)

Table (5-17) continued credit points of the Energy Efficiency of the Green Heritage scheme of GPRS

Description	**External lighting (one credit)** The average initial luminous efficacy of the external light fittings within the boundary of the building's site is not less than 60 luminaire lumens per circuit Watt All external light fittings are automatically controlled for prevention of operation during daylight hours and presence detection in areas of intermittent pedestrian traffic. ** There is a need to obtain an agreement about the lighting strategy plan for internal and external lighting systems from the urban harmony organization or its representatives committees in the Egyptian governorates or the Ministry of Antiquities.	**1**	**1**
Techniques	– A lighting strategy plan for internal and external lighting systems. – Lighting fittings ⩾ 60 luminaire lumens per circuit Watt. – Lighting controller by time switch. – Motion sensors corridor light.		
2.4.	**Vertical Transportation Systems.** (Max.2 credits)		
Description	**Stairs lighting (one credit)** stairs have a minimum lighting level of 150 lux measured at the walking surfaces; any artificial lighting used within the stairs must be supplied with color corrected lamps with minimum Color Rendering Index CRI=80. All stairs in the building are energy efficient i.e. operate in stand-by mode during off-peak periods; include a regenerative drive system for buildings over 3 stories; and use LED lighting and LCD display features.	**1**	**1**
	Elevators (one credit) Any elevators in the buildings (new / existing) are energy efficient, i.e. have an automated stop/start function linked to occupancy sensors to enable standby mode when there is no passenger demand; and use LED strip lighting. <u>For heritage elevators:</u> No replacing heritage elevators with new ones, restoring them or refurbishment the hidden parts "as motors" is allowable with not harming or losing the heritage value of them.	**1**	**1**

Source: (Researcher)

Table (5-17) continued credit points of the Energy Efficiency of the Green Heritage scheme of GPRS

Description	For purchasing new elevators, beside the previous requirement, it should achieve the following: – Be compatible with the heritage style of the building and the entrance and stairs areas. – Make an energy calculation and classification report for (at least two types of system), the system with the lowest energy consumption is selected and purchased. **There is a need to obtain an agreement about the plan of installing new elevators or restore/ refurbish the existing ones from the urban harmony organization or its representatives committees in the Egyptian governorates or the Ministry of Antiquities.		
Techniques	– Regenerative drive system /Motion sensors light. – Occupancy sensors for elevators. – An energy calculation and classification report for at least two elevators systems.		
2.5.	**Peak Load Reduction:**		
Description	Credit points are obtainable for demonstrating that a peak electrical load has been achieved that is not more than 80% greater than the project design annual average electrical load. Further credit points are obtainable for demonstrating that a peak electrical load has been achieved that is not more than 60% greater than the project design annual average electrical load. Evidence should include results of dynamic energy simulations giving an annual average, and peak electrical loads for the building and explanation of peak load reduction methodology, including drawings, equipment data sheets/specifications as necessary.	**1**	**1**
Techniques	- Dynamic energy simulations.		
2.6.	**Renewable Energy Sources** (Max.10 credits)		
	Credit points are obtainable for demonstrating that: ▪ an on-site and/or off-site renewable energy feasibility study has been undertaken; ▪ a minimum of 5% of the project's non-renewable energy use will be provided by on-site generated renewable energy.	1 1	**1** **1**

Source: (Researcher)

Table (5-17) continued credit points of the Energy Efficiency of the Green Heritage scheme of GPRS

Description	▪ A maximum 8 credit points are obtainable for demonstrating that a percentage of total energy demand is supplied by renewable energy, utilizing on-site or off-site sources. Points awarded are accumulative, and are shown opposite: % Total 1-4% 5-8% 9-12% 13-15% 16-20% 21-25% 26-29% over30% **There is a need to obtain an agreement about the plan of installing renewable technology at the heritage building or its from the urban harmony organization or its representatives committees in the Egyptian governorates or the Ministry of Antiquities.	 1 1 1 1 1 1 1 1	 1 1 1 1 1 1 1 1
Techniques	- Using photovoltaic panels on the flat roof of the heritage building, and other parts of the building / or site provided that don't have a negative impact on the heritage value of the building or its heritage view from the street. - Using solar heating systems, geothermal power, biomass power, or wind power provided that don't have a negative impact on the heritage value of the building or its heritage view from the street.		
2.7	**Environmental Impact.** (Max.4 credits)		
	The weighted average of all refrigerants and fire suppression systems media has an equivalent Global Warming Potential (GWP) that meets or is less than the requirements of Egyptian Environmental Law. Credit points are obtainable for demonstrating that: Points awarded as follows: ▪ The weighted average of all refrigerants shall have a GWP of 12 or less; ▪ The Project has installed a permanent refrigerant leak detection system; ▪ The Project has installed an automatic refrigerant pump-down system to a dedicated storage tank with isolation valves; ▪ All gaseous fire suppression system have a GWP of 2 or less.	**1** **1** **1** **1**	**1** **1** **1** **1**

Source: (Researcher)

Table (5-17) continued credit points of the Energy Efficiency of the Green Heritage scheme of GPRS

	**There is a need to obtain an agreement about the plan of installing refrigerants and fire suppression systems from the urban harmony organization or its representatives committees in the Egyptian governorates or the Ministry of Antiquities.		
2.8	**Operation and Maintenance.**		
	Credit points are obtainable for providing for a simple and easily-followed Operations Manual for all Mechanical, Electrical and Plumbing (MEP) apparatus, equipment, device, and sub-system.	**1**	**1**
2.9	**Optimized balance of Energy and Performance.** (Max.3 credits)		
	Credit points are obtainable for demonstrating design optimization studies and implementation of the following: ▪ Natural Vs. Artificial Lighting; ▪ Acceptable Indoor air quality at all operation profiles; ▪ Optimization between building Passive systems and the anticipated Minimum Thermal Cooling.	**1** **1** **1**	**1** **1** **1**
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 2: ENERGY EFFICIENCY		**37**	**37**

Source: (Researcher)

GREEN HERITAGE RATING SYSTEM SCHEME

GREEN PYRAMID RATING SYSTEM (GPRS)

WATER EFFICIENCY CATEGORY

WEIGHT 35%

Table (5-18). Comparing between the four rating Systems in the Water efficiency category

Applied for Heritage Buildings									New- Buildings		
Residential uses			All uses (Residential and non-residential Building)			Non-residential uses			New construction		
BREEAM refurbishment domestic buildings (2014			**LEED O+M**			**BREEAM 2014 Refurbishment and Fit-Out**			**Green Pyramid rating system- New construction**		
– Water			**- Water Efficiency**			**- Water**			**- Water Efficiency**		
Internal water use	**3**	√√	**Indoor Water Use Reduction**	**M**	√√	**Internal Water Consumption**	**3**	√√	**Minimum Water Efficiency**	**M**	√√
External Water Use	**1**	√√	**Building-Level Water Metering**	**M**	√√	**Water Meters**	**1**	√√	**Water Use Monitoring**	**M**	√√
Water meter	**1**	√√	**Outdoor Water Use Reduction**	**2**	√√	**External Water Consumption**	**1**	√√	**Indoor Water Efficiency Improvement.**	**8**	√√
			Indoor Water Use Reduction	**5**	√√				**Outdoor Water Efficiency Improvement.**	**9**	√
			Cooling Tower Water Use	**3**	×				**Efficiency of Water-based Cooling**	**4**	
			Water Metering	**2**	√√				**Water Feature Efficiency**	**4**	√
									Water Leakage Detection:	**6**	√
									Efficient water use during construction	**3**	
-									**Waste water management.**	**1 2**	√
-									**Sanitary Used Pip.**	**4**	√

Source of table: (Researcher)

Incompatible with Heritage Buildings | **Incompatible with Egyptian buildings conditions** × | **Recommended Credits** √√ | **Compatible with heritage building** √

5-7.The Credit points in category 2: Water Efficiency

5-7-1. Recommended credits can be added to this category

According to the recommendations of the analytical study of chapter 4, ,the followings credits will be added to green Heritage scheme of GPRS:

Table (5-19). Recommended credits can be added to the Water Efficiency category

The Source	Credits	Actions to the base (New construction rating system of GPRS)
The Recommendations of analytical study of chapter 4	▪ **Internal water use reductions,**	Modified credits
	▪ **External water use reduction,**	Modified credits
	▪ **Water meter**	Modified credit.

Source: (Researcher)

2.

5-7-2. The avoided credits from the category:

Table (5-20). The avoided credits from the Water Efficiency category.

Credit ID	Avoided credits	Reasons
	- **GPRS – NEW construction scheme**	
3.3	**Efficiency of Water-based Cooling systems:**	- This credit is not compatible heritage buildings in Egypt.
3.6	**Efficient water use during construction**	- This credit can be applied during the process of construction of new constructions only and it is no compatible with the existing building.
	- **LEED O+M**	
WE3.	**Cooling Tower Water Use**	- This credit is not compatible heritage buildings in Egypt.

Source: (Researcher)

5-7-3. The modified or maintained credits from the category:

Table (5-21). The modified or maintained credits in the Water Efficiency category.

Credit ID	The name of credit after modification	Reasons
3M.1	**Minimum Water Efficiency.**	- It is a recommended credit according to table (5-19). - The research adopts the name of the same credit that exists in new construction scheme in GPRS. - The credit " **Internal water use** " in **BREEAM domestic** and credit " **Internal Water Consumption** " in **BREEAM 2014 refurbishment** have the similar aim of the credit, but the research prefers to apply the requirements of " **Indoor Water Use Reduction**" in **LEED O+M** as calculations, and how to determine the base line of the water use , using UPC and IPC standards as reference in achieving the requirements of this credit . - The research added the bidet fixture to the calculations that is used in all the Egyptian buildings.
3.M.2	**Water Use Monitoring:**	- It is a recommended credit according to table (5-19). - The credit **"Building-Level Water Metering" in LEED O+M** ", credit " **Water Meters** " in **BREEAM domestic** and credit " **Water Meters** " in **BREEAM 2014 refurbishment** have the similar aim of the credit that exists in new construction scheme in GPRS. - The research adopts the name and the requirement of the same credit that exists in new construction scheme in GPRS.
.3.1	**Indoor Water Efficiency Improvement:**	- It is a recommended credit according to table (5-19). - The credit "**Indoor water use reduction"** in **LEED O+M** has the same aim of the credit **"indoor Water Efficiency Improvement**" in new construction in GPRS. - The research adopts in this credit, the name, and the aim which can be awarded the same credit that exists in new construction scheme in GPRS. - Some modifications have carried out in the points of this credit.

Source: (Researcher)

Table (5-21)continued . The modified or maintained credits in the Water Efficiency category.

Credit ID	The name of credit after modification	Reasons
3.2.	**Outdoor Water Efficiency Improvement recommends to be replaced by (Water Efficient Landscaping).**	- It is a recommended credit according to table (5-19). - The credit "Indoor **water use reduction"** in **LEED O+M** has the same aim of the credit **"indoor Water Efficiency Improvement**" in new construction in GPRS. - The research adopts in this credit, the name, the aim, and the points which can be awarded the same credit that exists in new construction scheme in GPRS.
3.3	**Water Feature Efficiency.**	- The research adopts in this credit, the name, and the aim, of the same credit that exists in new construction scheme in GPRS. - The research modified some requirements of new construction credit to be compatible with the heritage water features in the project (if they exist). - The credit has three options; if the project meets one of them, it will be able to award 4 points.
3.4	**Water Leakage Detection.**	- The research adopts in this credit, the name, the aim, and the points of the same credit that exists in new construction scheme in GPRS with no change.
3.5	**Waste water management.**	- The research adopts in this credit, the name, the aim, and the points of the same credit that exists in new construction scheme in GPRS with no change.
3.6	**Sanitary Used Pipes:**	- The research adopts in this credit, the name, and the aim, of the same credit that exists in new construction scheme in GPRS. - The research modified some requirements of new construction credit to be compatible with the existing buildings.

Source: (Researcher)

5-7-4. The Methodology for set credits of "Water Efficiency" category:

- The category was avoided two credits " **Efficiency of Water-based Cooling, and Efficient water use during construction**" from the New construction scheme of GPRS in this scheme.

- There is no change in the name of this category than the same credit in the New construction scheme of GPRS in this scheme.
- There are some modifications in the requirements of the other credits to be compatible with the heritage buildings.

5-7-5. Set the points of each credit:

Table (5-22) credit points of the Water Efficiency of the Green Heritage scheme of GPRS

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System						
CATEGORY 6: Management, Waste, and Pollution weight is 35% of the total						
Credit ID	The name of credit	Old Points In NC-GPRS	action	Points Residential	Points Non-Residential	Reasons
3M.1	**Minimum Water Efficiency.**	**M**	-	**M**	**M**	-
3.M.2	**Water Use Monitoring.**	**M**	-	**M**	**M**	
3.1	**Indoor Water Efficiency Improvement.**	**8**	-	**8**	**8**	-
3.2	**Outdoor Water Efficiency Improvement recommend to be replaced by (Water Efficient Landscaping).**	**9**	-	**9**	**9**	-
3.3	**Water Feature Efficiency.**	**4**	-	**4**	**4**	-
3.4	**Water Leakage Detection:**	**6**	-	**6**	**6**	-
3.5	**Waste water management.**	**12**	-	**12**	**12**	-
3.6	**Sanitary Used Pipes.**	**4**	-	**4**	**4**	-
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 5: INDOOR ENVIRONMENTAL QUALITY		**50**	**-7**	**43**	**43**	Two avoided Credits have 7 points

Source: (Researcher)

5-7-6. Details of credit points:

Table (5-23) credit points of the Water Efficiency of the Green Heritage scheme of GPRS

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System			
CATEGORY 1: WATER EFFICIENCY weight is 35% of the total			
Credit ID	Credit	**Residential**	**Non-Residential**
3M.1	**Minimum Water Efficiency:**	**M**	**M**
	Demonstrate, by means of a parametric analysis report, the percentage of improvement of potable water consumption will be no less than 20%. The baseline and annual designed water use can be calculated as showed in the techniques part of this credit. ** the decision of replacement of the old sanitary fixtures will be defined by project team according to the percentage of improvement of water use.		
Techniques	Calculate the total water use of the building: **Step 1:** Determine the average total annual water consumption of the building during the last 5 years from water bills. **Step 2:** Determine the project occupancy: the number of users/ resident. **Step 3:** Gender ration: the default gender mix is half male and half female, except the building has one gender only, ex. school for girls. Table (5-24), table (5-25), table (5-26) **Step 4**:complete calculations , table (5-27) Day water use of each fixture= fixture flush × duration × users × uses per person per day **Step 5 :** Determine the total annual designed water use of the heritage building. annual water use of each fixture = daily water use of fixture × numbers of days per year Total annual designed water use = summation of annual water use for all fixture **Step 6 :** Determine the percentage of improvement in water reduction, table (5-28) $\text{Percentage Of expected Improvement} = \frac{\text{baseline annual average} - \text{annual designed water use}}{\text{baseline annual average}} \times 100\%$		
3.M.2	**Water Use Monitoring:**		
Description	Demonstrate that efficient, regularly calibrated, easily accessible and clearly labelled water meters are provided and capable of monitoring the total water consumption.		

Source: (Researcher)

Table (5-23) continued credit points of the Water Efficiency of the Green Heritage scheme of GPRS

Techniques	Install water meters for measure the total water consumption.	**M**	**M**
3.1	**Indoor Water Efficiency Improvement:**		
Description	A maximum 8 credit points are obtainable for demonstrating that the proposed building has achieved a sensible reduction in indoor potable water consumption (not including irrigation) than the annual average water use baseline calculated for the building compared to the designed water use in 3M.1 (above). Calculations are based on using efficient, accessible, and clearly labelled water metering devices, and estimated occupant usage, and the use of conserving (saving) water and sanitary devices (fixtures) rather than the conventional ones (lavatory faucets, showers , kitchen sinks, water closets, and urinals). A maximum 8 credit points can be awarded as following: Reduction 21-30% 31-40% 41-50% More than 50%	 2 4 6 8	 2 4 6 8
Techniques	Use high efficient fixtures as mentioned in 3M.1 to reduce the total water consumption.		
3.2	**Outdoor Water Efficiency Improvement recommend to be replaced by (Water Efficient Landscaping):**		
Description	A maximum 9 credit points credit points are obtainable for demonstrating that: ▪ An Irrigation Operation and Maintenance plan has been developed; ▪ A water-efficient irrigation system is incorporated into landscape design; ▪ Landscape irrigation demand is less than 5 litres/m2/day average; ▪ Landscape irrigation demand is less than 3 litres/m2/day average; ▪ 100% exterior irrigation demand is met using Exterior Water Allowance; ▪ Reused grey water is maximized OR a recycled water mainline loop has been installed in anticipation for the availability of reused grey water; ▪ Color coding of pipes is used to distinguish recycled water from potable. ▪ Use of water treated and raw water resources by a public agency specifically for non-potable uses.	**2** **1** **1** **1** **1** **1** **1** **1**	**2** **1** **1** **1** **1** **1** **1** **1**

Source: (Researcher)

Table (5-23) continued credit points of the Water Efficiency of the Green Heritage scheme of GPRS

Techniques	- Install Drip irrigation. - Use gray water or recycled water to irrigation - Use native plants and reduce using turf grass that consumed more quantity of water. - Use irrigation moisture sensors.		
3.3	**Water Feature Efficiency:**		
Description	Credit points are obtainable for demonstrating that a) EITHER that the Project has no exterior water features or swimming pools. b) Using treated gray water for them such as: fountains. c) OR that all external water features or swimming pools are provided with adequate retractable shading covers or pool blankets ** The team of the project must obtain an agreement from the urban harmony organization or its representatives in Egyptian governorates or the Ministry of Antiquities; about any shading covers the water features, to don't have a negative impact on their heritage value.	4	4
Techniques	− Don't install new water features. − Or using treated gray water for water features as fountains. − Or using shading covers for swimming pools to reduce the rate of evaporations.		
3.4	**Water Leakage Detection:**		
Description	A maximum 6 credit points are obtainable for demonstrating the provision of: ▪ Easily accessible and clearly labelled water meters that are capable of monitoring the water consumption of major uses of water; ▪ A leak detection system that covers all main water distribution pipes within the project.	3 3	3 3
Techniques	− Labelled water meters measure major uses. − Install a leak detection system.		
3.5	**Waste water management.**		
Description	A maximum 12 credit points are obtainable for demonstrating that: - No un-treated water will enter the local environment (for example, into surfaces, deep wells, rivers, and enclosed lakes) or affect neighboring developments; all in accordance with National Environmental Laws. (***Obligatory Issue***), supporting documentation should include: drawings showing the proposed systems and relevant calculations, specifications and data sheets**.**	6	6

Source: (Researcher)

Table (5-23) continued credit points of the Water Efficiency of the Green Heritage scheme of GPRS

Description	- Ensuring that the reused treated waste water generation quality must complying the standards as prescribed in the Egyptian Environmental Laws (In case the water quality cannot be ensured, provide necessary treatment of raw water for achieving the desired concentration for various applications). (***Obligatory Issue***) - Reduce potable water use for building sewage conveyance by use of non-potable water (captured rainwater, or recycled grey water).	4 2	4 2
Techniques	- Using captured rainwater gray water for non-potable water purposes. - Treating the recycled water before use according to standards. - Don't use untreated water or raw water.		
3.6	**Sanitary Used Pipes:**		
	Replace the old sanitary pipes that have water leakage or manufactured from with non-secure materials for human health with new sanitary pipes that have the following: - Certified sanitary pipes material which secures water quality, cleanliness and sustainability for human use. - - Tested sanitary systems which ensure the high level of installation.	2 2	2 2
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 1: WATER EFFICIENCY		**43**	**43**

Source: (Researcher)

Table (5-24) the rate usage of Full time employee (FTE) Man and female of the WCs fixtures

FTE[2] (8hrs)	**WC**	**Urinal**	**Lavatory**		**Kitchen sink**		**Hydroject Bidet**
Man	1	2	3	30 sec per use	1	per 15 sec use	1
Female	3	0	3	30 sec per use	1	per 15 sec use	3

Source: (Researcher)

Table (5-25) the rate usage of Student and visitors (Man and female) of the WCs fixtures

Student/visitor	**WC**	**Urinal**	**Lavatory**		**Kitchen sink**		**Hydroject Bidet**
Man	0.1	0.4	0.5	30 sec per use	-		0.1
Female	0.5	0	0.5	30 sec per use	-		0.50

Source: (Researcher)

2 FTE: a full time equivalent such as employees and staff, that work 8 hours per day- 5 days per week.

Table (5-26) the rate usage of residents (Man and female) of the WCs fixtures

Resident	WC	Urinal	Lavatory	shower		Kitchen sink		Hydroject Bidet
Man	5	0	5	1	480 sec per use	4	60 Sec per use	5
Female	5	0	5	1	480 sec per use	4	60 sec per use	5

Source: (Researcher)

Table (5-27) the Baseline standards of sanitary fixtures

Baseline/ standard UPC[3]/IPC [4]standards	
Fixture or Fitting	**Baseline**
Conventional water facet/commercial toilet/ residential toilet	**1.6** gallons per flush (gpf)
Conventional urinal	**1.0** gallons per minite (gpm)
Conventional private [5] / public lavatory/ residential lavatory	**2.2** gallons per minite (gpm)
Residential kitchen faucet/ Kitchen sink	**2.2** gallons per minite (gpm)
Conventional showerheads	**2.5** gallons per minite (gpm)
Residential clothes washer	Energy Star[6] / or equalivant standard.
Commercial clothes washer	CEE[7] Tier 3A / or equalivant standard.
Residential dishwasher	Energy Star / or equalivant standard.
Preinse spray value	Less than or equal **1.3** gallons per minute (gpm)
Hydroject Bedit/ Hand held Bidet[8]	0.8 gallon per use[9]

Source: (Researcher)

[3] UPC: Uniform Plumping Code 2006, section 402.0, water-conserving fixtures and fittings: iapmo.org.
[4] IPC: International Plumping Code 2006, section 604, design of building water distribution system: iccsafe.org.
[5] Private fixtures: that are located in residences, hotel/ motel guest room, private room at hospitals.
[6] Energy star: energystar.gov
[7]CEE : Consortium for Energy Efficiency Label, cee1.org.
[8] The research add bidet to the calculations for using it in Egypt compared with USA that use the toilet paper.
[9] http://www.scientificamerican.com/article/earth-talks-bidets/

Table (5-28) the standards of high efficient sanitary fixtures

fixture	consumption
High efficient toilet, single- flush gravity, water sense standard toilet	**1.28** gallons per flush (gpf)
High efficient single – flush- pressure assist	**1.0** gallons per flush (gpf)
High efficient dual – flush- (full flush)	**1.6** gallons per flush (gpf)
High efficient dual – flush- (low flush)	**1.1** gallons per flush (gpf)
High efficient dual – flush- (foam flush)	**0.05** gallons per flush (gpf)
No-water toilet	**0 gallons**
High efficient urinal/ EPA urinal	0.5 gallons per flush (gpf)
No-water urinal	**0 gallons**
EPA[10] private lavatory	**1.5** gallons per minute (gpm)
Conventional public lavatory	**0.5** gallons per minute (gpm) Or **0.25** gallons per circle. **,** circle = 12 seconds
Low- flow kitchen sink	**1.8** gallons per minute (gpm)
Low- flow shower	**1.8** gallons per minute (gpm)
EPA shower	**1.5- 2** gallons per minute (gpm)

Source: (Researcher)

[10] EPA: The Energy Policy Act pf 1992 and 2005.

GREEN HERITAGE RATING SYSTEM SCHEME

GREEN PYRAMID RATING SYSTEM (GPRS)

MATERIALS AND RESOURCES CATEGORY

WEIGHT 5%

Table (5-29). Comparing between the four rating Systems in the Materials category

Applied for Heritage Buildings									New- Buildings		
Residential uses			All uses (Residential and non-residential Building)			Non-residential uses			New construction		
BREEAM refurbishment domestic buildings (2014			**LEED O+M**			**BREEAM 2014 Refurbishment and Fit-Out**			**Green Pyramid rating system- New construction**		
– **Materials**			- **Materials and Resources**			- **Materials**			- **Materials and Resources**		
Environmental Impact of Materials	**25**	√√	**Ongoing Purchasing and Waste Policy**	**M**	×	**Environmental impact of materials**	**6**	√√	**Presentation of a Schedule of Principal Project Materials**	**M**	√
Responsible Sourcing of Materials	**12**	√√	**Facility Maintenance and Renovations Policy**	**M**	×	**Responsible sourcing of materials**	**4**	√√	**Elimination of exposure to hazardous and toxic materials**	**M**	√
Insulation	**8**	×	**Purchasing- Ongoing**	**1**	×	**Insulation**	**1**	×	**Regionally procured materials**	**3**	√√
			Purchasing- Lamps	**1**	×	**Designing for durability and resilience ****	**1**	√	**Materials fabricated on site.**	**1**	
			Purchasing- Facility Management and Renovation	**2**	×	**Material efficiency**	**1**	×	**Use of readily renewable materials**	**3**	
									Use of salvaged materials	**3**	
									Use of recycled materials	**4**	√√
									Use of lightweight materials	**1**	
									Use of higher durability materials.	**1**	√
-									**Use of prefabricated elements**	**3**	

Source of table: (Researcher)

Incompatible with Heritage Buildings (grey) | **Incompatible with Egyptian buildings conditions** (×) | **Recommended Credits** (√√) | **Compatible with heritage building** (√)

5-8.. The Credit points in category 4: Materials and Resources

5-8-1. Recommended credits can be added to this category

According to the recommendations of the analytical study of chapter 4, ,the followings credits will be added to green Heritage scheme of GPRS:

Table (5-30). Recommended credits can be added to the Materials category

The Source	Credits	Actions to the base (New construction rating system of GPRS)
The Recommendations of analytical study of chapter 4	▪ **Environment impact of materials,**	New added credit
	▪ **Local regional materials,**	Modified credits
	▪ **Materials reuse**	Modified credit.

Source: (Researcher)

5-8-2. The avoided credits from the category:

Table (5-31). The avoided credits from the Materials category.

Credit ID	Avoided credits	Reasons
	- **GPRS – NEW construction scheme**	
4.2.	**Materials fabricated on site.**	this credit is not compatible with existing buildings rating system
4.3.	**Use of readily renewable materials**	this credit is not compatible with existing buildings rating system
4.4.	**Use of salvaged materials**	this credit is not compatible with existing buildings rating system
4.6.	**Use of lightweight materials**	this credit is not compatible with existing buildings rating system
4.8.	**Use of prefabricated elements**	this credit is not compatible with existing buildings rating system
	- **LEED O+M**	
MS.Preq1.	**Ongoing Purchasing and Waste Policy**	This credit is not compatible with the Egyptian buildings' systems

Source: (Researcher)

Table (5-31) continued. The avoided credits from the Materials category.

Credit ID	Avoided credits	Reasons
MS.Preq2.	**Facility Maintenance and Renovations Policy**	This credit is not compatible with the Egyptian buildings' systems
MS.1.	**Purchasing- Ongoing**	This credit is not compatible with the Egyptian buildings' systems
MS.2.	**Purchasing- Lamps**	This credit is not compatible with the Egyptian buildings' systems
MS.3.	**Purchasing- Facility Management and Renovation**	This credit is not compatible with the Egyptian buildings' systems
	- **BREEAM 2014 Refurbishment and Fit-Out**	
Mat04	**Insulation**	- The thermal insulation in the buildings that are located in the United Kingdom must include all external walls of the buildings and roofs due to very cold weather. For that, BREEAM has set an insulation credit in the existing building schemes to ensure the high thermal performance of the building. In Egypt, the thermal insulation of buildings as general is limited to the buildings' roof. For that, this credit is not compatible with the system of Egyptian buildings.
Mat06	**Material efficiency**	- This credit is not compatible with the Egyptian buildings' systems
	BREEAM Domestic Refurbishment	
Mat03	**Insulation**	- The thermal insulation in the buildings that are located in the United Kingdom must include all external walls of the buildings and roofs due to very cold weather. For that, BREEAM has set an insulation credit in the existing building schemes to ensure the high thermal performance of the building. In Egypt, the thermal insulation of buildings as general is limited to the buildings' roof. For that, this credit is not compatible with the system of Egyptian buildings.

Source: (Researcher)

5-8-3. The modified or maintained credits from the category:

Table (5-32). The modified or maintained credits in the Materials category.

Credit ID	The name of credit after modification	Reasons
4M.1	**Presentation of a Schedule of Principal Project Materials which lists all new significant building materials to be used in the restoration and greening Project of the heritage building. Information to be provided on the quantity, cost, and origin of the materials and transportation to the site.**	- The research adopts the name of the same credit that exists in new construction scheme in GPRS. - The research has modified the name of the credit to include only the new materials that are used in the restoration and greening project.
4M.2	**Elimination of exposure of building occupants to asbestos and to any other hazardous and toxic materials.**	- The research adopts the name of the same credit that exists in new construction scheme in GPRS. - The research provided to obtain an agreement from Urban Harmony Organization or its representatives to remove or replace the hazardous materials.
4.1	**Regionally procured materials:**	- It is a recommended credit according to the table (5-30). - The research adopts the name of the same credit that exists in new construction scheme in GPRS. - The research has modified the aim of the credit to include only the new purchased materials that are used in the restoration and greening project. - The research provided that the new material must be compatible with the heritage character of the building and committee the project team to obtain an agreement from Urban Harmony Organization for the compatibility of the new materials with the heritage values of the building.

Source: (Researcher)

Table (5-32) continued. The modified or maintained credits in the Materials category.

Credit ID	The name of credit after modification	Reasons
4.1	**Regionally procured materials:**	- The credit " **Responsible Sourcing of Materials"** in **BREEAM 2014 refurbishment and BREEAM Domestic** has the same aims of this credit
4.2	**Use of recycled materials.**	- It is a recommended credit according to the table (5-30). - The research adopts the name of the same credit that exists in new construction scheme in GPRS. - The research has modified the aim of the credit to include only the new purchased materials that are used in the restoration and greening project. - The research provided that the recycled material must be compatible with the heritage character of the building and committee the project team to obtain an agreement from Urban Harmony Organization for the compatibility of the recycled materials with the heritage values of the building.
4.3	**Use of higher new durability materials.**	- The research adopts the name of the same credit that exists in new construction scheme in GPRS. - The research has modified the name and aim of the credit to include only the new purchased materials that are used in the restoration and greening project. - The research provided that the new durability materials must be compatible with the heritage character of the building and committee the project team to obtain an agreement from Urban Harmony Organization.

Source: (Researcher)

5-8-4. The new added credits:

Table (5-33). The new added credits to the Materials category.

Credit ID	New added credits	Reasons
4.4.	**Designing for durability and resilience**	- The research adopts in this credit, the name, and the aim of the credit " **Designing for durability and resilience"** in **BREEAM 2014 refurbishment.** - The research gave this credit 6 points for non-residential buildings and 4 points for residential buildings for preserving the values of heritage buildings and protecting vulnerable and high value parts of the building from damage. - The research adopts to obtain an agreement for the plan of protecting vulnerable and high value parts of the building from the Urban Harmony organization or its representatives in Egyptian Governorates.
4.5.	**Environmental impact of materials**	- It is a recommended credit according to the table (5-30). - This credit is derived from the credit "**Environmental Impact of materials**" that exists in the **BREEAM 2014 refurbishment and BREEAM domestic.**

Source: (Researcher)

5-8-5. The Methodology for set credits of "Materials and Resources" the scheme:

- Most of the category "Materials and resources" in New constructions scheme in GBRS has avoided in "the Materials and Resources" of Green Heritage Buildings scheme - GBRS, such as " **Materials fabricated on site, Use of readily renewable materials**, **Use of salvaged materials**, **Use of lightweight materials and use of prefabricated elements"** that have great impact on the efficiency of Materials and resources when they apply to new buildings, and have little impact on the heritage building that conservation strategy don't depend on adding new materials but retaining and restoring the existing materials.

- There are three new added credits in Green Building rating system "**Designing for durability and resilience**", " **Environmental Impact of Materials**" and "**Environmental impact of materials**".

5-8-6. Set the points of each credit:

Table (5-34) credit points of the Materials and Resources of the Green Heritage scheme of GPRS

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System						
CATEGORY 4: Materials and Resources weight is 5% of the total						
Credit ID	The name of credit	Old Points In NC-GPRS	action	Points Residential	Points Non-Residential	Reasons
4M.1	**Presentation of a *Schedule of Principal Project Materials***	**M**		**M**	**M**	-
4M.2	**Elimination of exposure of building occupants to asbestos and to any other hazardous and toxic materials.**	**M**		**M**	**M**	-
4.1	**Regionally procured materials**	**3**		**3**	**3**	-
4.2	**Use of recycled materials:**	**4**		**4**	**4**	-
4.3	**Use of higher new durability materials.**	**1**	**+1**	**2**	**2**	Has a low importance
4.4.	**Designing for durability and resilience**	**-**	**+6**	**4**	**6**	Has high importance
4.5.	**Environmental Impact of Materials**	**0**	**+4**	**4**	**4**	Has a medium importance
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 4: Materials and Resources		**19**	**+7**	**17**	**19**	five avoided Credits from the category have 11 points

Source: (Researcher)

5-8-7. Details of credit points:

Table (5-35) credit points of the Materials and Resources of the Green Heritage scheme of GPRS

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System			
CATEGORY 4: Materials and Resources weight is 5% of the total			
Credit ID	Credit	Residential	Non-Residential
4M.1	**Presentation of a *Schedule of Principal Project Materials* which lists all new significant building materials to be used in the restoration and greening Project of the heritage building. Information to be provided on the quantity, cost, and origin of the materials and transportation to the site.**	**M**	**M**
4M.2	**Elimination of exposure of building occupants to asbestos and to any other hazardous and toxic materials.**	**M**	**M**
Description	Replacing all asbestos and other hazardous and toxic materials with other materials that don't have a bad impact on human health. **There is a need to obtain an agreement about **The report of the policy of replacement the hazardous materials of the heritage building** from the Urban Harmony organization or its representatives in Egyptian Governorates.		
Techniques	**The report of the policy of replacement the hazardous materials of the heritage building**, this report shows the quantity of materials, location of them, their heritage value, the specification of new ones, their cost, their impacts on health and on the heritage value of the heritage building.		
4.1	**Regionally procured materials (to reduce the environmental impact of transportation) :**		
Description	Credit points are obtainable for demonstrating that new materials that use in the restoration and greening project are extracted and manufactured in Egypt. Points awarded as follows (select one of the followings): ▪ Value of regional materials is not less than 25% of total new materials value; ▪ Value of regional materials is not less than 50% of total new materials value; ▪ Value of regional materials is not less than 75% of total new materials value. ** The new materials must be compatible with the heritage character and heritage fabric of the building. ** There is a need to obtain an agreement about the new materials report from the Urban Harmony	**1** **2** **3**	**1** **2** **3**

Source: (Researcher)

Table (5-35) continued. credit points of the Materials and Resources of the Green Heritage scheme of GPRS

	organization or its representatives in Egyptian Governorates.		
Techniques	Purchased materials are extracted and manufactured in Egypt.		
4.2	**Use of recycled materials:**	**4**	**4**
Description	Credit points are obtainable (with evidence) for the use of recycled materials, as follows: − Demonstrate that materials of at least 10% of the total new material costs are constituted of at least: a) 30% post-consumer recycled content, or b) 80% post-industrial content, or c) 50% agricultural waste by-products. ** The new materials must be compatible with the heritage character and heritage fabric of the building. ** There is a need to obtain an agreement about the new materials report from the Urban Harmony organization or its representatives in Egyptian Governorates.		
Techniques	- Purchased recycled materials (post-consumer materials, post-industrial materials, manufactured from agriculture waste).		
4.3	**Use of higher new durability materials.**	**2**	**2**
Description	A credit point is obtainable where it can be demonstrated that at least 25% (by value) of total new materials have higher abrasion resistance and minimal maintenance costs in comparison with similar conventional materials. ** The new materials must be compatible with the heritage character and heritage fabric of the building. ** There is a need to obtain an agreement about the new materials report from the Urban Harmony organization or its representatives in Egyptian Governorates or the Ministry of Antiquities.		
Techniques	− The new materials that are purchased have higher abrasion resistance and minimal maintenance costs		
4.4.	**Designing for durability and resilience**	**0**	**2**
	Protecting vulnerable and high value parts of the building from damage. a) Protect corridors, stairs, doors, valuable floors and main entrances that have high heritage value from the effects of high pedestrian traffic.		

Source: (Researcher)

Table (5-35) continued. credit points of the Materials and Resources of the Green Heritage scheme of GPRS

	b) Protection against, or prevention from, any potential vehicular collision where vehicular parking and maneuvering occurs within 1m of the external building façade for all car parking areas and within 2m for all delivery areas.	**2**	**2**
	c) Set a plan to protect the existing building elements such as "external walls, roof, balconies, glazing of windows and skylights, external doors, blasters. Claddings, external staircase, hardscaping" that are exposed to the environmental factors as "solar radiation, temperature variation, moisture, wind, rain, vegetation, pollutants, and air and ground contaminants". ** There is a need to obtain an agreement for the plan of protecting vulnerable and high value parts of the building from the Urban Harmony organization or its representatives in Egyptian Governorates or the Ministry of Antiquities.	**2**	**2**
	▪ Set a plan for protecting vulnerable and high value parts of the building from damage or degradation effects. ▪ Adopts some procedures in residential and non-residential heritage buildings such as: – Commit the visitors to takeoff their shoes or wearing fabric slippers to protect high value floor, wooden staircases and carpets from the effects of high pedestrian traffic. – Protection rails to protect walls of corridors and vulnerable and high value parts such as decorative blasters – Ensuring good conditions for vulnerable and high value parts of the building to protect them from the effects of moisture and vegetation. – Bollards/barriers/raised kerbs to delivery and vehicle drop-off areas. – Robust external wall construction, up to 2m high, – Designing out the risk without the need for additional materials specification to protect vulnerable areas.		

Source: (Researcher)

Table (5-35) continued. credit points of the Materials and Resources of the Green Heritage scheme of GPRS

4.5.	**Environmental Impact of Materials**		
	▪ This credit aims to reduce the environmental life cycle through the reuse of materials and use new materials with low environmental impact of martials through: – Use of tools to analyze the life cycle impact of any new materials using robust environmental information assessment of the main building elements.	**4**	**4**
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 4: MATERIALS AND RESOURCES		**17**	**19**

Source: (Researcher)

GREEN HERITAGE RATING SYSTEM SCHEME

GREEN PYRAMID RATING SYSTEM (GPRS)

INDOOR ENVIRONMENTAL QUALITY CATEGORY

WEIGHT 10%

Table (5-36). Comparing between the four rating Systems in the Indoor Environmental Quality

Applied for Heritage Buildings									New- Buildings		
Residential uses			All uses (Residential and non-residential Building)			Non-residential uses			New construction		
BREEAM refurbishment domestic buildings (2014			**LEED O+M**			**BREEAM 2014 Refurbishment and Fit-Out**			**Green Pyramid rating system- New construction**		
– Health and wellbeing – Management			**- Indoor Environmental Quality**			**- Health and wellbeing**			**- Indoor Environmental Quality**		
Daylighting	**2**	√√	**Minimum Indoor Air Quality Performance**	**M**	√√	**Visual Comfort****	**7**	√√	**Minimum Ventilation and Indoor Air Quality**	**M**	√√
Sound Insulation**	**4**	×	**Environmental Tobacco Smoke Control**	**M**	√	**Indoor air quality****	**5**	√	**Control of Smoking in and around the Building**	**M**	√
Volatile Organic Compounds	**1**	√√	**Green Cleaning Policy**	**M**	×	**Safe Containment in laboratories**	**2**	×	**Control of Legionella and other health risks**	**M**	√
Inclusive Design	**2**	×	**Indoor Air Quality Management Program**	**2**	×	**Thermal Comfort****	**3**	√	**Optimized Ventilation**	**5**	√√
Ventilation**	**2**	√√	**Enhanced Indoor Air Quality Strategies**	**2**	√	**Acoustic performance****	**4**	×	**Controlling emissions from building materials**	**5**	√√
Safety	**1**	√	**Thermal Comfort**	**1**	√	**Safety and Security**	**1**	×	**Thermal Comfort**	**2**	√
Security	**2**	×	**Interior Lighting**	**2**	√				**Visual Comfort**	**2**	

Source of table: (Researcher)

Incompatible with Heritage Buildings | **Incompatible with Egyptian buildings conditions** × | **Recommended Credits** √√ | **Compatible with heritage building** √

Table (5-36) continued. Comparing between the four rating Systems the Indoor Environmental Quality

BREEAM refurbishment domestic buildings (2014			LEED O+M			BREEAM 2014 Refurbishment and Fit-Out			Green Pyramid rating system- New construction		
-			Daylight and Quality Views	4	√√				Acoustic Comfort	1	
-			Green Cleaning-Custodial Effectiveness Assessment	1	×						
			Green Cleaning-Products and Materials	1	×						
			Green Cleaning-Equipment	1	×						
			Integrated Pest Management	2	×						
			Occupant Comfort Survey	1	×						

Source of table: (Researcher)

Incompatible with Heritage Buildings | Incompatible with Egyptian buildings conditions × | Recommended Credits √√ | Compatible with heritage building √

5-9. The Credit points in category 5: INDOOR ENVIRONMENTAL QUALITY

5-9-1. recommended credits can be added to this category

According to the recommendations of the analytical study of chapter 4, ,the followings credits will be added to green Heritage scheme of GPRS:

Table (5-37). Recommended credits can be added to the indoor environmental category

The Source	Credits	Actions to the base (New construction rating system of GPRS)
The Recommendations of analytical study of chapter 4	▪ **Minimum indoor air quality,**	Modified credits
	▪ **Reduce VOCs**	Modified credits
	▪ **Daylighting**	New added credit
	▪ **CO2 monitor**	New added credit

Source: (Researcher)

5-9-2. The avoided credits from the category:

Table (5-38). The avoided credits from the indoor environmental category.

Credit ID	Avoided credits	Reasons
	- **GPRS – NEW construction scheme**	
	Acoustic Comfort	Most of the heritage buildings in Egypt were constructed by bearing wall systems, they characterize with thick walls that achieve good rate sound insulation between spaces. For that the research has avoided this credit.
LEED O+M		
IQ.preq.3	**Green Cleaning Policy**	This credit doesn't be compatible with the buildings system in Egypt.
IQ.1	**Indoor Air Quality Management Program**	This credit doesn't be compatible with the system of this rating system scheme.

Source: (Researcher)

Table (5-38) continued. The avoided credits from the the indoor environmental category.

Credit ID	Avoided credits	Reasons
IQ.7	**Green Cleaning-Products and Materials**	This credit doesn't be compatible with the buildings system in Egypt.
IQ.8	**Green Cleaning-Equipment**	This credit doesn't be compatible with the buildings system in Egypt.
IQ.9	**Integrated Pest Management**	This credit doesn't be compatible with the buildings system in Egypt.
IQ.10	**Occupant Comfort Survey**	This credit doesn't be compatible with the system of this rating system scheme.
BREEAM Domestic		
Hea04	**Inclusive Design**	This credit does not be compatible with the Egyptian buildings system.
Hea02	**Sound Insulation**	The criteria for this credit have an explicit requirement to obtain confirmation from a conservation officer. Most of the heritage buildings in Egypt were constructed by bearing wall systems, they characterize with thick walls that achieve sound insulation between spaces. For that the research has avoided this credit.
Man04	**Security**	- According to the conclusions of chapter 4, this credit aims to change the old external doors with new doors have a strong frame with double glazed to achieve minimum security requirements. That could need to replace the windows of the ground floor with new one have the same requirement or put metal cover on the existing windows; these will have a negative impact on the values of these heritage objects. - For that the research has avoided this credit.
- BREEAM Refurbishment		
Hea01	**Visual Comfort**	The regulations of listed heritage building in Egypt could require the retention of existing listed lighting features, and the original size and materials of opening windows and glazed doors. For that the research has avoided this credit.

Source: (Researcher)

Table (5-38) continued. The avoided credits from the indoor environmental category.

Credit ID	Avoided credits	Reasons
Hea03	**Safe Containment in laboratories**	This credit doesn't be compatible with the heritage buildings in Egypt.
Hea05	**Acoustic performance**	Most of the heritage buildings in Egypt were constructed by bearing wall systems, they characterize with thick walls that achieve good rate sound insulation between spaces. For that the research has avoided this credit.
Hea06	**Safety and Security**	This credit aims to promote the safe and secure use and access to and from the building, replacing the old windows and doors of the heritage building will harm and lose the values of heritage buildings. For that the research has avoided this credit.

Source: (Researcher)

5-9-3. The modified or maintained credits from the category:

Table (5-39). The modified or maintained credits in the indoor environmental category.

Credit ID	The name of credit after modification	Reasons
5M.1	**Minimum Ventilation and Indoor Air Quality:**	- It is a recommended credit according to the table (5-37). - The credit "**Ventilation**" in **BRREAM Domestic** has special requirements related to the heritage building will be taken into account for this credit. - The research was adopted the steps/ standards and requirements of "**Minimum indoor quality performance**" in **LEED O+M** to achieve this credit. - The research has also adapted some criteria from the "**Minimum ventilation and indoor quality**" in a new-construction scheme in **GPRS**.

Table (5-39) continued. The modified or maintained credits in the indoor environmental category.

Credit ID	The name of credit after modification	Reasons
5M.1	**Minimum Ventilation and Indoor Air Quality:**	- The requirement of the "**Indoor air quality**" in **BREEAM Refurbishment** that related to ventilation was taken into account in the requirements of Mechanically spaces part of this credit .
5M.2	**Control of Smoking in and around the Building:**	- The research adopts the name of the same credit that exists in new construction scheme in GPRS with no change. - The credit "**Environmental Tobacco smoke control**" in LEED O+M has the same aim of this credit.
5M.3	**Control of Legionella and other health risks:**	- The research adopts the name of the same credit that exists in new construction scheme in GPRS with no change. - The credit "**Environmental Tobacco smoke control**" in LEED O+M has the same aim of this credit.
5.1.	**Enhanced Indoor quality strategy**	- It is a recommended credit according to the table (5-37). - The research was modified the name of the credit "**Optimized ventilation**" that exists in New construction scheme in **GPRS** to " **Enhanced Indoor quality strategy**", one of the aims of the first credit is increasing the fresh air ventilation rate of 15% over the base case determined in item 5M.1. This will need more modifications on the heritage building, by increasing the size of the opening or by install mechanical ventilation if the spaces of the building naturally ventilation. - The item 5M.1 ensures the minimum air ventilation of the heritage building's spaces for achieving the minimum rate of comfortable and health air of occupants and users with limited or no change of the heritage fabric of the heritage building .

Table (5-39) continued. The modified or maintained credits in the indoor environmental category.

Credit ID	The name of credit after modification	Reasons
5.2.	**Thermal Comfort**	- The research adopted the name and the aims of this credit from the credit "**Thermal Comfort**" in new construction scheme- GPRS. - The requirement "thermal comfort sensors" that added to this credit has derived from the "Thermal Comfort" in **LEED O+M** that also adopted the ASHRAE 55 as this credit's standard. - This credit also derived some criteria from the credit "**Thermal comfort**" of **BREEAM Refurbishment** that has special requirements related to heritage buildings.
5.6.	**Controlling emissions from building materials**	- It is a recommended credit according to the table (5-37). - The research adopts the name and the aims and requirements of the same credit exists in new construction in GPRS. - **The credit "Volatile Organic Compounds**" in BREEAM domestic has the same aims of this credit

Source: (Researcher)

5-9-4. The new added credits:

Table (5-40). The new added credits to Indoor Environmental category.

The Number Of new add credit	New added credits	Reasons
5.3.	**Safety**	- It is a recommended credit according to the table (5-37). - The importance of detected the fire and carbon monoxide infiltration to protect the occupiers/users of the building from the risk and the heritage building from the risk of fire destruction. - The research derived the name of this credit and the requirements for the credit " **Safety** " in **BREEAM Domestic.**

Table (5-40). The new added credits to Indoor Environmental category.

The Number Of new add credit	New added credits	Reasons
5.4.	**Interior Lighting**	- This importance of providing the building's occupants with high quality lighting with the control system, that achieves more energy saving. - The research derived the name of this credit and the requirements for the credit " **Interior Lighting**" in **LEED O+M** after made some modification to be compatible with Egyptian case.
5.5.	**Daylighting**	- It is a recommended credit according to the table (5-37). - The research derived the name of this credit and the requirements for the credit " **Daylighting**" from the **BREEAM Domestic**, but the requirements of the credit are the same exists in the "**visual comfort**" in new construction in GRPS. - The credit "**daylight and views**" in LEED O+M and "**Visual comfort**" in BREEAM Refurbishment have the same aims of this credit.

Source: (Researcher)

5-9-5. The Methodology for set credits of " INDOOR ENVIRONMENTAL QUALITY " the scheme:

- The research has maintained the name of the credit of New-Construction GPRS in this scheme.
- The research has avoided two credits from the credits of Indoor Environmental Quality category of New-Construction scheme of GPRS, "**, Visual Comfort, and Acoustic Comfort**", added new three credits "**Safety, Interior lighting, and daylighting**",
- The research has maintained the name of mandatory credits of New-Construction scheme of GPRS in this scheme with no changed but their requirements have modified according to the heritage buildings case.

- The credit " **Optimized ventilation**" in New construction-GPRS, was replaced with credit " **Enhanced Indoor quality strategy**".

5-9-6. Set the points of each credit:

Table (5-41) credit points of the Indoor Environmental Quality category of the Green Heritage scheme of GPRS

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System						
CATEGORY 5: INDOOR ENVIRONMENTAL QUALITY weight is 10% of the total						
Credit ID	Credit	Old Points In NC-GPRS	action	Points Residential	Points Non-Residential	Reasons
5M.1	**Minimum Ventilation and Indoor Air Quality:**	**M**	**-**	**M**	**M**	-
5M.2	**Control of Smoking in and around the Building:**	**M**	**-**	**M**	**M**	
5M.3	**Control of Legionella and other health risks:**	**M**	**-**	**M**	**M**	
5.1.	**Enhanced Indoor quality strategy**	**5**	**-2**	**3**	**3**	Reduce the requirement -s
5.2.	**Thermal Comfort**	2	-	**2**	**2**	-
5.3	**Safety**	-	**+2**	**2**	**2**	has low importance
5.4.	**Interior Lighting**	-	**+2**	**2**	**2**	has low importance
5.5.	**Daylight**		**+2**	**2**	**2**	has low effect in the case of heritage buildings
5.6.	**Controlling emissions from building materials**	5	**-3**	**2**	**2**	has low effect in the case of heritage buildings
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 5: INDOOR ENVIRONMENTAL QUALITY		**15**	**+6 -8**	**13**	**13**	There are 2 avoided credits have 3 points

Source: (Researcher)

5-9-7. Details of credit points:

Table (5-42) credit points of the Indoor Environmental Quality category of the Green Heritage scheme of GPRS

<table>
<tr><th colspan="4">Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System</th></tr>
<tr><th colspan="4">CATEGORY 5: INDOOR ENVIRONMENTAL QUALITY weight is 12% of the total</th></tr>
<tr><th>Credit ID</th><th>Credit</th><th>Residential</th><th>Non-Residential</th></tr>
<tr><td>5M.1</td><td>Minimum Ventilation and Indoor Air Quality:</td><td rowspan="2">M</td><td rowspan="2">M</td></tr>
<tr><td>Description</td><td>The majority of heritage buildings are constructed of porous materials that both absorb moisture and allow it to escape. Ventilation stops this moisture building up in any one place and causing damage and problems with condensation and mold. However, heritage buildings typically have high levels of air infiltration leading to discomfort and heat loss. Heritage buildings however also typically require a higher level of infiltration to remove structural moisture in the absence of impermeable damp proofing.
For naturally ventilation spaces:
• Confirmed the minimum outdoor air opening and space configuration requirements using the natural ventilation procedure from ANSI / ASHRAE 62 or local equivalent, whichever is more stringent.
• Ventilation rates in all habitable and inhabitable spaces are sufficient to allow moisture are sufficient to allow structural moisture to be dealt with effectively.
Step 1:
• Collect the information for each naturally ventilated space (minimum celling height of the space, location of natural ventilation opening (on one side, twp opposide slides..etc), and size of the natural ventilation opening (openable area))
Step2:
• Determine the size of opening required for each space according to the standard
• for each space depended on
Step 3:
• Compare the calculation results with the information collected in step2.
**If the ventilation is not achieved the minimum standard, the project team may be able to achieve the mandatory credit through mechanical ventilation.
For Mechanically ventilation spaces or mixed-mode spaces
Step 1:
– Define the location of all air-handling units or rooftop units and ventilation fans.
– Determine the total supply for each unit.</td></tr>
</table>

Source: (Researcher)

Table (5-42) continued credit points of the Indoor Environmental Quality category of the Green Heritage scheme of GPRS

Description	– Identify the minimum supply flow. – Determine of the equipment operates in cooling mode only, or both heating and cooling modes. – Identify the locations of supply diffusers and return grilles in each space, if they are located underfloor, overhead, or side wall (for HVAC systems). **Step2:** – Confirm compliance with ANSI / ASHRAE 62 or local equivalent standard. **For mechanically ventilation spaces, must achieve the following requemnts:** • Separation distances between outdoor air intakes and any exhausts or discharge points comply with local codes or ASHRAE (whichever is more stringent); • all exhausts are located outside of the defined public realm or as defined by local code, whichever is more stringent; • all occupied areas comply with the minimum thresholds set out in ANSI / ASHRAE 62 using the ventilation rate procedure or local code, (whichever is more ** For new or existing mechanically ventilation spaces, the project team must obtain the approval of Urban Harmony organization about the plan of mechanical ventilation that includes the type of systems, location of units, if they have a negative impact on heritage building values.		
Techniques	▪ Using Natural ventilation, mechanical ventilation or mix mode ventilation. ▪ Using simulation model .		
5M.2	**Control of Smoking in and around the Building:**		
Description	- Demonstrate that smoking is prohibited throughout the building including car parks, and 25 m smoke free zones around all entrances, outdoor air intakes and operable windows. - Train all security staff for smoking control within and outside buildings. - Locate any dedicated external smoking areas away from public or high use pedestrian thoroughfares and install suitable facilities for collecting ash and cigarette ends; and install, in all dedicated external smoking areas, signage that lists the negative health impacts of smoking and details assistance for those aiming to stop.	**M**	**M**

Source: (Researcher)

Table (5-42) continued credit points of the Indoor Environmental Quality category of the Green Heritage scheme of GPRS

5M.3	**Control of Legionella and other health risks:**	M	M
Description	- Demonstrate that a Legionella Management Plan exists for all relevant water based systems, following the requirements and guidance in local health regulations		
5.1.	**Enhanced Indoor quality strategy**		
Description	Credit points are obtainable for the provision of CO2 sensors installed at all return points. Ensure the CO2 monitoring system has sensors located in the breathing zone and is capable of alerting occupants when the additional fresh air is required. At minimum CO2 levels must not exceed 1000ppm.	3	3
Techniques	Install CO2 sensors at all return points.		
5.2.	**Thermal Comfort**	2	2
Description	Credit points are obtainable for demonstrating that all spaces within the building have been modelled to determine zonal cooling demand and designed to have separately controllable thermal zones, Provision for these zones and various types of the building should be in accordance with ANSI / ASHRAE 55 adapted for Egyptian Climatic Regions. - Install at least one air temperature sensor for each thermal zone with occupied spaces. - Install at least one humidity sensor for each humidity zone in the building. - The monitoring system must record measurements at an interval of 15 minutes or less. A system alarm must be triggered when measured temperature or humidity is outside the standard range of ASHRAE 55.		
Techniques	- Using simulation program for modelled the spaces. - Install air temperature sensors, and humidity sensors.		
5.3.	**Safety**	2	2
Description	Credit points are obtainable for installing the following: - Fire detection and alarm system. - Carbon monoxide detector and alarm system for the building that is supplied with mains gas.		
Techniques	Install fire detection with alarm system, carbon monoxide detector with an alarm system.		

Source: (Researcher)

Table (5-42) continued credit points of the Indoor Environmental Quality category of the Green Heritage scheme of GPRS

5.4.	**Interior Lighting**	**2**	**2**
Description	This credit promotes occupants' / users' productivity, comfort, and well-being by providing lighting control. Credit points are obtainable for providing lighting control for at least 50% of occupant spaces (individual and multi-occupant spaces) have in place individual lighting controls, and there are at least three lighting levels (on, off, midlevel). The midlevel is 30%-70% of the maximum illumination level. ** The project team must obtain the approval of Urban Harmony organization or Ministry of Antiquities about the plan of lighting control and the impacts of heritage building values.		
Techniques	- Using a control lighting system for 50% of spaces.		
5.5.	**Daylighting**	**2**	**2**
	- This credit aims to increase the natural light in the internal spaces of the heritage building to be comfortable to the occupants without harming or losing the heritage windows or doors of the heritage building - all spaces within the building have been modelled to determine the suitable lighting intensity to meet the required applications as per local codes; ** The project team must obtain the approval of Urban Harmony organization or Ministry of Antiquities about the daylighting plan of the heritage building.		
	- using simulation program. - Increasing the daylights via by restored windows and new skylights if that is possible.		
5.6.	**Controlling emissions from building materials**		
Description	Credit points are obtainable for demonstrating the use of low emission adhesives, sealants, and paints, coatings, flooring and ceiling systems, and certification that building materials and products containing formaldehyde have not been used.	2	**2**
Techniques	- Using materials finished and paints that have low VOC.		
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 6: INDOOR ENVIRONMENTAL QUALITY		**13**	**13**

Source: (Researcher)

GREEN HERITAGE RATING SYSTEM SCHEME

GREEN PYRAMID RATING SYSTEM (GPRS)

MANAGEMENT, WASTE AND POLLUTION

CATEGORY

WEIGHT 10%

Table (5-43). Comparing between the four rating Systems in the Management Category

Applied for Heritage Buildings									New- Buildings		
Residential uses			All uses			Non-residential uses			New construction		
BREEAM refurbishment domestic buildings (2014			LEED O+M			BREEAM 2014 Refurbishment and Fit-Out			Green Pyramid rating system- New construction		
Management			- Sustainable Sites - Materials and resources			- Management			- Management - Sustainable sites		
Management											
Home Users Guide	3	√				Project brief and Design	4	√	Presentation of the *Project Design and Implementation Plan*	M	√
Responsible Construction Practices	2	√√				Life cycle cost and service life planning**	4	×	Compatibility with the National Development Plan.	M	√
Construction Site impacts	1	√√				Responsible construction practices	6	√√	Presentation of a suitable Integrated Plan and Method Statement for site operations	M	√
Project Management	2					Commissioning and handover	4	×	Compliance with all relevant national Health & Safety and Welfare regulations;	M	√
						Aftercare	3	×	Where the Project involves demolition work, a Method Statement with clear evidence of the use of suitable methods of demolition.	M	
									Providing a Building User Guide	3	√
									Providing a Periodic Maintenance Schedule	2	√

Source of table: (Researcher)

Incompatible with Heritage Buildings | Incompatible with Egyptian buildings conditions × | Recommended Credits √√ | Compatible with heritage building √

Table (5-43) continued. Comparing between the four rating Systems in the Management Category

BREEAM refurbishment domestic buildings (2014			LEED O+M			BREEAM 2014 Refurbishment and Fit-Out			Green Pyramid rating system- New construction		
Waste											
Household Waste	2	√√	Solid Waste Management-Ongoing	2	√√	Project waste management	7		Containers for site materials waste	2	√√
Refurbishment Site Waste Management	√√	6	Solid Waste Management-Facility Management and Renovation	2	√√	Recycled aggregates	1	√	Employing waste recycling workers on site	1	√
						Operational waste	1	√√	Access for lorries, plant and equipment	1	
						Speculative floor and ceiling finishes	1	×	Identified and separated storage areas	2	
						Adaptation to climate change	1	×	Project Waste Management Plan	2	√
						Functional adaptability	1	×	Engaging a company specialized in recycling	2	
Pollution											
Surface Water Runoff	3	√√	Light Pollution Reduction	1	×	Impact of refrigerants		×	Protecting water sources from pollution	3	
Flooding	3	×	Rainwater Management		√√	Nox emissions	9	×	Waste from mixing equipment	2	
Nitrogen Oxide Emissions	2	×				Flood risk management and reducing surface water runoff	8	√	Control of emissions and pollutants	2	

Source of table: (Researcher)

Incompatible with Heritage Buildings — Incompatible with Egyptian buildings conditions × — Recommended Credits √√ — Compatible with heritage building √

Table (5-43) continued. Comparing between the four rating Systems in the Management Category

BREEAM refurbishment domestic buildings (2014			LEED O+M			BREEAM 2014 Refurbishment and Fit-Out			Green Pyramid rating system- New construction		
						Reduction of night time Light pollution		×	Minimizing pollution during construction	1	√
						Reduction of noise pollution		×			

Source of table: (Researcher)

Incompatible with Heritage Buildings		Incompatible with Egyptian buildings conditions	×	Recommended Credits	√√	Compatible with heritage building	√

5-10.The Credit points in category 6: MANAGEMENT, WASTE AND Pollution

5-10-1. Recommended credits can be added to this category

According to the recommendations of the analytical study of chapter 4, ,the followings credits will be added to green Heritage scheme of GPRS:

Table (5-44). Recommended credits can be added to the Management category.

The Source	Credits	Actions to the base (New construction rating system of GPRS)
The Recommendations of analytical study of chapter 4	▪ Construction waste management.	New added credit
	▪ Recycling occupancy waste	Modified credits
	▪ Storm water design- Quantity and Quality Control.	New added credit

Source: (Researcher)

5-10-2. The avoided credits from the category:

Table (5-45). The avoided credits from the Management category.

Credit ID	Avoided credits	Reasons
	- GPRS – NEW construction scheme	
6M.3	**Where the Project involves demolition work, a Method Statement with clear evidence of the use of suitable methods of demolition.**	This credit is not compatible with heritage buildings rating system.
6.1.3.	**Access for lorries, plant and equipment**	this credit specifies for new construction or demolitions projects, and not compatible with existing buildings rating system

Table (5-45) continued. The avoided credits from the Management category.

Credit ID	Avoided credits	Reasons
6.1.4.	**Identified and separated storage areas**	The requirements of this credit are partially avoided. The requirement of separated the flammable and toxic materials was separated in new added credit in the Green heritage building scheme.
6.2.2.	**Engaging a company specialized in recycling**	The restoration project doesn't have a size of waste as demolition or construction projects that need to engaging a company specialized in recycling to salvaged the materials from the waste then recycled them.
6.2.3.	**Protecting water sources from pollution**	This credit is specified for new construction buildings, it is not compatible with existing buildings rating system.
6.2.4.	**Waste from mixing equipment**	This credit is not compatible with heritage buildings rating system.
LEED O+M		
SS.4	**Light Pollution Reduction**	This credit is not compatible with the Egyptian buildings' systems.
- **BREEAM 2014 Refurbishment and Fit-Out**		
Man 02	**Life cycle cost and service life planning**	- This credit is not compatible with the Egyptian buildings' systems.
Man 04	**Commissioning and handover**	- This credit is not compatible with the Egyptian buildings' systems.
Wst 04	**Speculative finishes**	- This credit is not compatible with the Egyptian buildings' systems and the heritage buildings.
Wst 05	**Adaptation to climate change**	- This credit was set to encourage facing the impact of extreme weather conditions arising from climate change over the lifespan of the building. Egypt doesn't face any extreme weather all over the year. For that, this credit is not compatible with the Egyptian buildings' systems.
Wst 06	**Functional adaptability**	- This credit aims to make adaption to the building to be compatible with the new use, that is non-compatible with the heritage buildings that allows (in some cases) to create limited internal modifications according to the recommendations and the agreement of

Source: (Researcher)

Table (5-45) continued. The avoided credits from the Management category..

Credit ID	Avoided credits	Reasons
Wst 06	**Functional adaptability**	the Urban Harmony organization or its representatives in Egyptian Governorates.
Pol 01	**Impact of refrigerants**	- The research has already credit related to the impact of refrigerants in Energy efficiency.
Pol 02	**Nox emissions**	- This credit related to heating and hot water system, for that it is not compatible with the Egyptian environment.
BREEAM Domestic		
Pol03	**Flooding**	This credit is not compatible with the Egyptian environment.
Pol01	**Nitrogen Oxide Emissions**	This credit related to heating and hot water system, for that it is not compatible with the Egyptian environment.

Source: (Researcher)

5-10-3. The modified or maintained credits from the category:

Table (5-46). The modified or maintained credits in the Management category.

Credit ID	The name of credit after modification	Reasons
6M.1.	**Presentation of the Greening and restoration design and implementation plan for a heritage building.**	- Change the name of the credit " **Presentation of the Project Design and Implementation Plan**" of new construction scheme of GPRS to be compatible with a strategy of greening the heritage building. - It is a mandatory credit as the new-construction scheme of GPRS.
6M.2.	**Compatibly with the recommendations of Urban Harmony organization or their Committees.**	- Modified the name of the credit " **Compatibility with the National Development Plan**" of new construction scheme of GPRS, to "**compatibility with the recommendations of Urban Harmony organization or their Committees**" to be compatible with a strategy of greening the heritage building.
6.1.	**Providing a Building User Guide.**	- The research adopts the name of the same credit that exists in new construction scheme in GPRS. - This credit exists in the **BREEAM domestic (Home Users Guide)** has a

Source: (Researcher)

Table (5-46) continued. The modified or maintained credits in the Management category.

Credit ID	The name of credit after modification	Reasons
6.1.	**Providing a Building User Guide.**	similar aim to the credit of New construction in GPRS.
6.2.	**Providing a Periodic Maintenance Schedule.**	- The research adopts the name of the same credit that exists in new construction scheme in GPRS.
6.3.	**Project Waste Management**	- It is a recommended credit according to the table (5-44). - The research adopts the name of the same credit that exists in new construction scheme in GPRS after deleted the word plan from the name of the credit " **Project Waste Management plan**", the research aims to make one credit only for managing the waste during the project by merging three credits of new-construction scheme of GPRS in one credit (**Presenting a project waste management plan**, **Provide containers for site Materials waste**, and **Employing waste recycling workers on site)**. - The research adopted the requirements of those three credits after made some modifications on them to be compatible with the restoration and greening projects. - The credits "**Refurbishment Site Waste Management" in BREEAM domestic**, and "**Project Waste Management" in BREEAM refurbishment** have the similar aim of this credit. - The research adopts the aim and the percentage of recycling project waste from the credit " **Recycled aggregates**" in **BREEAM refurbishment.** - The credit "**Solid Waste Management- Facility Management and Renovation**" in LEED O+M has the similar aim of this credit. -

Source: (Researcher)

Table (5-46) continued. The modified or maintained credits in the Management category.

Credit ID	The name of credit after modification	Reasons
6.6.	**Minimizing Pollution during restoration and greening project.**	- Modified the name of the credit " **Minimizing pollution during construction**" that exists in new construction scheme in GPRS to " **Minimizing Pollution during restoration and greening project"** to be compatible the goal of rating system scheme.

Source: (Researcher)

5-10-4. The new added credits:

Table (5-47). The new added credits to the Management category.

Credit ID	New added credits	Reasons
6M.3	**Separation of flammable and toxic materials**	- The importance of safe disposal of the flammable and toxic materials to protect the human health and environment. - Some of the requirements of this credit exist in the requirements of the credit "**Identified and separated storage areas**" in new construction scheme in GPRS.
6.4.1.	**Operational waste**	- It is a recommended credit according to the table (5-44). - The importance of managing the waste of non-residential building to reduce the waste goes to a landfill that reduces the negative effect of waste on the environment. - The research derived the requirements of this credit from the credit "**Operational waste**" in **BREEAM Refurbishment** after made some modification to be compatible with Egyptian environment. - The requirement of "**Implement waste management plan for operational waste**" and safely

Source: (Researcher)

Table (5-47) continued. The new added credits to the Management category.

Credit ID	New added credits	Reasons
6.4.1.	**Operational waste**	disposed of the unsafe materials was derived from the credit " **solid waste management- ongoing**" in **LEED O+M.**
6.4.2.	**Household waste**	- It is a recommended credit according to the table (5-44). - The importance of managing the waste of non-residential building to reduce the waste goes to a landfill that reduces the negative effect of waste on the environment. - The research derived the requirements of this credit from the credit " **Household waste**" in **BREEAM Domestic** after made some modification to be compatible with Egyptian environment. - The requirement of "**Implement waste management plan for operational waste**" and safely disposed of the unsafe materials was derived from the credit " **solid waste management- ongoing**" in **LEED O+M.**
6.5.	**Managing Surface Water Runoff**	- It is a recommended credit according to the table (5-44). - The research derives the name and the aim of this credit from the credit "**Surface Water Run-off**" that exists in **BREEAM Domestic**. - The research derived the requirements of this credit from the same credit at **BREEAM Domestic** after made some modification to be compatible with the Egyptian case. - The credit "**Flood risk management and reducing surface water runoff**" in **BREEAM Refurbishment** and the credit "**Rainwater Management**" in **LEED O+M** have the similar aims and requirements of this credit.

Source: (Researcher)

5-10-5. The Methodology for set credits of "Management, Waste and pollution " the scheme:

- The category was divided into three parts "Management, Waste, and Pollution", with ten credits a total.
- The research added two credits to mandatory credits**" Presentation of the Greening and restoration design and implementation plan for a heritage building,** and **Compatibly with the recommendations of Urban Harmony organization or their Committees**" that exists in the sustainable sites category of New-construction of GPRS .
- The research added one new mandatory credit " **Separation of flammable and toxic materials**", and add three non-mandatory credits" **Operational waste, Household waste, Managing Surface Water Runoff**".
- There is no change in the name and requirements of the two mandatory credits in this scheme " **Providing a Building User Guide, and Providing a Periodic Maintenance Schedule**" than the New-constructions scheme of GPRS.
- There is some modification in the name and requirements of credit " **Project Waste Management"** than the original credit that exists in New-constructions scheme of GPRS.

5-10-6. Set the points of each credit:

Table (5-48). credit points of the Management category of the Green Heritage scheme of GPRS

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System						
CATEGORY 6: Management, Waste, and Pollution weight is 10% of the total						
Credit ID	Credit	Old Points In NC-GPRS	action	Points Residential	Points Non-Residential	Reasons
6M.1	**Presentation of the Greening and restoration design and implementation plan for a heritage building.**	**M**	-	**M**	**M**	

Source: (Researcher)

Table (5-48) continued. credit points of the Management category of the Green Heritage scheme

Credit ID	Credit	Old Points In NC-GPRS	action	Points Residential	Points Non-Residential	Reasons
6M.2	**Compatibly with the recommendations of Urban Harmony organization or their Committees.**	**M**	**-**	**M**	**M**	
6M.3	**Presentation of an Integrated Plan and Method Statement for site operations**	**M**	**-**	**M**	**M**	-
6M.4	**Compliance with all relevant national Health & Safety regulations for workers during restoration and greening project.**	**M**	**-**	**M**	**M**	
6M.5	**Separation of flammable and toxic materials**	**M**	**-**	**M**	**M**	
	Management					
6.1.	**Providing a Building User Guide.**	**3**	**-**	**3**	**3**	-
6.2.	**Providing a Periodic Maintenance Schedule.**	**2**	**-**	**2**	**2**	-
	Waste					
6.3	**Project Waste Management**	**2**	**+5**	**7**	**7**	Merge three credits in one.
6.4.1.	**Operational waste** (for non-residential buildings only)	**-**	**+2**	**0**	**2**	New added credit medium importance
6.4.2.	**Household Waste** (for residential buildings only)	**-**	**+2**	**2**	**0**	New added credit medium importance

Source: (Researcher)

Table (5-48) continued. credit points of the Management category of the Green Heritage scheme

Credit ID	Credit	Old Points In NC-GPRS	action	Points Residential	Points Non-Residential	Reasons
	Pollution					
6.5.	**Managing Surface Water Runoff**	-	**+3**	**3**	**3**	New added credit medium importance
6.6.	**Minimizing Pollution during restoration and greening project.**	1	-	**1**	**1**	
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 5: INDOOR ENVIRONMENTAL QUALITY		**20**	**+10 -12**	**18**	**18**	There are 7 avoided credits have 12 points

Source: (Researcher)

5-10-7. Details of credit points:

Table (5-49). credit points of the Management category of the Green Heritage scheme

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System			
CATEGORY 6: MANAGEMENT, WASTE AND POLLUTION weight is 10% of the total			
Credit ID	Credit	**Residential**	**Non-Residential**
Management			
6M.1	**Presentation of the Greening and restoration design and implementation plan for a heritage building.**	**M**	**M**
Description	Demonstrate the restoration design and implementation plan for the heritage building. **The plan must be approval from the Urban Harmony organization or their Committees in governorates.		
6M.2	**Compatibly with the recommendations of Urban Harmony organization or their Committees.**	**M**	**M**
Description	Preserve the heritage value of the urban fabric of the city by implementing the recommendation of Urban Harmony organization or their Committees. For non-listing heritage buildings, restoring the heritage building and submit to the organization for listing it.		

Source: (Researcher)

Table (5-49). Continued credit points of the Management category of the Green Heritage scheme

6M.3	**Presentation of an Integrated Plan and Method Statement for site operations**	**M**	**M**
6M.4	**Compliance with all relevant national Health & Safety regulations for workers during restoration and greening project.**	**M**	**M**
6M.5	**Separation of flammable and toxic materials**	**M**	**M**
Description	Separate the flammable and toxic materials in specific external container and prevention of soil pollution in these areas. The contents of the container must be disposed according to local regulations and national Health & Safety regulations and codes.		
6.1.	**Providing a Building User Guide:**		
Description	Credit points are obtainable for providing a building user guide containing the necessary technical and non-technical information for the building users / occupants to enable the efficient and responsible operation of the Heritage building.	**3**	**3**
Techniques	Set a Building user guide for users and occupants.		
6.2.	**Providing a Periodic Maintenance Schedule:**	**2**	**2**
Description	Credit points are obtainable for the provision of a Periodic Maintenance Schedule, which should be comprehensive and regularly updated. **The Periodic Maintenance Schedule must be approval from the Urban Harmony organization or their Committees in governorates.		
Techniques	Set a periodic maintenance schedule.		
	Waste		
6.3.	**Project Waste Management**		
	This credit aims to avoid waste being disposed of the landfill through reusing, recycling, or reselling the materials of the project waste. Credit points are obtainable for implement the following:		

Source: (Researcher)

Table (5-49). Continued credit points of the Management category of the Green Heritage scheme

Description	**1- Presenting a project waste management plan** that includes strategies for reducing, and, where possible, re-using and recycling the waste arising from site operations. **2- Recycled the project waste**, two points can be awarded if the project recycled or reused equal or greater than 25% (by weight or volume) of the total project waste. **3- Provide containers for site Materials waste** providing and an appropriate number of separate specific and identified containers for different kinds of wastes with clear signs on each, as (glasses, Metals, stones, fabric …etc). **4- Employing waste recycling workers on site** workers for daily recycling of waste materials on site.	**2** **2** **2** **1**	**2** **2** **2** **1**
Techniques			
6.4.1	**Operational waste** (for non-residential buildings only)	0	**2**
Description	Providing a dedicated space for storage recyclable waste volumes generated by the building's units, it must have capacity appropriate to the building type, size, number of units (if relevant) and predicted volumes of waste that will arise from daily/weekly operational activities and occupancy rates. The area and the location of the dedicated space ,and the number of containers or bins that put in dedicated space and at the units will be defined after making a study of the proposed activities in the building and the estimated volume of the waste stream. ****Clinical Waste** that derived from medical practices and defined as bodily fluids and wastes, drugs and medical equipment; and other waste which, unless rendered safe, may prove hazardous or infectious to persons coming into contact with it must be separated and disposed according to the health regulations and laws.		
Techniques	- Make a study about the proposed activities in the building and the estimated volume of the waste stream to define daily/weekly operational activities and occupancy rates. The area and the location of the dedicated space, and the number of containers. - Implement waste management plan for operational waste.		

Source: (Researcher)

Table (5-49). Continued credit points of the Management category of the Green Heritage scheme

6.4.2.	**Household Waste** (for residential buildings only)		
Description	- **One point** for providing three containers: two containers for recycling materials as" paper, glass, metal, fabric, plastic ..etc" and one container for kitchen waste. - The project can be awarded **one additional point** if the total containers for recycling materials are three, addition to one container for kitchen waste and one container for green/garden waste if the building has a garden. - The containers have volume compatible with the number of the units at the heritage building. - Safely dispose if all discarded batteries, and all mercury lamps. - If the residential building has commercial units on the ground floor, each unit must have one wheeled bin[11] to award any point in this credit. - All recycling containers have specific colors and signs demonstrate the type of recycling material that container has. - Inform the local authority that the building has containers for recycled materials to send recycling collectors that sent them back to the manufacturer.	**1** **1**	**0**
Techniques	- Implement waste management plan for household waste. - Provide waste colored containers for household waste.		
Pollution			
6.5.	**Managing Surface Water Runoff**		
Description	This credit aims to directly infiltrate to the ground water that will reduce the discharge of rainfall to public sewers, this will reduce the risk of localized flooding of public sewers, the points of the credit can be awarded as a following:		

Source: (Researcher)

[11] Wheeled bins: 360 litre = 0.86m x 0.62/660 L= 1.2m x 0.7m/1100 L = 1.28m x 0.98m

Table (5-49). Continued credit points of the Management category of the Green Heritage scheme

Description	- **One point** is awarded if there is non-addition or modification of the hardscaping of the site of the heritage building. - **One point** is awarded if all new hardscaping pavements, driveways, car parks, walkers ways are permeable materials or from an impermeable surface that drains onto a permeable surface (e.g. paving slabs set on concrete that drained onto soft landscaped areas), when there is no value of the hardscaping of the site. - **An additional one point,** if all run-off from the roof rainfall, have been managed onsite after transferred pipes to the landscape areas to infiltrate groundwater. - **An additional one point** if the project managing rainfall by using one or more of the systems: green roofs, bio-retention areas, rainwater harvesting systems, and swales. ** There is a need to obtain an agreement about "the plan of the project for renovating the site" from the Urban Harmony organization or its representatives in Egyptian Governorates.	**1** **1** **1**	**1** **1** **1**
Techniques	- Set a plan of the policy of restoration or renovation of the site. - Using permeable surfaces or an impermeable surface that drains onto a permeable surface in the hardscaping of the site.		
.6.6	**Minimizing Pollution during restoration and greening project.**		
Description	A credit is obtainable for demonstrating a strategy to minimize pollution from restoration and greening operations (including generation of dust and pollutants).	**1**	**1**
Techniques	Set a Management plan for project waste and pollutions.		
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 6: MANAGEMENT, WASTE, AND POLLUTION		**18**	**18**

Source: (Researcher)

GREEN HERITAGE RATING SYSTEM SCHEME

GREEN PYRAMID RATING SYSTEM (GPRS)

INNOVATION CATEGORY

WEIGHT BONUS

Table (5-50). Comparing between the four rating Systems in the Innovation Category

Applied for Heritage Buildings									New- Buildings		
Residential uses			All uses (Residential and non-residential Building)			Non-residential uses			New construction		
BREEAM refurbishment domestic buildings (2014			**LEED O+M**			**BREEAM 2014 Refurbishment and Fit-Out**			**Green Pyramid rating system- New construction**		
– **Innovation**			- **Innovation**			- **Innovation**			- Innovation **and add values**		
Innovation	**10**	√	**Innovation**	**5**	√	**Innovation**	**10**		**Cultural Heritage**	**3**	
			LEED Accredited Professional	**1**	×				**Exceeding Benchmarks**	**4**	√
									Innovation	**3**	√

Source of table: (Researcher)

Incompatible with Heritage Buildings | **Incompatible with Egyptian buildings conditions** × | **Compatible with heritage building** √

3.

5-11. The Credit points in category 7: INNOVATION

5-11-1.The avoided credits from the category:

Table (5-51). The avoided credits from the Innovation category.

Credit ID	Avoided credits	Reasons
- **GPRS – NEW construction scheme**		
7.1.	**Cultural Heritage:**	This credit aims to preserve the culture heritage and identity at the new construction buildings. the main aim of this scheme to preserve the cultural heritage values by restoring the heritage buildings, For that the research has avoided this credit.
LEED O+M		
	LEED Accredited Professional	This credit does not be compatible with this rating system scheme.

Source: (Researcher)

5-11-2. The modified or maintained credits from the category:

Table (5-52). The modified or maintained credits in the Innovation category.

Credit ID	The name of credit after modification	Reasons
4M.1	**Exceeding Benchmarks**	- The research adopts the name and the aims of the same credit that exists in new construction scheme in GPRS. - The credits that have the name of " **Innovation**" are located in **LEED O+M**, **BREEAM Refurbishment**, and **BREEAM Domestic** schemes have some requirements related to exemplary performance.
4M.2	**Innovation**	- The research adopts the name and the aims of the same credit that exists in new construction scheme in GPRS. - The credits that have the name of " **Innovation**" are located in **LEED O+M**, **BREEAM Refurbishment**, and **BREEAM Domestic** schemes with the same aim of this credit.

Source: (Researcher)

5-11-3. The Methodology for set credits of "INNOVATION" the scheme:

- The research has modified the name of the credit from "**Innovation and added value**" to "**Innovation**", due to the Exclusion of the credit "**Culture Heritage**" from the category.
- The research has adopted the credits of " **Exceeding Benchmarks**" and "**innovation**" with no change in requirements but increasing the number of available credit points for each credit.

5-11-4. Set the points of each credit:

Table (5-53) credit points of the Innovation category of the Green Heritage scheme

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System						
CATEGORY 7: INNOVATION weight is Bonus						
	Credit	Old Points	action	Points Residential	Points Non-Residential	Reasons
7.1	**Exceeding Benchmarks:**	4	+2	**6**	**6**	To reach the total numbers of the total points to 10.
7.2	**Innovation**	3	+1	**4**	**4**	
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 6: INDOOR ENVIRONMENTAL QUALITY		**10**		**10**	**10**	

Source: (Researcher)

5-11-5. Details of credit points:

Table (5-54) credit points of the Innovation category of the Green Heritage scheme

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System			
CATEGORY 7: INNOVATION weight is Bonus			
Credit ID	Credit	**Residential**	**Non-Residential**
7.1	**Exceeding Benchmarks:**	6	6
Description	Credit points are obtainable for demonstrating that the current benchmarks of GPRS have been exceeded by a significant margin and providing evidence that the improvement has an additional environmental benefit. One Credit Point is available for each Category (up to a maximum of six Credit Points).		
Techniques	--		
7.2	**Innovation**	4	4
Description	Credit points are obtainable for innovative design or construction practices which have a significant measurable environmental benefit and which are not otherwise awarded points by GPRS.		
Techniques	--		
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 6: INDOOR ENVIRONMENTAL QUALITY		**10**	**10**

Source: (Researcher)

PROPOSAL FOR GREEN HERITAGE RATING SYSTEM– GPRS

5-12. The Proposal for Green Heritage Building rating system – GPRS

Green Heritage Buildings rating system - GPRS is assumed as one of the green pyramid rating systems schemes that are can be used to assess heritage buildings. It provides definitive criteria by which the environmental credentials of heritage buildings can be evaluated, and the buildings themselves can be rated. Additionally, the System should assist building designers, contractors and developers to make reasoned choices based on the environmental impact of their decisions in the implementation of the conservation strategy of the heritage building.

- The aims of the **Green Heritage Buildings rating system – GPRS** are:
  - To provide a green heritage building that has a high functional value in the society, generate more income for its owners, become more compatible with the environmental systems by consuming less water consumption, less energy consumption, less materials during restoration by retaining the old and existing materials, producing less waste disposed of landfill (whether during restoration works or during occupation). All of that lead to sustain the heritage building that will be able to meet the current and future needs without prejudice to the ecosystem or lose the building's values.
  - To provide a benchmark for good practice that enables heritage buildings in Egypt to be assessed for their green credentials through a credible, challenging and transparent environmental rating system in a framework ensures the preservation of the buildings values.

- The research was avoided 22 credits from the New-Construction scheme of GPRS, and added 8 new credits, and made modification the remaining credits to be compatible with the heritage building.
- Green heritage buildings rating system is based on the predicated performance, it can be used to assess the residential and non-residential buildings.

- Green heritage buildings rating system adopted the same seven categories of the GPRS, and the levels of certifications.
- The research added to the each credit the techniques that can be used to achieve the credit

Components of the Green Heritage Buildings rating system – GPRS:

- The system comprises seven rating Categories (1-7) which in turn contain sub-categories (numbered 1.1, 1.1.1, etc.).
- Credit points will be awarded based upon specific criteria, and in certain cases a Category will have one or more *Mandatory Minimum Requirements,* without meeting them, there are no further points will be obtainable.
- To be eligible for assessment, a building should meet all of the minimum national statutory provisions and Egyptian National Codes for the design and construction of buildings.
- Each of category sections has the followings:
  - The objectives of the category.
  - Summary of credit points in the category.
  - The credits need approval from urban harmony organization.
  - Details of credit points in the category.

Category weights

The Green Pyramid for Heritage building scheme's Category Weightings are as mentioned in table (5-55).

Table (5-55), The Green Pyramid for Heritage Building scheme's Category Weights

Green Pyramid Category	Category Weighting
1: Sustainable Site, Accessibility, Ecology	**5%**
2: Energy Efficiency	**30%**
3: Water Efficiency	**35%**
4: Materials and Resources	**5%**
5: Indoor Environmental Quality	**10%**
6: Management, Waster , and Pollutions	**10%**
7: Innovation	**Bonus**

Source: (researcher)

Certification and levels of rating

To earn Green Pyramid certification in this scheme, a project must satisfy all the stated Mandatory Minimum Requirements and may obtain Credit Points by meeting certain criteria. Unlike other international rating systems, the highest level of certification is labeled "green" rather than platinum.[12]

Projects will be rated, based on Credit Points accumulated, according to the following rating system:

Level of rating	Credits
GPRS Certified	40–49
Silver Pyramid	50–59
Gold Pyramid	60–79
Green Pyramid	Equal or greater than 80
Projects with less than 40 credits will be classified as 'Uncertified'.	

Table (5-56). Level of rating of Green Pyramid rating system.

Source : The Egyptian Green Building Council (April 2011).

Fig(5-1). Level of rating of Green Pyramid rating system.

Source : , http://www.egypt-gbc.gov.eg/ratings/index.html ,

CATEGORY 1: SUSTAINABLE SITE, ACCESSIBILITY AND ECOLOGY

OBJECTIVES

The objectives of this Category are:

- Heat island reduction: to reduce the urban heat island temperature, that reduces the energy consumption in cooling the internal spaces of the buildings.
- Accessibility: to minimize pollution and traffic congestion from car use and to conserve non-renewable energy by encouraging public and alternative transport such as bicycle.
- Ecological balance: to minimize the environmental impact of the project on the site and its surroundings; to protect existing natural systems, such as fauna and flora (including

[12]**The official site of Green Pyramid Rating system**, http://www.egypt-gbc.gov.eg/ratings/index.html , (access 06 May 2016)

wildlife corridors and seasonal uses), soil, hydrology and groundwater from damage and to promote biodiversity.

-

SUMMARY OF CREDIT POINTS IN THIS CATEGORY

	Sustainable Site, Accessibility, and Ecology ,weight is 5% of the total	Points Residential	Points Non-Residential
1.1.	Heat Island Reduction.	2	2
1.2.	Transport infrastructure connection.	0	1
1.3.	Proximity to amenities	1	1
1.4.	Alternative methods of transport	0	1
1.5.	Cycle Storage	1	2
1.6.	Protection and Enhancement of Ecological Features and Habitat.	1	1
1.7.	Respect for sites of historic or cultural interest.	5	5
TOTAL		10	13

THE CREDITS that NEED APPROVAL FROM URBAN HARMONY ORGANIZATION

There are four credits in this category have required an approval about their strategies to meet the credits' requirements; the approval will obtain from the Urban harmony organization or its representatives in Egyptian governorates ,or the Ministry of Antiquities.

Table (5-57). the credits need approval in Sustainable Sites Category

	Credits
1.1.	Heat Island Reduction.
1.5.	Cycle Storage
1.6	Protection and Enhancement of Ecological Features and Habitat.
1.7.	Respect for sites of historic or cultural interest.

DETAILS OF CREDIT POINTS IN CATEGORY 1: SUSTAINABLE SITE, ACCESSIBILITY AND ECOLOGY

Table (5-58). the category Sustainable Site, Accessibility and Ecology of the Green Heritage scheme of GPRS

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System			
CATEGORY 1: Sustainable Site, Accessibility, and Ecology weight is 5% of the total			
Credit ID	Credit	**Residential**	**Non-Residential**
Sustainable Site		**points**	**points**
1.1.	**Heat Island Reduction (Max, 2 credits)**		
Description	**Reducing heat islands by implement one of the followings options:** - **Option 1 (Non-Roof).** - **Option 2 (Roof)** - **Option 3 (Non-Roof and Roof)** **The team of the project should obtain an agreement from the urban harmony organization or its representative committees or the Ministry of Antiquities in the Egyptian governorates about the Heat Island Reduction plan for the heritage building evaluated.	**1** **1** **2**	**1** **1** **2**
Techniques	**Option 1 (Non-Roof).: use any combination of the following strategies for a minimum of 50% of the site paving:** - Use the existing plant or install plants that provide shade over paving areas including playgrounds on the site within 10 years of planting, plants must be in place at the time of certification. - Provide shade with structures that compatible with the heritage style of the building, that covers by solar thermal collectors or photovoltaics, the shades put in areas cannot abstract the public views of the heritage building. - Provide shade with vegetated structure. - Using new paving materials (if that will be allowable) with solar reflectance index (SRI) value of at least 0.33. - Use an open-grid pavement system (at least 50% of the site area). **Option 2 (Roof)** Using roofing materials with SRI equal or greater than 82 for a minimum of 75% of the roof area or a vegetated roof for a minimum of 50% of the roof area, or both. **Option 3 (Non-Roof and Roof)**		

Source: (Researcher).

Table (5-58) continued. the category Sustainable Site, and Ecology of the Green Heritage scheme of GPRS

	Use the strategies for each of the two options mentioned above.		
Location and Transportation Accessibility			
1.2.	**Transport infrastructure connection.** (for non-residential buildings and mix-uses' buildings)**	0	1
Description	A credit point is obtainable for demonstrating a suitable connection with existing public transport systems.		
Techniques	If the building doesn't locate near mass transportation lines such as buses or Metro stations consider a shuttle service to help employees reach public transportation. An example is a company provides a shuttle every 30 minutes to a mass transit hub a few miles away.		
1.3.	**Proximity to amenities**	1	1
Description	Presenting a suitable method for connecting the site with the nearest urban area (that has amenities and services).		
Techniques	Accessibility to amenities via safe pedestrian routes, e.g. pavements/paths and safe crossing points or, where provided, dedicated pedestrian crossing points.		
1.4.	**Alternative methods of transport** (for non-residential buildings, and mix-uses' buildings)**		
Description	A credit point is obtainable for demonstrating strategies to reduce reliance on private automobile use and encourage the use of greener methods of transport.	0	1
Techniques	Carpool and Vanpool share program.		
1.5.	**Cycle Storage**		
Description	Encourage occupants/ users to use cycles by providing adequate and secure cycle storage facilities, thus reducing the need for short car journeys. Providing showers facilities for non-residential buildings **The team of the project should obtain an agreement from the urban harmony organization or its representative committees in the Egyptian governorates about the cycle storage plan for the heritage building evaluated.	1 0	1 1
Techniques	<u>**Bicycle racks:**</u> **For non-residential buildings** : Provided for 5% of all commercial, office and industrial occupants, with numerous secured racks throughout the site to allow for easy movement within the community. **For non-residential buildings** Bicycle racks will also be supplied one rack for each residential unit. **For Mix-residential buildings:** the total numbers of the required racks of Bicycle is equal the numbers of the required of residential units plus non-residential units.		
Techniques	The cycle storage must be nearest the entrance as possible without has negative impact on the public view for heritage building.		

Source: (Researcher).

Table (5-58) continued. the category Sustainable Site, and Ecology of the Green Heritage scheme of GPRS

	<u>the showers (non-residential buildings only)</u> if total numbers of non-residential building users are equal or less than 100 , the required showers = 1 if total numbers of non-residential building users are greater than 100 , the required showers = 1+ (numb. of users – 100)/150		
Ecological and cultural interest			
1.6.	**Protection and Enhancement of Ecological Features and Habitat.**		
Description	Protect existing ecological features from substantial damage during refurbishment and enhance the ecological value of a site. **The team of project should obtain an agreement from the urban harmony organization or its representative committees in the Egyptian governorates or the Ministry of Antiquities about the Protection and Enhancement of Ecological Features and Habitat plan for the heritage building evaluated.	**1**	**1**
Techniques	- Set a plan to how all existing ecological features on the site can be protected and maintained during restoration works. - Set a strategy to how restoring natural areas to provide habitat and promote biodiversity including enhancing the ecological features of the site by replanting trees and plants on site.		
1.7.	**Respect for sites of historic or cultural interest.**		
Description	- Three credit points are obtainable for demonstrating a suitable strategy for conserving and protecting the urban heritage site of the heritage building that is located, that could include (streets, squares, or alleyways) - Two additional credit points for demonstrating a suitable strategy for conserving and protecting the remains of heritage building or cultural interest that is part of or nearby the site. ** The team of the project should obtain an agreement from the urban harmony organization or its representative committees in the Egyptian governorates or the Ministry of Antiquities about the plan for achieving the requirements of this credit.	**5**	**5**
Techniques	- Set a plan for restoring one or more of the features of the urban heritage site where the heritage building located. - Set a plan for restoring one or more of other heritage buildings where are located nearby or adjacent the heritage building.		
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 1: SUSTAINABLE SITE		**10**	**13**

Source of table: (Researcher)

CATEGORY 2: ENERGY EFFICIENCY

OBJECTIVES

The objectives of this Category are:

a) to reduce energy consumption and carbon emissions by using renewable technologies strategies that don't have a bad impact on the values of heritage building;
b) to optimize the choice of electrical and mechanical equipment, to and to evaluate the inventory of energy and carbon for each developed MEP system, and to minimize their impact on the environment;
c) to reduce energy demand to cater for loads at peak use times through efficient building and services design and site based, where possible, on renewable energy generation.
d) to encourage the provision of metering facilities that allow the energy performance of the building to be recorded and monitored to allow future improvement and prove validity;
e) to minimize the energy consumed by using high efficient internal and external lighting bulbs and control systems for lighting.

SUMMARY OF CREDIT POINTS IN THIS CATEGORY

	Energy Efficiency weight is 30% of the total	Points Residential	Points Non-Residential
2.M.1	**Minimum Energy Performance Level:**	**M**	**M**
2.M.2	**Energy Monitoring & Reporting**	**M**	**M**
2.M.3	**Ozone depletion avoidance**	**M**	**M**
2.1.	**Energy Efficiency Improvement**	**10**	**10**
2.2.	**Energy Efficient Appliances**	**3**	**3**
2.3.	**Internal and external Lighting**	**3**	**3**
2.4.	**Vertical Transportation Systems.**	**2**	**2**
2.5.	**Peak Load Reduction:**	**1**	**1**
2.6.	**Renewable Energy Sources.**	**10**	**10**
2.7	**Environmental Impact.**	**4**	**4**
2.8	**Operation and Maintenance.**	**1**	**1**
2.9	**Optimized balance of Energy and Performance.**	**3**	**3**
TOTAL		**37**	**37**

THE CREDITS NEED APPROVAL FROM URBAN HARMONY ORGANIZATION

There are eight credits in this category have required an approval about their strategies to meet the credits' requirements; the approval will obtain from the Urban harmony organization or its representatives in Egyptian governorates, or the Ministry of Antiquities.

Table (5-59). the credits need approval Energy Efficiency Energy Efficiency Category

	Credits
2.M.1	**Minimum Energy Performance Level:**
2.M.3	**Ozone depletion avoidance**
2.1.	**Energy Efficiency Improvement**
2.3.	**Internal and external Lighting**
2.4.	**Vertical Transportation Systems.**
2.5.	**Peak Load Reduction:**
2.6.	**Renewable Energy Sources**
2.7	**Environmental Impact.**

Source: (Researcher)

DETAILS OF CREDIT POINTS IN CATEGORY 2: ENERGY EFFICIENCY

Table (5-60) credit points of the Energy Efficiency of the Green Heritage scheme of GPRS

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System			
CATEGORY 1: Energy Efficiency weight is 30% of the total			
Credit ID	Credit	**Residential**	**Non-Residential**
2.M.1	**Minimum Energy Performance Level:**	**M**	**M**
Description	Demonstrate a Minimum Energy Performance Level 10% above an appropriate simulated base case model. The base case model is to be produced in accordance with the Egyptian Energy Efficiency Code and using the methods outlined in ANSI/ASHRAE/IESNA Standard 90.1-2007 (or equal approved standard). **The team of the project should obtain the agreement of the urban harmony organization or its representative committees in the Egyptian governorates or the Ministry of Antiquities about the energy performance plan for the heritage building evaluated.		

Source: (Researcher)

3.

Table (5-60) continued credit points of the Energy Efficiency of the Green Heritage scheme of GPRS

Techniques	– Using a simulation model to calculate the baseline of energy performance for the building evaluated. And then calculate the minimum reductions required after adding techniques that achieve more energy performance efficiency to the building without harming or lose the building heritage values. – The guide references are "the Egyptian Energy Efficiency Code, and ANSI/ASHRAE/IESNA Standard 90.1-2007 (or equal approved standard). – The team of the project should balance between the requirements to achieve minimum energy performance and preserve the heritage values of the buildings, any techniques could have a negative effect on the building values, the team should be ruled out. The following are techniques can be used to reduce the total energy consumption: ▪ Using a computer modelling to calculate energy consumption. ▪ Using high efficient appliance and systems. ▪ Using LEDs in Lighting. ▪ Using renewable technologies that don't have a negative impact on the heritage value of the buildings. ▪ Using energy metering. ▪ Insulate and increase the efficiency of the heritage windows and doors without harming or losing their values. ▪ Using occupancy sensors. Capturing more daylight if that is possible.	**M**	**M**
2.M.2.	**Energy Monitoring & Reporting**	**M**	**M**
Description	Demonstrate provision of accessible energy sub-meters, clearly labelled and with instructions, for all occupied areas. Sub-meters should enable monitoring and recording of a minimum of 90% of the estimated annual consumption of each fuel type, with separate meters for equipment that exceeds 10 kW.		
Techniques	– Install sub-meters for all occupied areas, – Install separate meters for any electrical equipment that exceeds 10 kW. if the building installs any types of renewable resources, advanced meters must be installed to measure both of the consumption of total energy and the supply of energy to the general electricity network.		

Source: (Researcher)

Table (5-60) continued credit points of the Energy Efficiency of the Green Heritage scheme of GPRS

2.M.3.	**Ozone depletion avoidance**	M	M
Description	Demonstrate that all refrigerants and gaseous fire suppression agents within the Project have an Ozone Depletion Potential (ODP) near zero. Don't use new equipment that contains chlorofluorocarbon (CFC) refrigerants in heating, ventilation, air-conditioning, or third party audit make a plan for replacement or conversion of the refrigerant systems, or make CFC-phase out plan is in place. The phase out –plan should be scheduled for completion within 10 years. Small HVAC units, small water cooler and any other cooling equipment that contains less than 0.5 pounds of refrigerant are exempt. **The team of the project should obtain the agreement of the urban harmony organization or its representative committees in the Egyptian governorates or the Ministry of Antiquities about the ozone depletion plan.		
Techniques	– Using refrigerants not contain (CFCs). – Or set a phase-out plan for replacement or conversion of the refrigerant systems.		
2.1.	**Energy Efficiency Improvement** (Max10 credits)		
Description	Energy Efficiency Improvement: A maximum 10 credit points are obtainable for demonstrating (using the methodology outlined in 2.M.1, above) further reductions in energy consumption from the base case determined in item 2.M.1 (above). **Points awarded are accumulative, and are shown opposite:** **Reduction**		
	%10-5	1	1
	%15-11	1	1
	%20-16	1	1
	%25-21	1	1
	%27-26	1	1
	%30-28	1	1
	%35-31	1	1
	%40-36	1	1
	%45-41	1	1
	%50-46	1	1
Techniques	Using the same techniques that mentioned in item 2.M.1		

Source: (Researcher)

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Table (5-60) continued credit points of the Energy Efficiency of the Green Heritage scheme of GPRS

2.2.	**Energy Efficient Appliances**	3	3
Description	Credit points are obtainable for demonstrating that the building occupier will be provided with formal documentary guidelines on using of Energy Efficient Appliances for the building, with reference to rating schemes such as Energy Star (USA) or the Energy Efficiency Labelling Scheme (EU), or other international/local equalivant Energy Efficiency Labelling Schemes: For new purchased appliances: – The new purchased appliances must have **A+** rate or better under the EU Energy Labelling scheme or an equalivant rate under any international/local energy efficient labelling schemes. For any existing appliances: – For appliances less than 10years old can still be used if it has Energy Label. – For appliances greater than 10years, they are less efficient from 30-40% than the new A rated appliance, they will need to replace with new rated appliances. – If the age of equipment is unknown, they will need to replace with new rated appliances.		
Techniques	Using high energy efficient appliances have rated according to Energy Star (USA) or the Energy Efficiency Labelling Scheme (EU).		
2.3.	**Internal and external Lighting** (Max.3 credits)		
	Internal lighting (two credits) shall have a minimum luminaire efficacy of ≥ 60 luminaire lumens per circuit Watt. Internal lighting fittings shall also be controlled by a time switch to prevent operation after midnight (in the non-residential building) except where the area is open to the public, or controlled by motion sensors corridor light to switch off the lighting when there is no occupiers or users in the corridors of the residential/ non-residential buildings. This part of credit might be ruled out if it has a negative effect on the heritage lighting objects, heritage value of interior walls or/and celling.	2	**2**

Source: (Researcher)

Table (5-60) continued credit points of the Energy Efficiency of the Green Heritage scheme of GPRS

Description	**External lighting (one credit)** The average initial luminous efficacy of the external light fittings within the boundary of the building's site is not less than 60 luminaire lumens per circuit Watt All external light fittings are automatically controlled for prevention of operation during daylight hours and presence detection in areas of intermittent pedestrian traffic. ** There is a need to obtain an agreement about the lighting strategy plan for internal and external lighting systems from the urban harmony organization or its representatives committees in the Egyptian governorates or the Ministry of Antiquities.	**1**	**1**
Techniques	– A lighting strategy plan for internal and external lighting systems. – Lighting fittings ⩾ 60 luminaire lumens per circuit Watt. – Lighting controller by the time switch. – Motion sensors corridor light.		
2.4.	**Vertical Transportation Systems.** (Max.2 credits)		
Description	**Stairs lighting (one credit)** stairs have a minimum lighting level of 150 lux measured at the walking surfaces; any artificial lighting used within the stairs must be supplied with color corrected lamps with minimum Color Rendering Index CRI=80. All stairs in the building are energy efficient i.e. operate in stand-by mode during off-peak periods; include a regenerative drive system for buildings over 3 stories; and use LED lighting and LCD display features.	**1**	**1**
	Elevators (one credit) Any elevators in the buildings (new / existing) are energy efficient, i.e. have an automated stop/start function linked to occupancy sensors to enable standby mode when there is no passenger demand; and use LED strip lighting. For heritage elevators: No replacing heritage elevators with new ones, restoring them or refurbishment the hidden parts "as motors" is allowable with not harming or losing the heritage value of them.	**1**	**1**

Source: (Researcher)

Table (5-60) continued credit points of the Energy Efficiency of the Green Heritage scheme of GPRS

Description	<u>For purchasing new elevators</u>, beside the previous requirement, it should achieve the following: – Be compatible with the heritage style of the building and the entrance and stairs areas. – Make an energy calculation and classification report for (at least two types of system), the system with the lowest energy consumption is selected and purchased. **There is a need to obtain an agreement about the plan of installing new elevators or restore/ refurbish the existing ones from the urban harmony organization or its representatives committees in the Egyptian governorates or the Ministry of Antiquities.		
Techniques	– Regenerative drive system /Motion sensors light. – Occupancy sensors for elevators. – An energy calculation and classification report for at least two elevators systems.		
2.5.	**Peak Load Reduction:**		
Description	Credit points are obtainable for demonstrating that a peak electrical load has been achieved that is not more than 80% greater than the project design annual average electrical load. Further credit points are obtainable for demonstrating that a peak electrical load has been achieved that is not more than 60% greater than the project design annual average electrical load. Evidence should include results of dynamic energy simulations giving an annual average, and peak electrical loads for the building and explanation of peak load reduction methodology, including drawings, equipment data sheets/specifications as necessary.	**1**	**1**
Techniques	- Dynamic energy simulations.		
2.6.	**Renewable Energy Sources** (Max.10 credits)		
	Credit points are obtainable for demonstrating that: ▪ an on-site and/or off-site renewable energy feasibility study has been undertaken; ▪ a minimum of 5% of the project's non-renewable energy use will be provided by on-site generated renewable energy.	1 1	**1** **1**

Source: (Researcher)

Table (5-60) continued credit points of the Energy Efficiency of the Green Heritage scheme of GPRS

Description	▪ A maximum 8 credit points are obtainable for demonstrating that a percentage of total energy demand is supplied by renewable energy, utilizing on-site or off-site sources. Points awarded are accumulative, and are shown opposite:		
	% Total		
	1-4%	1	1
	5-8%	1	1
	9-12%	1	1
	13-15%	1	1
	16-20%	1	1
	21-25%	1	1
	26-29%	1	1
	over30%	1	1
	**There is a need to obtain an agreement about the plan of installing renewable technology at the heritage building or its from the urban harmony organization or its representatives committees in the Egyptian governorates or the Ministry of Antiquities.		
Techniques	- Using photovoltaic panels on the flat roof of the heritage building, and other parts of the building / or site provided that don't have a negative impact on the heritage value of the building or its heritage view from the street. - Using solar heating systems, geothermal power, biomass power, or wind power provided that don't have a negative impact on the heritage value of the building or its heritage view from the street.		
2.7	**Environmental Impact.** (Max.4 credits)		
	The weighted average of all refrigerants and fire suppression systems media has an equivalent Global Warming Potential (GWP) that meets or is less than the requirements of Egyptian Environmental Law. Credit points are obtainable for demonstrating that: Points awarded as follows:		
	▪ The weighted average of all refrigerants shall have a GWP of 12 or less;	**1**	**1**
	▪ The Project has installed a permanent refrigerant leak detection system;	**1**	**1**
	▪ The Project has installed an automatic refrigerant pump-down system to a dedicated storage tank with isolation valves;	**1**	**1**
	▪ All gaseous fire suppression system have a GWP of 2 or less.	**1**	**1**

Source: (Researcher)

Table (5-6) continued credit points of the Energy Efficiency of the Green Heritage scheme of GPRS

	**There is a need to obtain an agreement about the plan of installing refrigerants and fire suppression systems from the urban harmony organization or its representatives committees in the Egyptian governorates or the Ministry of Antiquities.		
2.8	**Operation and Maintenance.**		
	Credit points are obtainable for providing for a simple and easily-followed Operations Manual for all Mechanical, Electrical and Plumbing (MEP) apparatus, equipment, device, and sub-system.	**1**	**1**
2.9	**Optimized balance of Energy and Performance.** (Max.3 credits)		
	Credit points are obtainable for demonstrating design optimization studies and implementation of the following: ▪ Natural Vs. Artificial Lighting; ▪ Acceptable Indoor air quality at all operation profiles; ▪ Optimization between building Passive systems and the anticipated Minimum Thermal Cooling.	**1** **1** **1**	**1** **1** **1**
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 2: ENERGY EFFICIENCY		**37**	**37**

Source: (Researcher)

CATEGORY 3: WATER EFFICIENCY

OBJECTIVES

The objectives of this category are:

- Develop and implement a comprehensive water strategy

- Minimize indoor and outdoor water demands

- Reduce potable water use.

- to reduce potable water use by promoting the use of reused grey water or avoiding the use of potable clean water, where possible;

- Water efficient landscaping

- Minimize potable use for irrigation

SUMMARY OF CREDIT POINTS IN THIS CATEGORY

	Water Efficiency weight is 35% of the total	Points Residential	Points Non-Residential
3M.1	**Minimum Water Efficiency**.	**M**	**M**
3.M.2	**Water Use Monitoring.**	**M**	**M**
3.1	**Indoor Water Efficiency Improvement.**	**8**	**8**
3.2	**Outdoor Water Efficiency Improvement recommend to be replaced by (Water Efficient Landscaping).**	**9**	**9**
3.3	**Water Feature Efficiency.**	**4**	**4**
3.4	**Water Leakage Detection:**	**6**	**6**
3.5	**Waste water management.**	**12**	**12**
3.6	**Sanitary Used Pipes.**	**4**	**4**
TOTAL		**43**	**43**

THE CREDITS NEED APPROVAL FROM URBAN HARMONY ORGANIZATION

There are eight credits in this category have required an approval about their strategies to meet the credits' requirements; the approval will obtain from the Urban harmony organization or its representatives in Egyptian governorates ,or the Ministry of Antiquities.

Table (5-61). the credits need approval in Water Efficiency Category

	Credits
3M.1	**Minimum Water Efficiency:**
3.3	**Water Feature Efficiency:**

Source: (Researcher)

Table (5-61) credit points of the Water Efficiency of the Green Heritage scheme of GPRS

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System			
CATEGORY 1: WATER EFFICIENCY weight is 35% of the total			
Credit ID	Credit	Residential	Non-Residential
3M.1	**Minimum Water Efficiency:**	**M**	**M**
	Demonstrate, by means of a parametric analysis report, the percentage of improvement of potable water consumption will be no less than 20%. The baseline and annual designed water use can be calculated as showed in the techniques part of this credit. ** the decision of replacement of the old sanitary fixtures will be defined by project team according to the percentage of improvement of water use.		
Techniques	Calculate the total water use of the building: **Step 1:** Determine the average total annual water consumption of the building during the last 5 years from water bills. **Step 2:** Determine the project occupancy: the number of users/ resident. **Step 3:** Gender ration: the default gender mix is half male and half female, except the building has one gender only, ex. school for girls. Table (5-62), table (5-63), table (5-64) **Step 4**:complete calculations , table (5-65) Day water use of each fixture= fixture flush × duration × users × uses per person per day **Step 5 :** Determine the total annual designed water use of the heritage building. annual water use of each fixture = daily water use of fixture × numbers of days per year Total annual designed water use = summation of annual water use for all fixture **Step 6 :** Determine the percentage of improvement in water reduction, table (5-66). $\text{Percentage Of expected Improvement} = \frac{\text{baseline annual average} - \text{annual designed water use}}{\text{baseline annual average}} \times 100\%$		
3.M.2	**Water Use Monitoring:**		
Description	Demonstrate that efficient, regularly calibrated, easily accessible and clearly labelled water meters are provided and capable of monitoring the total water consumption.		

Source: (Researcher)

Table (5-61) continued credit points of the Water Efficiency of the Green Heritage scheme of GPRS

Techniques	Install water meters for measure the total water consumption.	M	M
3.1	**Indoor Water Efficiency Improvement:**		
Description	A maximum 8 credit points are obtainable for demonstrating that the proposed building has achieved a sensible reduction in indoor potable water consumption (not including irrigation) than the annual average water use baseline calculated for the building compared to the designed water use in 3M.1 (above). Calculations are based on using efficient, accessible, and clearly labelled water metering devices, and estimated occupant usage, and the use of conserving (saving) water and sanitary devices (fixtures) rather than the conventional ones (lavatory faucets, showers , kitchen sinks, water closets, and urinals). A maximum 8 credit points can be awarded as following: Reduction 21-30% 31-40% 41-50% More than 50%	 2 4 6 8	 2 4 6 8
Techniques	Use high efficient fixtures as mentioned in 3M.1 to reduce the total water consumption.		
3.2	**Outdoor Water Efficiency Improvement recommend to be replaced by (Water Efficient Landscaping):**		
Description	A maximum 9 credit points credit points are obtainable for demonstrating that: ▪ An Irrigation Operation and Maintenance plan has been developed; ▪ A water-efficient irrigation system is incorporated into landscape design; ▪ Landscape irrigation demand is less than 5 litres/m2/day average; ▪ Landscape irrigation demand is less than 3 litres/m2/day average; ▪ 100% exterior irrigation demand is met using Exterior Water Allowance; ▪ Reused grey water is maximized OR a recycled water mainline loop has been installed in anticipation for the availability of reused grey water; ▪ Color coding of pipes is used to distinguish recycled water from potable. ▪ Use of water treated and raw water resources by a public agency specifically for non-potable uses.	**2** **1** **1** **1** **1** **1** **1** **1**	**2** **1** **1** **1** **1** **1** **1** **1**

Source: (Researcher)

Table (5-61) continued credit points of the Water Efficiency of the Green Heritage scheme of GPRS

Techniques	- Install Drip irrigation. - Use gray water or recycled water to irrigation - Use native plants and reduce using turf grass that consumed more quantity of water. - Use irrigation moisture sensors.		
3.3	**Water Feature Efficiency:**		
Description	Credit points are obtainable for demonstrating that a) EITHER that the Project has no exterior water features or swimming pools. b) Using treated gray water for them such as: fountains. c) OR that all external water features or swimming pools are provided with adequate retractable shading covers or pool blankets ** The team of the project must obtain an agreement from the urban harmony organization or its representatives in Egyptian governorates or the Ministry of Antiquities; about any shading covers the water features, to don't have a negative impact on their heritage value.	4	4
Techniques	– Don't install new water features. – Or using treated gray water for water features as fountains. – Or using shading covers for swimming pools to reduce the rate of evaporations.		
3.4	**Water Leakage Detection:**		
Description	A maximum 6 credit points are obtainable for demonstrating the provision of: ▪ Easily accessible and clearly labelled water meters that are capable of monitoring the water consumption of major uses of water; ▪ A leak detection system that covers all main water distribution pipes within the project.	3 3	3 3
Techniques	– Labelled water meters measure major uses. – Install a leak detection system.		
3.5	**Waste water management.**		
Description	A maximum 12 credit points are obtainable for demonstrating that: - No un-treated water will enter the local environment (for example, into surfaces, deep wells, rivers, and enclosed lakes) or affect neighboring developments; all in accordance with National Environmental Laws. (***Obligatory Issue***), supporting documentation should include: drawings showing the proposed systems and relevant calculations, specifications and data sheets**.**	6	6

Source: (Researcher)

Table (5-61) continued credit points of the Water Efficiency of the Green Heritage scheme of GPRS

Description	- Ensuring that the reused treated waste water generation quality must complying the standards as prescribed in the Egyptian Environmental Laws (In case the water quality cannot be ensured, provide necessary treatment of raw water for achieving the desired concentration for various applications). (***Obligatory Issue***) - Reduce potable water use for building sewage conveyance by use of non-potable water (captured rainwater, or recycled grey water).	4 2	4 2
Techniques	- Using captured rainwater gray water for non-potable water purposes. - Treating the recycled water before use according to standards. - Don't use untreated water or raw water.		
3.6	**Sanitary Used Pipes:**		
	Replace the old sanitary pipes that have water leakage or manufactured from with non-secure materials for human health with new sanitary pipes that have the following: - Certified sanitary pipes material which secures water quality, cleanliness and sustainability for human use. - - Tested sanitary systems which ensure the high level of installation.	2 2	2 2
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 1: WATER EFFICIENCY		**43**	**43**

Source: (Researcher)

Table (5-63) the rate usage of Full time employee (FTE) Man and female of the WCs fixtures

FTE[13] (8hrs)	WC	Urinal	Lavatory		Kitchen sink		Hydroject Bidet
Man	1	2	3	30 sec per use	1	per 15 sec use	1
Female	3	0	3	30 sec per use	1	per 15 sec use	3

Source: (Researcher)

Table (5-64) the rate usage of Student and visitors (Man and female) of the WCs fixtures

Student/visitor	WC	Urinal	Lavatory		Kitchen sink		Hydroject Bidet
Man	0.1	0.4	0.5	30 sec per use	-		0.1
Female	0.5	0	0.5	30 sec per use	-		0.50

Source: (Researcher)

[13] FTE: a full time equivalent such as employees and staff, that work 8 hours per day- 5 days per week.

Table (5-64) the rate usage of residents (Man and female) of the WCs fixtures

Resident	WC	Urinal	Lavatory	shower		Kitchen sink		Hydroject Bidet
Man	5	0	5	1	480 sec per use	4	60 Sec per use	5
Female	5	0	5	1	480 sec per use	4	60 sec per use	5

Source: (Researcher)

Table (5-66) the Baseline standards of sanitary fixtures

Baseline/ standard UPC[14]/IPC [15]standards	
Fixture or Fitting	**Baseline**
Conventional water facet/commercial toilet/ residential toilet	**1.6** gallons per flush (gpf)
Conventional urinal	**1.0** gallons per minite (gpm)
Conventional private [16] / public lavatory/ residential lavatory	**2.2** gallons per minite (gpm)
Residential kitchen faucet/ Kitchen sink	**2.2** gallons per minite (gpm)
Conventional showerheads	**2.5** gallons per minite (gpm)
Residential clothes washer	Energy Star[17] / or equalivant standard.
Commercial clothes washer	CEE[18] Tier 3A / or equalivant standard.
Residential dishwasher	Energy Star / or equalivant standard.
Preinse spray value	Less than or equal **1.3** gallons per minite (gpm)
Hydroject Bedit/ Hand held Bidet[19]	0.8 gallon per use[20]

Source: (Researcher)

[14] UPC: Uniform Plumping Code 2006, section 402.0, water-conserving fixtures and fittings: iapmo.org.
[15] IPC: International Plumping Code 2006, section 604, design of building water distribution system: iccsafe.org.
[16] Private fixtures: that are located in residences, hotel/ motel guest room, private room at hospitals.
[17] Energy star: energystar.gov
[18]CEE : Consortium for Energy Efficiency Label, cee1.org.
[19] The research add bidet to the calculations for using it in Egypt compared with USA that use the toilet paper.
[20] http://www.scientificamerican.com/article/earth-talks-bidets/

Table (5-67) the standards of high efficient sanitary fixtures

fixture	consumption
High efficient toilet, single- flush gravity, water sense standard toilet	**1.28** gallons per flush (gpf)
High efficient single – flush- pressure assist	**1.0** gallons per flush (gpf)
High efficient dual – flush- (full flush)	**1.6** gallons per flush (gpf)
High efficient dual – flush- (low flush)	**1.1** gallons per flush (gpf)
High efficient dual – flush- (foam flush)	**0.05** gallons per flush (gpf)
No-water toilet	**0 gallons**
High efficient urinal/ EPA urinal	0.5 gallons per flush (gpf)
No-water urinal	**0 gallons**
EPA[21] private lavatory	**1.5** gallons per minute (gpm)
Conventional public lavatory	**0.5** gallons per minute (gpm) Or **0.25** gallons per circle. **,** circle = 12 seconds
Low- flow kitchen sink	**1.8** gallons per minute (gpm)
Low- flow shower	**1.8** gallons per minute (gpm)
EPA shower	**1.5- 2** gallons per minute (gpm)

Source: (Researcher)

[21] EPA: The Energy Policy Act pf 1992 and 2005.

CATEGORY 4: MATERIALS AND RESOURCES

OBJECTIVES

The objectives of this Category are:

- Selection of materials: to encourage selection of new materials with a low environmental impact and cost over the full life cycle of the building, particularly:
- Regional and local materials (to reduce the environmental impacts resulting from transportation);
- Renewable materials;
- Recycled materials;
- Highly efficient materials (to reduce the need for maintenance, construction energy or skill or can be easily dismantled for reuse).
  - Materials re-use: to promote the re-use of previously used materials and avoid wastage.

Note: The determination of the environmental impact and the life cycle cost of particular materials may be based on published international guidelines until a National or Regional material selection guideline is produced.

SUMMARY OF CREDIT POINTS IN THIS CATEGORY

	Materials and Resources weight is 5% of the total	Points Residential	Points Non-Residential
4M.1	**Presentation of a *Schedule of Principal Project Materials***	**M**	**M**
4M.2	**Elimination of exposure of building occupants to asbestos and to any other hazardous and toxic materials.**	**M**	**M**
4.1	**Regionally procured materials**	**3**	**3**
4.2	**Use of recycled materials:**	**4**	**4**
4.3	**Use of higher new durability materials.**	**2**	**2**

4.4.	**Designing for durability and resilience**	**4**	**6**
4.5.	**Environmental Impact of Materials**	**4**	**4**
TOTAL		**17**	**19**

THE CREDITS NEED APPROVAL FROM URBAN HARMONY ORGANIZATION

There are five credits in this category have required an approval about their strategies to meet the credits' requirements; the approval will obtain from the Urban harmony organization or its representatives in Egyptian governorates ,or the Ministry of Antiquities.

Table (5-68). the credits need approval Materials Category

	Credits
4M.2	**Elimination of exposure of building occupants to asbestos and to any other hazardous and toxic materials.**
4.1	**Regionally procured materials (to reduce the environmental impact of transportation) :**
4.2	**Use of recycled materials:**
4.3	**Use of higher new durability materials.**
4.4.	**Designing for durability and resilience**

Source: (Researcher)

DETAILS OF CREDIT POINTS IN CATEGORY 4: MATERIALS AND RESOURCES

Table (5-69) credit points of the Materials and Resources of the Green Heritage scheme of GPRS

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System			
CATEGORY 4: Materials and Resources weight is 5% of the total			
Credit ID	Credit	Residential	Non-Residential
4M.1	**Presentation of a *Schedule of Principal Project Materials* which lists all new significant building materials to be used in the restoration and greening Project of the heritage building. Information to be provided in the quantity, cost, and origin of the materials and transportation to the site.**	**M**	**M**

Table (5-69) continued. credit points of the Materials and Resources of the Green Heritage scheme of GPRS

4M.2	**Elimination of exposure of building occupants to asbestos and to any other hazardous and toxic materials.**	**M**	**M**
Description	Replacing all asbestos and other hazardous and toxic materials with other materials that don't have a bad impact on human health. **There is a need to obtain an agreement about **The report of the policy of replacement the hazardous materials of the heritage building** from the Urban Harmony organization or its representatives in Egyptian Governorates.		
Techniques	**The report of the policy of replacement the hazardous materials of the heritage building**, this report shows the quantity of materials, location of them, their heritage value, the specification of new ones, their cost, their impacts on health and on the heritage value of the heritage building.		
4.1	**Regionally procured materials (to reduce the environmental impact of transportation) :**		
Description	Credit points are obtainable for demonstrating that new materials that use in the restoration and greening project are extracted and manufactured in Egypt. Points awarded as follows (select one of the followings): ▪ Value of regional materials is not less than 25% of total new materials value; ▪ Value of regional materials is not less than 50% of total new materials value; ▪ Value of regional materials is not less than 75% of total new materials value. ** The new materials must be compatible with the heritage character and heritage fabric of the building. ** There is a need to obtain an agreement about the new materials report from the Urban Harmony organization or its representatives in Egyptian Governorates.	**1** **2** **3**	**1** **2** **3**
Techniques	Purchased materials are extracted and manufactured in Egypt.		

Table (5-69) continued. credit points of the Materials and Resources of the Green Heritage scheme of GPRS

4.2	**Use of recycled materials:**	4	4
Description	Credit points are obtainable (with evidence) for the use of recycled materials, as follows: – Demonstrate that materials of at least 10% of the total new material costs are constituted of at least: d) 30% post-consumer recycled content, or e) 80% post-industrial content, or f) 50% agricultural waste by-products. ** The new materials must be compatible with the heritage character and heritage fabric of the building. ** There is a need to obtain an agreement about the new materials report from the Urban Harmony organization or its representatives in Egyptian Governorates.		
Techniques	- Purchased recycled materials (post-consumer materials, post-industrial materials, manufactured from agriculture waste).		
4.3	**Use of higher new durability materials.**	2	2
Description	A credit point is obtainable where it can be demonstrated that at least 25% (by value) of total new materials have higher abrasion resistance and minimal maintenance costs in comparison with similar conventional materials. ** The new materials must be compatible with the heritage character and heritage fabric of the building. ** There is a need to obtain an agreement about the new materials report from the Urban Harmony organization or its representatives in Egyptian Governorates or the Ministry of Antiquities.		
Techniques	– The new materials that are purchased have higher abrasion resistance and minimal maintenance costs		
4.4.	**Designing for durability and resilience**		
	Protecting vulnerable and high value parts of the building from damage. A. Protect corridors, stairs, doors, valuable floors and main entrances that have high heritage value from the effects of high pedestrian traffic.	0	2
	B. Protection against, or prevention from, any potential vehicular collision where vehicular parking and maneuvering occurs within 1m of the external building façade for all car parking areas and within 2m for all delivery areas.	2	2

Source: (Researcher)

Table (5-69) continued. credit points of the Materials and Resources of the Green Heritage scheme of GPRS

	c. Set a plan to protect the existing building elements such as "external walls, roof, balconies, glazing of windows and skylights, external doors, blasters. Claddings, external staircase, hardscaping" that are exposed to the environmental factors as "solar radiation, temperature variation, moisture, wind, rain, vegetation, pollutants, and air and ground contaminants". ** There is a need to obtain an agreement for the plan of protecting vulnerable and high value parts of the building from the Urban Harmony organization or its representatives in Egyptian Governorates or the Ministry of Antiquities.	**2**	**2**
	▪ Set a plan for protecting vulnerable and high value parts of the building from damage or degradation effects. ▪ Adopts some procedures in residential and non-residential heritage buildings such as: – Commit the visitors to takeoff their shoes or wearing fabric slippers to protect high value floor, wooden staircases and carpets from the effects of high pedestrian traffic. – Protection rails to protect walls of corridors and vulnerable and high value parts such as decorative blasters – Ensuring good conditions for vulnerable and high value parts of the building to protect them from the effects of moisture and vegetation. – Bollards/barriers/raised kerbs to delivery and vehicle drop-off areas. – Robust external wall construction, up to 2m high, – Designing out the risk without the need for additional materials specification to protect vulnerable areas.		
4.5.	**Environmental Impact of Materials**		
	▪ This credit aims to reduce the environmental life cycle through the reuse of materials and uses new materials with low environmental impact of martials through: – Use of tools to analyze the life cycle impact of any new materials using robust environmental information assessment of the main building elements.	**4**	**4**
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 4: MATERIALS AND RESOURCES		**17**	**19**

Source: (Researcher)

CATEGORY 5: INDOOR ENVIRONMENTAL QUALITY

OBJECTIVES

The objectives of this Category are:

a) to provide a building and its systems that support the wellbeing and comfort of occupants by providing sufficient outside air ventilation and indoor air quality;

b) to eliminate exposure of building occupants to the harmful effects of tobacco smoke, the risk of Legionella and other pathogens;

c) to encourage the use of low-emission adhesives, sealants, paints, coatings, flooring and ceiling systems and to mitigate the health risks associated with formaldehyde in building products;

d) to promote thermal comfort of occupants (including the provision of individual comfort controls, where appropriate) to optimize occupant wellbeing, productivity, energy efficiency and future flexibility;

e) to promote using natural daylighting controlling interior lighting

to achieve comfortable for occupants or users.

SUMMARY OF CREDIT POINTS IN THIS CATEGORY

	Indoor Environmental Quality weight is 10% of the total	Points Residential	Points Non-Residential
5M.1	**Minimum Ventilation and Indoor Air Quality:**	**M**	**M**
5M.2	**Control of Smoking in and around the Building:**	**M**	**M**
5M.3	**Control of Legionella and other health risks:**	**M**	**M**
5.1.	**Enhanced Indoor quality strategy**	**3**	**3**
5.2.	**Thermal Comfort**	**2**	**2**
5.3	**Safety**	**2**	**2**
5.4.	**Interior Lighting**	**2**	**2**
5.5.	**Daylighting**	**2**	**2**
5.6.	**Controlling emissions from building materials**	**2**	**2**
TOTAL		**13**	**13**

THE CREDITS THAT NEED APPROVAL FROM URBAN HARMONY ORGANIZATION

There are eight credits in this category have required an approval about their strategies to meet the credits' requirements; the approval will obtain from the Urban harmony organization or its representatives in Egyptian governorates, or the Ministry of Antiquities.

Table (5-70). the credits need approval in Indoor Environmental Quality Category

	Credits
5M. 1	**Minimum Ventilation and Indoor Air Quality:**
5.4.	**Interior Lighting**
5.5.	**Daylighting**

Source: (Researcher)

DETAILS OF CREDIT POINTS IN CATEGORY 5: INDOOR ENVIRONMENTAL QUALITY

Table (5-71) credit points of the Indoor Environmental Quality category of the Green Heritage scheme of GPRS

<table>
<tr><td colspan="4">Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System</td></tr>
<tr><td colspan="4">CATEGORY 5: INDOOR ENVIRONMENTAL QUALITY weight is 12% of the total</td></tr>
<tr><td>Credit ID</td><td>Credit</td><td>Residential</td><td>Non-Residential</td></tr>
<tr><td>5M.1</td><td>Minimum Ventilation and Indoor Air Quality:</td><td rowspan="2">M</td><td rowspan="2">M</td></tr>
<tr><td></td><td>The majority of heritage buildings are constructed of porous materials that both absorb moisture and allow it to escape. Ventilation stops this moisture building up in any one place and causing damage and problems with condensation and mold. However, heritage buildings typically have high levels of air infiltration leading to discomfort and heat loss. Heritage buildings however also typically require a higher level of infiltration to remove structural moisture in the absence of impermeable damp proofing.
For naturally ventilation spaces:
• Confirmed the minimum outdoor air opening and space configuration requirements using the natural ventilation procedure from ANSI / ASHRAE 62 or local equivalent, whichever is more stringent.
• Ventilation rates in all habitable and inhabitable spaces are sufficient to allow moisture are sufficient to allow structural moisture to be dealt with effectively.</td></tr>
</table>

Source: (Researcher)

Table (5-71) continued credit points of the Indoor Environmental Quality category of the Green Heritage scheme of GPRS

Description	Step 1: • Collect the information for each naturally ventilated space (minimum celling height of the space, location of natural ventilation opening (on one side, twp opposite slides..etc), and size of the natural ventilation opening (openable area)) Step2: • Determine the size of opening required for each space according to the standard • for each space depended on Step 3: • Compare the calculation results with the information collected in step2. **If the ventilation is not achieved the minimum standard, the project team may be able to achieve the mandatory credit through mechanical ventilation. **For Mechanically ventilation spaces or mixed-mode spaces** **Step 1:**		
	– Define the location of all air-handling units or rooftop units and ventilation fans. – Determine the total supply for each unit. – Identify the minimum supply flow. – Determine of the equipment operates in cooling mode only, or both heating and cooling modes. – Identify the locations of supply diffusers and return grilles in each space, if they are located underfloor, overhead, or side wall (for HVAC systems). **Step2:** – Confirm compliance with ANSI / ASHRAE 62 or local equivalent standard. **For mechanically ventilation spaces, must achieve the following requemnts:** • Separation distances between outdoor air intakes and any exhausts or discharge points comply with local codes or ASHRAE (whichever is more stringent); • all exhausts are located outside of the defined public realm or as defined by local code, whichever is more stringent; • all occupied areas comply with the minimum thresholds set out in ANSI / ASHRAE 62 using the ventilation rate procedure or local code, (whichever is more ** For new or existing mechanically ventilation spaces, the project team must obtain the approval of Urban Harmony organization about the plan of mechanical ventilation that includes the type of systems, location of units, if they have a negative impact on heritage building values.		
Techniques	▪ Using Natural ventilation, mechanical ventilation or mix mode ventilation. ▪ Using simulation model .		

Source: (Researcher)

Table (5-71) continued credit points of the Indoor Environmental Quality category of the Green Heritage scheme of GPRS

5M.2	**Control of Smoking in and around the Building:**	M	M
Description	- Demonstrate that smoking is prohibited throughout the building including car parks, and 25 m smoke free zones around all entrances, outdoor air intakes and operable windows. - Train all security staff for smoking control within and outside buildings. - Locate any dedicated external smoking areas away from public or high use pedestrian thoroughfares and install suitable facilities for collecting ash and cigarette ends; and install, in all dedicated external smoking areas, signage that lists the negative health impacts of smoking and details assistance for those aiming to stop.		
5M.3	**Control of Legionella and other health risks:**	M	M
Description	- Demonstrate that a Legionella Management Plan exists for all relevant water based systems, following the requirements and guidance in local health regulations		
5.1.	**Enhanced Indoor quality strategy**		
Description	Credit points are obtainable for the provision of CO2 sensors installed at all return points. Ensure the CO2 monitoring system has sensors located in the breathing zone and is capable of alerting occupants when the additional fresh air is required. At minimum CO2 levels must not exceed 1000ppm.	3	3
Techniques	Install CO2 sensors at all return points.		
5.2.	**Thermal Comfort**	2	2
Description	Credit points are obtainable for demonstrating that all spaces within the building have been modelled to determine zonal cooling demand and designed to have separately controllable thermal zones, Provision for these zones and various types of the building should be in accordance with ANSI / ASHRAE 55 adapted for Egyptian Climatic Regions. - Install at least one air temperature sensor for each thermal zone with occupied spaces. - Install at least one humidity sensor for each humidity zone in the building. - The monitoring system must record measurements at an interval of 15 minutes or less. A system alarm must be triggered when measured temperature or humidity is outside the standard range of ASHRAE 55.		
Techniques	- Using simulation program for modelled the spaces. - Install air temperature sensors, and humidity sensors.		

Source: (Researcher)

Table (5-71) continued credit points of the Indoor Environmental Quality category of the Green Heritage scheme of GPRS

5.3.	**Safety**	**2**	**2**
Description	Credit points are obtainable for installing the following: - Fire detection and alarm system. - Carbon monoxide detector and alarm system for the building that is supplied with mains gas.		
Techniques	Install fire detection with alarm system, carbon monoxide detector with alarm system.		
5.4.	**Interior Lighting**	**2**	**2**
Description	This credit promotes occupants' / users' productivity, comfort, and well-being by providing lighting control. Credit points are obtainable for providing lighting control for at least 50% of occupant spaces (individual and multi-occupant spaces) have in place individual lighting controls, and there are at least three lighting levels (on, off, midlevel). The midlevel is 30%-70% of the maximum illumination level. ** The project team must obtain the approval of Urban Harmony organization or Ministry of Antiquities about the plan of lighting control and the impacts of heritage building values.		
Techniques	- Using a control lighting system for 50% of spaces.		
5.5.	**Daylighting**	**2**	**2**
	- This credit aims to increase the natural light in the internal spaces of the heritage building to be comfortable to the occupants without harming or losing the heritage windows or doors of the heritage building - all spaces within the building have been modelled to determine the suitable lighting intensity to meet the required applications as per local codes; ** The project team must obtain the approval of Urban Harmony organization or Ministry of Antiquities about the daylighting plan of the heritage building.		
	- using simulation program. - Increasing the daylights via by restored windows and new skylights if that is possible.		
5.6.	**Controlling emissions from building materials**		
Description	Credit points are obtainable for demonstrating the use of low emission adhesives, sealants, and paints, coatings, flooring and ceiling systems, and certification that building materials and products containing formaldehyde have not been used.	2	**2**
Techniques	- Using materials finished and paints that have low VOC.		
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 6: INDOOR ENVIRONMENTAL QUALITY		**13**	**13**

Source: (Researcher)

CATEGORY 6: MANAGEMENT, WASTE, AND POLLUTION

OBJECTIVES

The objectives of this Category are:

- to minimize the environmental impacts associated with restoration operations.
- Building User Guide: to ensure that the building will be operated responsibly and maintained properly by providing a Building User Guide and Periodic Maintenance schedule.
- To manage the operational waste and encourage recycling it.
- To manage the surface water run –off for avoiding surface run-off and flooding.

SUMMARY OF CREDIT POINTS IN THIS CATEGORY

	Management, Waste, and Pollution weight is 10% of the total	Points Residential	Points Non-Residential
6M.1	**Presentation of the Greening and restoration design and implementation plan for a heritage building.**	**M**	**M**
6M.2	**Compatibly with the recommendations of Urban Harmony organization or their Committees.**	**M**	**M**
6M.3	**Presentation of an Integrated Plan and Method Statement for site operations**	**M**	**M**
6M.4	**Compliance with all relevant national Health & Safety regulations for workers during restoration and greening project.**	**M**	**M**
6M.5	**Separation of flammable and toxic materials**	**M**	**M**
6.1.	**Providing a Building User Guide.**	**3**	**3**
6.2.	**Providing a Periodic Maintenance Schedule.**	**2**	**2**
6.3	**Project Waste Management**	**7**	**7**
6.4.1.	**Operational waste** (for non-residential buildings only)	**0**	**2**
6.4.2.	**Household Waste** (for residential buildings only)	**2**	**0**

6.5.	**Managing Surface Water Runoff**	**3**	**3**
6.6.	**Minimizing Pollution during restoration and greening project.**	**1**	**1**
TOTAL		**18**	**18**

THE CREDITS NEED APPROVAL FROM URBAN HARMONY ORGANIZATION OR THE MINISTRY OF ANTIQUITIES:

There are three credits in this category have required an approval about their strategies to meet the credits' requirements; the approval will obtain from the Urban harmony organization or its representatives in Egyptian governorates or the Ministry of Antiquities.

Table (5-72). the credits need approval in Management Category

	Credits
6M.1	**Presentation of the Greening and restoration design and implementation plan for a heritage building.**
6.2.	**Providing a Periodic Maintenance Schedule:**
6.5.	**Managing Surface Water Runoff**

DETAILS OF CREDIT POINTS IN CATEGORY 7: INNOVATION

Table (5-73). credit points of the Management category of the Green Heritage scheme

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System			
CATEGORY 6: MANAGEMENT, WASTE AND POLLUTION weight is 10% of the total			
Credit ID	Credit	**Residential**	**Non-Residential**
	Management		
6M.1	**Presentation of the Greening and restoration design and implementation plan for a heritage building.**	**M**	**M**
Description	Demonstrate the restoration design and implementation plan for the heritage building. **The plan must be approval from the Urban Harmony organization or their Committees in governorates.		
6M.2	**Compatibly with the recommendations of Urban Harmony organization or their Committees.**	**M**	**M**
Description	Preserve the heritage value of the urban fabric of the city by implementing the recommendation of Urban Harmony organization or their Committees. For non-listing heritage buildings, restoring the heritage building and submit to the organization for listing it.		

Table (5-73). Continued credit points of the Management category of the Green Heritage scheme

6M.3	**Presentation of an Integrated Plan and Method Statement for site operations**	**M**	**M**
6M.4	**Compliance with all relevant national Health & Safety regulations for workers during restoration and greening project.**	**M**	**M**
6M.5	**Separation of flammable and toxic materials**	**M**	**M**
Description	Separate the flammable and toxic materials in specific external container and prevention of soil pollution in these areas. The contents of the container must be disposed according to local regulations and national Health & Safety regulations and codes.		
6.1.	**Providing a Building User Guide:**		
Description	Credit points are obtainable for providing a building user guide containing the necessary technical and non-technical information for the building users / occupants to enable the efficient and responsible operation of the Heritage building.	**3**	**3**
Techniques	Set a Building user guide for users and occupants.		
6.2.	**Providing a Periodic Maintenance Schedule:**	**2**	**2**
Description	Credit points are obtainable for the provision of a Periodic Maintenance Schedule, which should be comprehensive and regularly updated. **The Periodic Maintenance Schedule must be approval from the Urban Harmony organization or their Committees in governorates.		
Techniques	Set a periodic maintenance schedule.		
Waste			
6.3.	**Project Waste Management**		
	This credit aims to avoid waste being disposed of the landfill through reusing, recycling, or reselling the materials of the project waste. Credit points are obtainable for implement the following:		

Source: (Researcher)

Table (5-73). Continued credit points of the Management category of the Green Heritage scheme

Description	**5- Presenting a project waste management plan** that includes strategies for reducing, and, where possible, re-using and recycling the waste arising from site operations. **6- Recycled the project waste**, two points can be awarded if the project recycled or reused equal or greater than 25% (by weight or volume) of the total project waste. **7- Provide containers for site Materials waste** providing and an appropriate number of separate specific and identified containers for different kinds of wastes with clear signs on each, as (glasses, Metals, stones, fabric …etc). **8- Employing waste recycling workers on site** workers for daily recycling of waste materials on site.	**2** **2** **2** **1**	**2** **2** **2** **1**
Techniques			
6.4.1	**Operational waste** (for non-residential buildings only)	0	**2**
Description	Providing a dedicated space for storage recyclable waste volumes generated by the building's units, it must have capacity appropriate to the building type, size, number of units (if relevant) and predicted volumes of waste that will arise from daily/weekly operational activities and occupancy rates. The area and the location of the dedicated space ,and the number of containers or bins that put in dedicated space and at the units will be defined after making a study of the proposed activities in the building and the estimated volume of the waste stream. ****Clinical Waste** that derived from medical practices and defined as bodily fluids and wastes, drugs and medical equipment; and other waste which, unless rendered safe, may prove hazardous or infectious to persons coming into contact with it must be separated and disposes according to the health regulations and laws.		
Techniques	- Make a study about the proposed activities in the building and the estimated volume of the waste stream to define daily/weekly operational activities and occupancy rates. The area and the location of the dedicated space, and the number of containers. - Implement waste management plan for operational waste.		

Source: (Researcher)

Table (5-73). Continued credit points of the Management category of the Green Heritage scheme

6.4.2.	**Household Waste** (for residential buildings only)		
Description	- **One point** for providing three containers: two containers for recycling materials as" paper, glass, metal, fabric, plastic ..etc" and one container for kitchen waste. - The project can be awarded **one additional point** if the total containers for recycling materials are three, addition to one container for kitchen waste and one container for green/garden waste if the building has a garden. - The containers have volume compatible with the number of the units at the heritage building. - Safely dispose if all discarded batteries, and all mercury lamps. - If the residential building has commercial units on the ground floor, each unit must have one wheeled bin[22] to award any point in this credit. - All recycling containers have specific colors and signs demonstrate the type of recycling material that container has. - Inform the local authority that the building has containers for recycled materials to send recycling collectors that sent them back to the manufacturer.	**1** **1**	**0**
Techniques	- Implement waste management plan for household waste. - Provide waste colored containers for household waste.		
Pollution			
6.5.	**Managing Surface Water Runoff**		
Description	This credit aims to directly infiltrate to the ground water that will reduce the discharge of rainfall to public sewers, this will reduce the risk of localized flooding of public sewers, the points of the credit can be awarded as a following:		

Source: (Researcher)

[22] Wheeled bins: 360 litre = 0.86m x 0.62/660 L= 1.2m x 0.7m/1100 L = 1.28m x 0.98m

Table (5-73). Continued credit points of the Management category of the Green Heritage scheme

Description	- **One point** is awarded if there is non-addition or modification of the hardscaping of the site of the heritage building. - **One point** is awarded if all new hardscaping pavements, driveways, car parks, walkers ways are permeable materials or from an impermeable surface that drains onto a permeable surface (e.g. paving slabs set on concrete that drained onto soft landscaped areas), <u>when there is no value of the hardscaping of the site</u>. - **An additional one point,** if all run-off from the roof rainfall, have been managed onsite after transferred pipes to the landscape areas to infiltrate groundwater. - **An additional one point** if the project managing rainfall by using one or more of the systems: green roofs, bio-retention areas, rainwater harvesting systems, and swales. ** There is a need to obtain an agreement about "the plan of the project for renovating the site" from the Urban Harmony organization or its representatives in Egyptian Governorates.	**1** **1** **1**	**1** **1** **1**
Techniques	- Set a plan of the policy of restoration or renovation of the site. - Using permeable surfaces or an impermeable surface that drains onto a permeable surface in the hardscaping of the site.		
.6.6	**Minimizing Pollution during restoration and greening project.**		
Description	A credit is obtainable for demonstrating a strategy to minimize pollution from restoration and greening operations (including generation of dust and pollutants).	**1**	**1**
Techniques	Set a Management plan for project waste and pollutions.		
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 6: MANAGEMENT, WASTE, AND POLLUTION		**18**	**18**

Source: (Researcher)

CATEGORY 7: INNOVATION

OBJECTIVES

The objectives of this Category are:

- Exceeding Benchmarks: initiatives which demonstrate additional environmental benefit by exceeding the current benchmarks of GPRS.
- Innovation: design initiatives and construction practice which have a significant measurable environmental benefit and which are not otherwise awarded points by GPRS.

SUMMARY OF CREDIT POINTS IN THIS CATEGORY

	Innovation weight is bonus	Points Residential	Points Non-Residential
7.1	**Exceeding Benchmarks:**	**6**	**6**
7.2	**Innovation**	**4**	**4**
TOTAL		**10**	**10**

THE CREDITS NEED APPROVAL FROM URBAN HARMONY ORGANIZATION

There are no specific credits in this category have required an approval; for exceeding benchmarks, an approval may be needed , depended on the selected credit that has been exceeded, the approval will obtain from the Urban harmony organization or its representatives in Egyptian governorates.

DETAILS OF CREDIT POINTS IN CATEGORY 7: INNOVATION

Table (5-74) credit points of the Innovation category of the Green Heritage scheme

Proposal of scheme "Green Heritage Buildings Rating System" – Green Pyramid Rating System			
CATEGORY 7: INNOVATION weight is Bonus			
Credit ID	Credit	Residential	Non-Residential
7.1	**Exceeding Benchmarks:**	6	6
Description	Credit points are obtainable for demonstrating that the current benchmarks of GPRS have been exceeded by a significant margin and providing evidence that the improvement has an additional environmental benefit. One Credit Point is available for each Category (up to a maximum of six Credit Points).		
Techniques	--		
7.2	**Innovation**	4	4
Description	Credit points are obtainable for innovative design or construction practices which have a significant measurable environmental benefit and which are not otherwise awarded points by GPRS.		
Techniques	--		
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 6: INDOOR ENVIRONMENTAL QUALITY		**10**	**10**

Source: (Researcher)

Conclusions of Chapter 5:

In this chapter, the research has achieved the main aim of the research by producing a green heritage building rating system under the Green Pyramid rating system (GPRS), this scheme can assess and evaluated the green practices and environmental impacts of the heritage buildings in Egypt.

In the next chapter (chapter 6), the research will apply and use this tool to assess a listed heritage building in Egypt after transforming it as a **green heritage building** by merging the principles of the green building practices in the conservation strategies of the heritage building.

PART THREE

Applied Study

CHAPTER

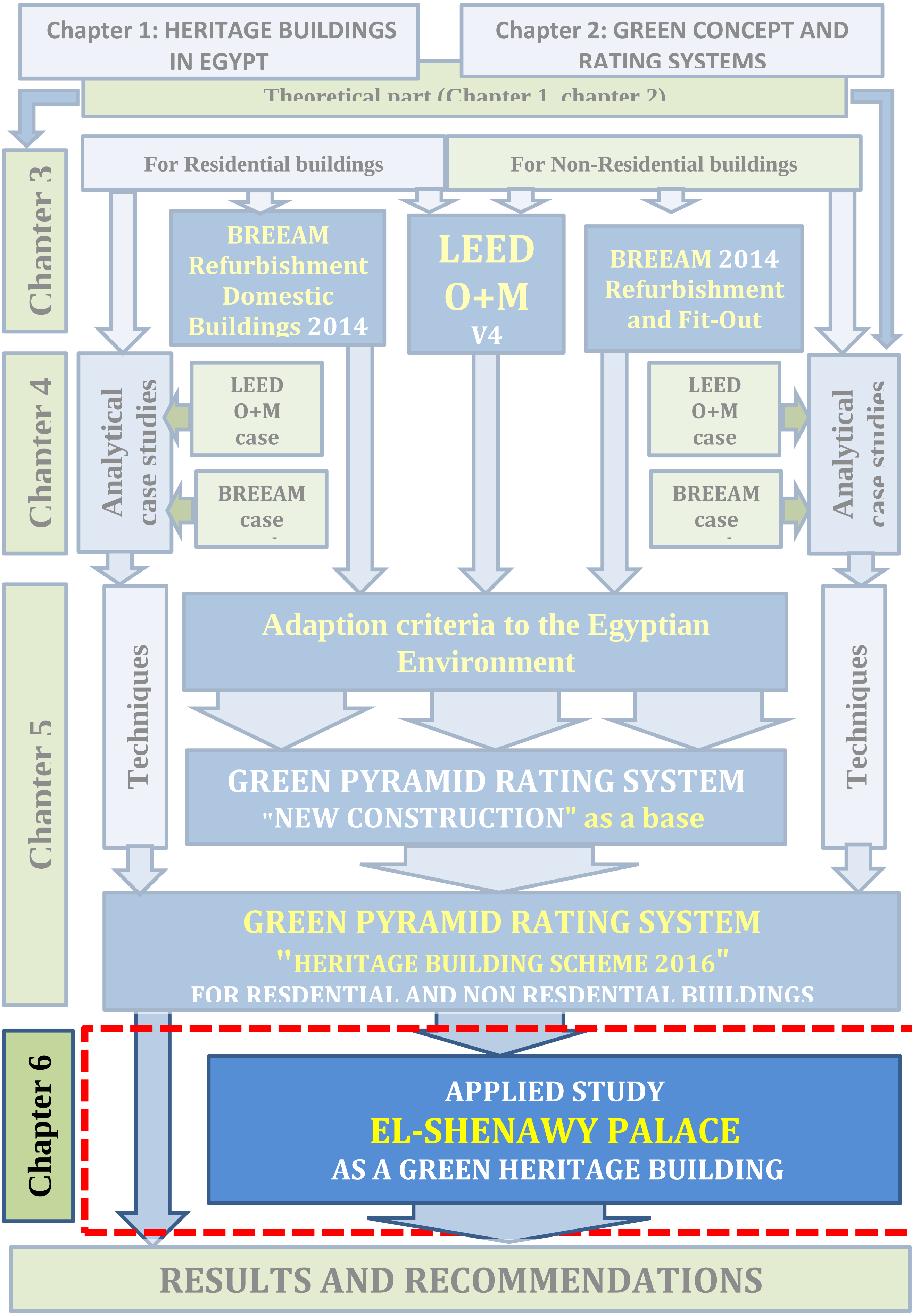
VI

An applied study to assess the green rating system for

EL-Shenawy Palace - Mansoura

6-5. The current physical state of the palace: 294

6-5. The current physical state of the palace: 294



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Chapter 6
APPLIED STUDY
EL-SHENAWY PALACE
AS A GREEN HERITAGE BUILDING
RESULTS AND RECOMMENDATIONS

6. An applied study to assess the green rating system for El-Shenawy Palace-Mansoura

El-Shenawy palace is located in the north west of Mansoura, it was built from 1927 to 1930 in the same period of construction of El-Montaza Royal Palace at Alexanderia.

Fig (6-1). The location map of El-Shenawy palace

Source: Google Earth

5-6-1. History of the palace:

The owner of the palace " Mohamed Bek El-Shenawy" (who was a senior member of the El-Wafd party) had good relations with King Farouk and the Italian Engineers who supervisors on the construction of royal palaces at that time. He hired their experiences when he decided to build his palace on the south bank of the river Nile at Mansoura City.

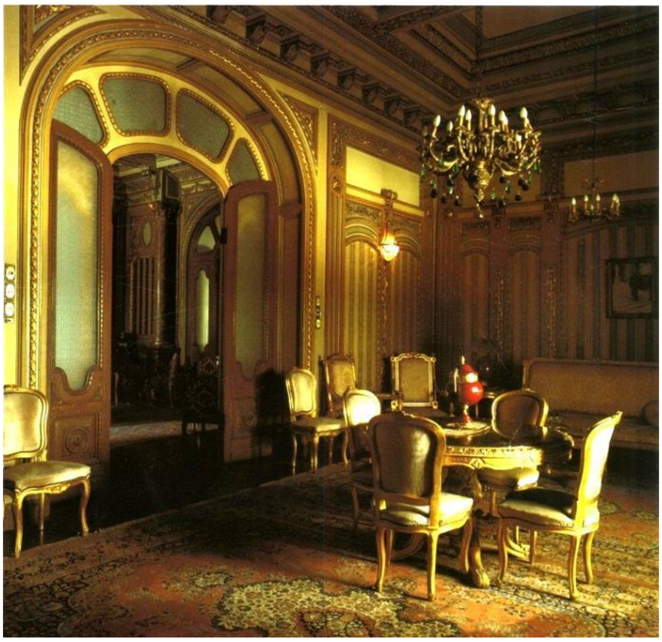
All the designers, architects, engineers, workers and sculptors were from Italy. The original area of the site of the palace in 1930 was 4500 m2. that area of the palace building is 441 m2, two roofed spaces for car-parking, front garden, tennis playgrounds, fountain, the back garden that were overlooking the Nile, and marina for boats.

Fig (6-2). The main facade of El-Shenawy palace

Source: The photographer: Roland Unger

Fig (6-3), Fig (6-4). The back garden of El-Shenawy palace before detucted from its area

Source: Ali, Maha and others(2015), " **Investigation and Conservation of El-Shenawy Palace Photographic Collection In Mansoura Egypt",** Mediterranean Archaeology and Archaeometry, Vol. 15, No 3, (2015), pp. 165-185.



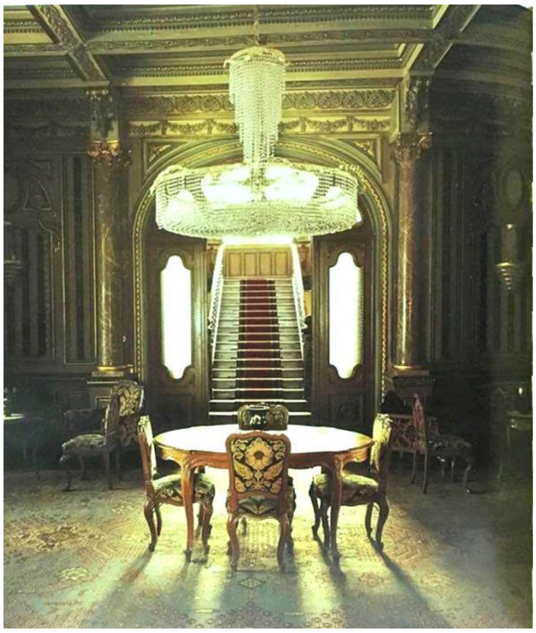


Fig (6-5), Fig (6-6) The internal spaces of El-Shenawy palace in 2005.

Source: The Photographer: Sheriff Sonbol at Johnston, Shirley (2006).

"*The Italians produced exuberant carved plastwork, wooden paneling, and intricate ironworks to rival the palaces of the Khedive Ismail himself*" said Saad the second of two sons of Mohamed Bek El-shenawy, In fact they would win for Mohamed Bek El-shenawy a gold medal for architecture at the Fiera Esposiziona Al Litoraale In Bologna in 1931, with a framed certificate signed by Mussolini as the best building in the middle east that was built in the Italian style outside Italy.[1] See fig (6-7).

Fig (6-7). The certificate for the palace signed By Mussolini in 1931

Source: (Researcher)

The skeleton of the building was made of stones covered with bricks, and the details made of lime stone, the columns are made of white marble. The interior decoration of the spaces is in the Italian renaissance and most of the materials and furniture were imported from Italy[2], as well as

[1]Johnston, Shirley (2006)" **Egyptian Palaces and Villas**", Book, Abrams, NewYork, USA, ISPN 0-8109-5538-5, Page167.

[2]Khalil, Mohamed Ali and El-Eashy, Alaa shams (May 2010) "**Analysis of the Architectural heritage of El-Mansoura city, Egypt towards urban conservation approach**", Youth in Conservation of Cultural Heritage - YOCOCU" Palermo (Italy), 24th – 26th May 2010.

the main wooden staircase that had been sent in one piece from that from Italy.[1]

The same Italians working on King Foad's Palace at Montaza evidently had extra floral floor tiles to spare for use also on Mohamed El-shenawy columned balcony.[2]

The basement had a salon that was open every night all year long, it had a billards table, the basements also comprised the rooms of the servant and kitchen, the food was sent up by " an elevator" to a wooden – paneled dining hall on the second floor.[3]

The first floor comprised the office room of Mohamed Bek El-shenawy and salons. The second floor comprised the Master bedroom, and other Bedrooms for his sons and daughters, as well as the dining room and three bath rooms. See fig (6-22), and fig (6-24).

Fig (6-8). The back façade of the palace from back garden

Source: Ali, Maha and others(2015).

In the sixtieth of the twenty century, after the High Dam was constructed, and the level of the River Nile was dropped, the governor of Ad-Dakahlyia.

[1] Johnston, Shirley (2006), page170.
[2] Johnston, Shirley (2006), page170.
[3] Ibid.

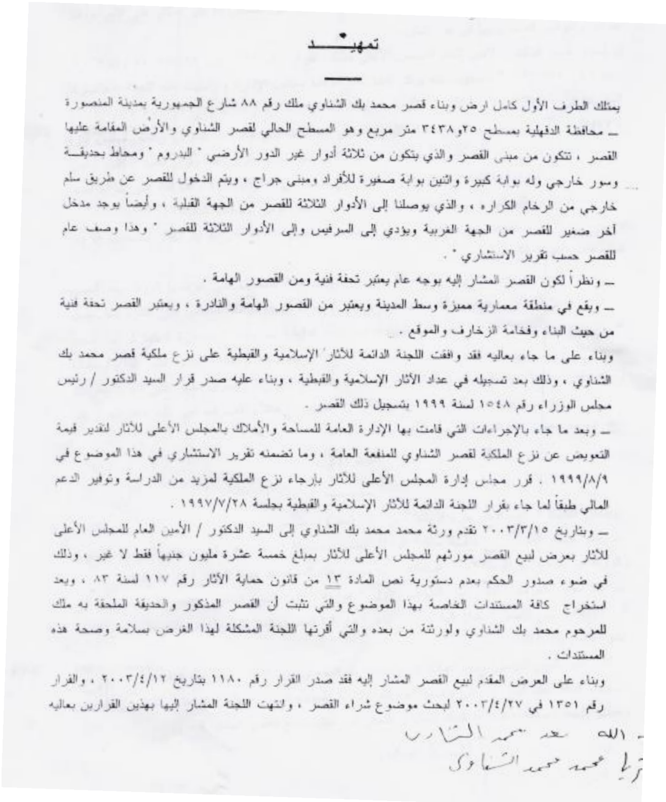
Governorate at that time, dec`ided to construct a new road parallel to the Nile "El-Mashaya St.", that needed to deduct a part of the back garden of the palace and the marina's boats, that was interrupted the direct relation between the palace and the Nile. The total area of the palace became around 3500 m2.

In the beginning of the eightieth of the twenty century, the owner of the palace was died, the inheritors of Mohamed Bek El-shenawy sold 1250 m2 from the area of the palace's site that represented the tennis playgrounds and most area of the back garden, the total area of the palace became 2250 m2 which represents the current area of the palace.

Fig (6-9). floral floor tiles at columned balcony of the palace.
Source: The photographer: Roland Unger

In this 1980s and 1990s, most of the adjacent palaces to El-shenawy palace were demolished as well as most of the city's palaces, and villas. They were replaced with multi-stories residential buildings, and commercial buildings. Now, the palace with surrounding from its three sides with multi-stories buildings.

Before the beginning of the third millennium, many real-estate companies stepped forward to buy the palace from its owners (the inheritors), but the Ministry of culture (that was responsible for culture and antiquities at that time before established a separate Ministry of antiquities in 2011) has listed the palace in the list of the



تمهيـــد

يمتلك الطرف الأول كامل ارض وبناء قصر محمد بك الشناوي ملك رقم ٨٨ شارع الجمهورية بمدينة المنصورة – محافظة الدقهلية بمسطح ٣٤٣٨,٢٥ متر مربع وهو المسطح الحالي لقصر الشناوي والأرض المقامة عليها القصر ، تتكون من مبنى القصر والذي يتكون من ثلاثة أدوار غير الدور الأرضي " البدروم " ومحاط بحديقة وسور خارجي وله بوابة كبيرة واثنين بوابة صغيرة للأفراد ومبنى جراج ، ويتم الدخول للقصر عن طريق سلم خارجي من الرخام الكراره ، والذي يوصلنا إلى الأدوار الثلاثة للقصر من الجهة القبلية ، وأيضاً يوجد مدخل آخر صغير للقصر من الجهة الغربية ويؤدي إلى السرفيس وإلى الأدوار الثلاثة للقصر " وهذا وصف عام للقصر حسب تقرير الاستشاري " .

– ونظراً لكون القصر المشار إليه بوجه عام يعتبر تحفة فنية ومن القصور الهامة .

– ويقع في منطقة معمارية مميزة وسط المدينة ويعتبر من القصور الهامة والنادرة ، ويعتبر القصر تحفة فنية من حيث البناء وفخامة الزخارف والموقع .

وبناء على ما جاء بعاليه فقد وافقت اللجنة الدائمة للآثار الإسلامية والقبطية على نزع ملكية قصر محمد بك الشناوي ، وذلك بعد تسجيله في عداد الآثار الإسلامية والقبطية ، وبناء عليه صدر قرار السيد الدكتور / رئيس مجلس الوزراء رقم ١٠٤٨ لسنة ١٩٩٩ بتسجيل ذلك القصر .

– وبعد ما جاء بالإجراءات التي قامت بها الإدارة العامة للمساحة والأملاك بالمجلس الأعلى للآثار لتقدير قيمة التعويض عن نزع الملكية لقصر الشناوي للمنفعة العامة ، وما تضمنه تقرير الاستشاري في هذا الموضوع في ١٩٩٩/٨/٩ . قرر مجلس إدارة المجلس الأعلى للآثار بإرجاء نزع الملكية لمزيد من الدراسة وتوفير الدعم المالي طبقاً لما جاء بقرار اللجنة الدائمة للآثار الإسلامية والقبطية بجلسة ١٩٩٧/٧/٢٨ .

– وبتاريخ ٢٠٠٣/٣/١٥ تقدم ورثة محمد محمد بك الشناوي إلى السيد الدكتور / الأمين العام للمجلس الأعلى للآثار بعرض لبيع القصر مورثهم للمجلس الأعلى للآثار بمبلغ خمسة عشرة مليون جنيهاً فقط لا غير ، وذلك في ضوء صدور الحكم بعدم دستورية نص المادة ١٣ من قانون حماية الآثار رقم ١١٧ لسنة ٨٣ ، وبعد استخراج كافة المستندات الخاصة بهذا الموضوع والتي تثبت أن القصر المذكور والحديقة الملحقة به ملك للمرحوم محمد بك الشناوي ولورثته من بعده والتي أقرتها اللجنة المشكلة لهذا الغرض بسلامة وصحة هذه المستندات .

وبناء على العرض المقدم لبيع القصر المشار إليه فقد صدر القرار رقم ١١٨٠ بتاريخ ٢٠٠٣/٤/١٢ ، والقرار رقم ١٣٥١ في ٢٠٠٣/٤/٢٧ لبحث موضوع شراء القصر ، وانتهت اللجنة المشار إليها بهذين القرارين بعاليه

Fig (6-10). A photocopy from the first page the of Purchase contact.
Source: (Researcher)

Islamic and Coptic monuments in 1999, then the ministry began the purchase negotiations with the palace's owners, as a preliminary stage to transform it as a Museum.

The property of the palace transform to the ministry in 9 October 2005 according to the purchase contract between the Ministry and the palace's owners, the total area of the palace is 3438,25 m2, and the selling price was EGP 15 million (equal $ 2,599,653 at that time, was 1 dollar = 5.77 EGP). See fig (6-10).

According to a meeting with the Lady / Toraya El-Shenawy the youngest of Mohamed Bek El-Shenawy's six daughters in 25 November 2014**,** she reported that the selling price of the palace did not include the furniture of the palace**,** the ministry of antiquities was delivered the palace as empty rooms, and the daughter of his brother "Saad" delivered the palace's furniture and light units as a part of the rightful legacy of her father, then she sold them at the antiquities galleries and auction houses that care to buy master pieces and luxury Italian furniture.

6-2. The values of El-Shenawy palace:

El-shenawy palace has many values lead to be listed as a monument for the following:

1. **Architecture, aesthetic and artistic values:** the palace facades designed on the Baroque and Rococo style.
2. **Heritage value:** the palace was built at the time of Montaza palace in 1928-1930. It has tiles from Montaza palace, its Italian furniture and wooden staircase.
3. **Exclusivity value:** the best building in the Middle East that was built in the Italian style outside Italy according to the certificate that signed by Mussolini. See fig (6-7).
4. **Witnessed important events:** the meetings of El-Wafd party, and the wedding of Saad the son of Mohamed Bek El-shenawy that was attended by public figures as Mostafa El-Nahas Basha, and the wedding singer was "Omm Kalthoum".[1] See fig (6-11) and fig (6-12).

[1]Johnston, Shirley (2006), page167.

5. **Associate with famous figures:** Mohammed Bek El-shenawy, Omm Kalthoum, Mostafa El-Nahas Basha, the singer / Mohamed Abdel Wahab.
6. **National Value:** the palace was open for citizens, pashas, as well as poor people especially in Ramadan, it became known as Beit El-Oumma the" House if the Nation".[1]

Fig (6-11). Mostafa El-Nahas Basha in the main salon of El-Shenawy Palace
Source: (Researcher)

Fig (6-12). Mostafa El-Nahas in the wedding tent at the back garden of El-Shenawy palace
Source: (Researcher)

Fig (6-13). One of the rooms of the ground floor in El-Shenawy palace
Source: (Researcher)

Fig (6-14). One of the rooms of the ground floor in El-Shenawy palace
Source: ~~(Researcher)~~

[1] Ibid.

Fig (6-15). The Master bedroom of El-Shenawy in palace the first floor
Source: (Researcher)

Fig (6-16). The main hall of the ground floor in El-Shenawy palace
Source: (Researcher)

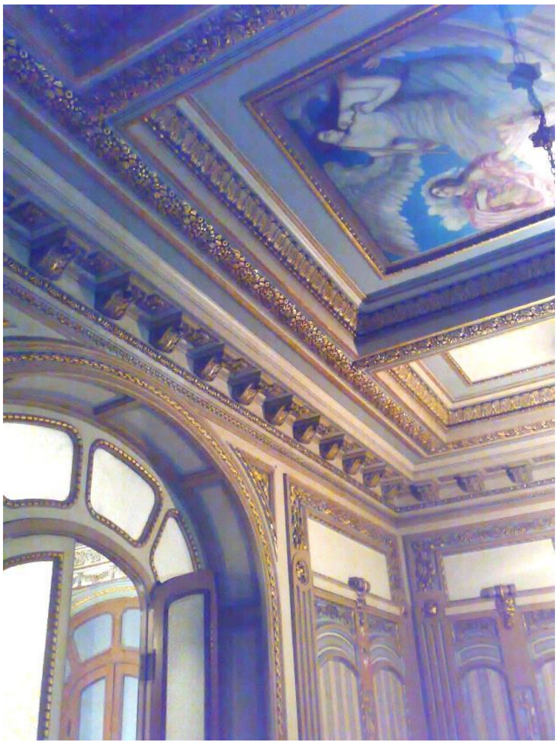


Fig (6-17). One of the rooms of the ground floor in El-Shenawy palace
Source: (Researcher)

Fig (6-18). The painting celling of one of the rooms of the ground floor in El-Shenawy palace
Source: (Researcher)

Fig (6-19). The dining room of El-Shenawy in palace the first floor

Source: (Researcher)

6-3. El-Shenawy palace as a Mansoura National Museum (Plan of 2010)[1]:

The Ministry of Antiquities intended since 2010 to transform the palace as a museum comprises antiquities from the different eras as a following:

- Pharaonic era's antiquities were discovered in the archeological hills, in Ad-Dakahlyia Governorate.
- Islamic Antiquities.
- The recent era represents in some of the Mohamed Ali family's antiquities.

The project of the museum aimed to:

- Transform the rooms and living areas to exhibits halls,
- Demolish the roofed parking areas, and construct an electronic gate for visitors.
- Construct fire alarm system, security system, and lighting systems for exhibits.

[1] According to a meeting with Dr. Mohamed Taman (the director of Islamic and Coptic antiquities in El-Dakahlyia Governorate) in January 2013.

- Construct a service building in the back garden that comprises W.Cs and cafeteria.
- Construct a shop for souvenirs and guards rooms.
- Construct high concrete wall surrounding the palace from its three sides.
- Import specified glass display cabinets for exhibits from Germany.
- Prepare the scenario display for exhibits and antiquities inside the museum.
- Install HVAC systems for exhibits halls, its ducts will be hidden to don't hide the ornaments of the internal walls and roofs "the ducts will be suspended to the celling of underground floor for ground floor's rooms, and on the roof for the first floor rooms".
- Reinstall the waterproof of the roof to achieve more protection from rainfall and the moisture that could be escaped at some points of the roof lead to damage the internal stucco ornaments of the celling.

The project began at 2010, but the project was stopped since the outbreak of the revolution of January of 2011 for the lack of financial resources.

Fig (6-20). The sign of the restoration project and transform it as Mansoura National Museum on the front of El-Shenawy palace since 2010
Source: (Researcher)

The total of works that have carried out not exceeded than 10% from the aims of the project. Most of the works have carried out were concentrated in the site of the building as: the construction of souvenir shop and guards room, the removal of old trees for constrcuting the bases for firefighting tank and the electronic gate, the construction of the surrounding concrete walls, the demolition of the roofed car parking, the removal of the original roof tiles, and reinstalling the roof waterproof without recovering it with the roof tiles.

6-4. El-Shenawy palace as a cultural center (Plan of 2016):

In the last field visit of the researcher to the palace on 10 May 2016, Dr. Taman said that there is a modification in the plan of 2010 for El-Shenawy Place, the ministry of Antiquities changed the adaptive reuse of the palace from Museum to Cultural center for the lack of the financial resources of the ministry.

Taman said that the works of the project will be started soon, after executing some of measurements and preparing the required drawings.

Fig (6-21). The main facade of El-Shenawy palace after installing Metal scaffolding in January 2013.
Source: (Researcher)

<u>The plan of 2016 for the palace aimed to:</u>

- Restore the deteriorated internal and external parts of the palace.
- Recover the roof with roof tiles.

- Complete the construction of firefighting tanks, and electronic gates.
- Adaptive reusing the underground floor to be offices for the sector of Islamic and Coptic antiquities of Ad-Dakahlyia and the sector of Museums of Ad-Dakahlyia Governorate where totally accommodate 70 employees.
- All the W.Cs and Baths inside the palace will be restored including their heritage water fixtures and tiles.
- Construct the service building that will have W.Cs and cafeteria for visitors and employees, the external facades of it will be compatible with the heritage style of the palace.
- Install HVAC system for the offices of the underground floor, but the spaces of the ground and first floors will be naturally ventilated.
- Redesign the landscape and hardscape of the palace's gardens, and trim the high trees.
- Install external lighting on the main façade of the palace to highlight its aesthetic and artistic values at night.
-

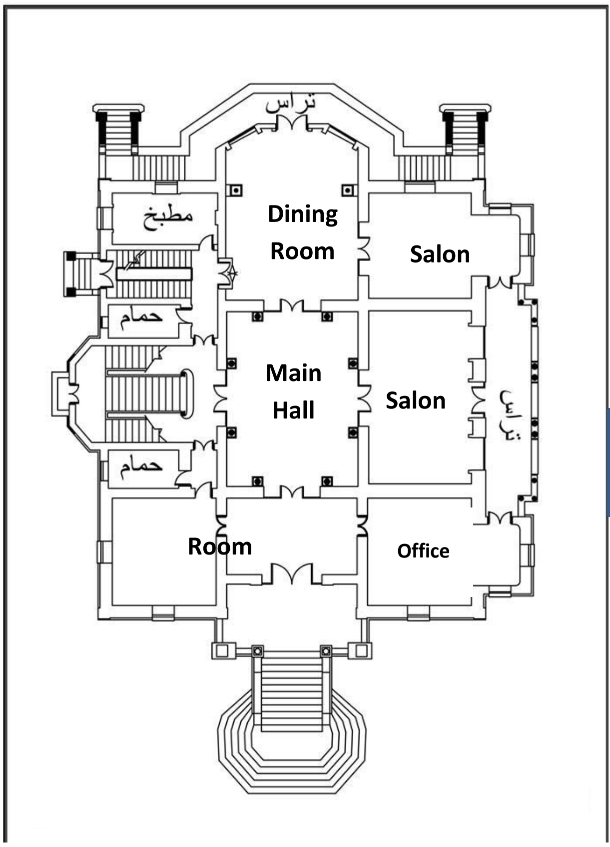


Fig (6-22). The original design of the ground floor
Source: (Researcher)

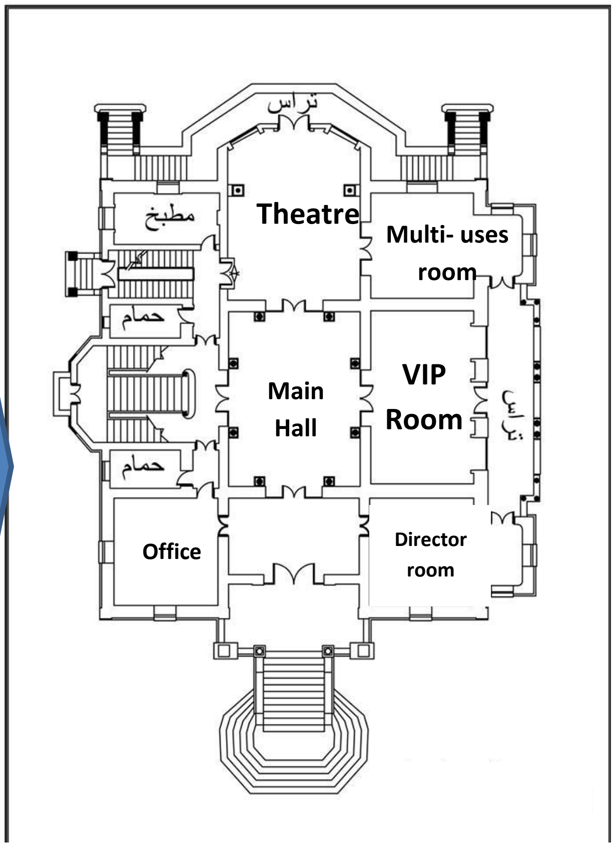


Fig (6-23). The ground floor in the plan of 2016
Source: (Researcher)

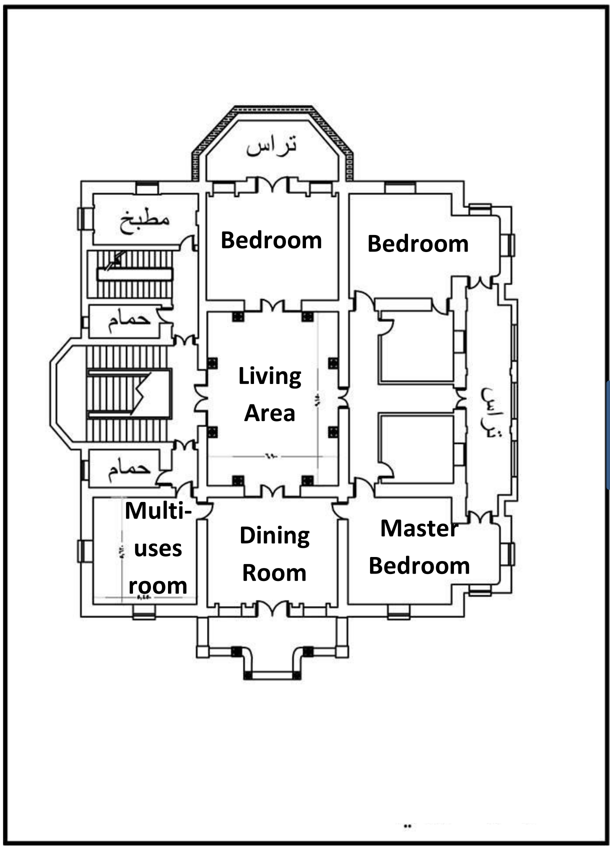


Fig (6-24). The original design of The first floor
Source: (Researcher)

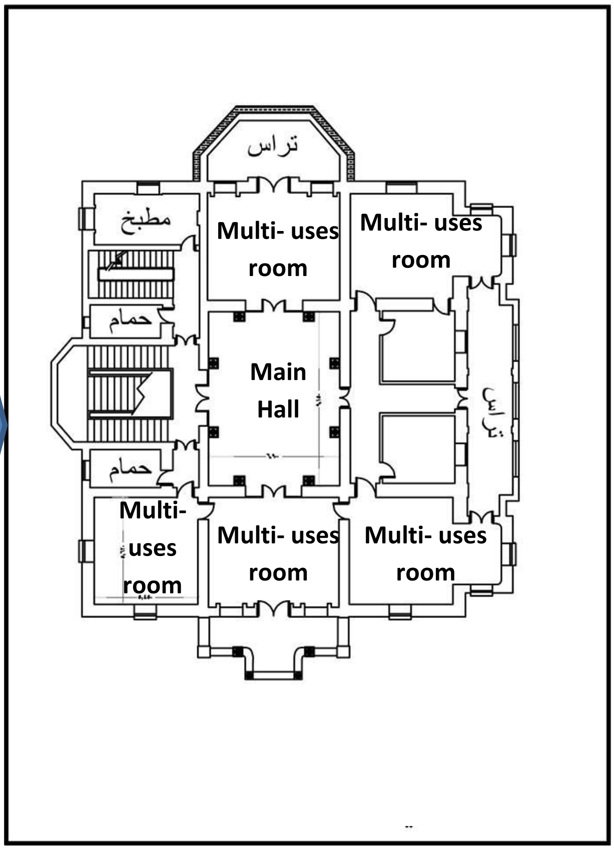


Fig (6-25). The first floor in the plan of 2016
Source: (Researcher)

6-5. The current physical state of the palace:

From 2011 to May 2016, the palace has been used as a headquarter for the sector of Islamic and Coptic Antiquities in Ad-Dakahlyia Governorate, it was occupied daily with 70 employees.

From the several field visits to the palace from 2011 to 2016, the researcher can summarize the current state of the palace as followings:

- Increased levels of internal air moisture at the internal spaces of the palace due to the high number of the employees with inadequate ventilation lead to some peeling of paints and wallpapers and the deterioration of some parts of wall's stucco.
- The Oak parquet flooring in the most of the internal spaces of the palace has been deteriorated by the dense traffic of employees.
- Some ornaments of the celling of the first floor were deteriorated, and some hotbeds of moisture have been emerged due to the inefficiency of

the installation of waterproof and not recovering it with roof tiles lead to the rainfall and moisture escaped from the roof to the celling.

- There are some deteriorated parts at the external facades suffering from the don't be restored
- The building has some problems due to the groundwater and in some parts of the ground floor, and some degradation in the side façades due to problems in the water supply leakage and the moisture before 2010 until now.
- The bathrooms and W.Cs are in bad condition, whether the sanitary fixtures that had broken or deteriorated, or the heritage tiles. That's caused by ignorance the periodic maintenance, negligence, and the leakage of the old sanitary pipes.

Fig (6-26). The deteriorated parts on the facades of El-Shenawy palace

Source: Khalil, Mohamed Ali and El-Eashy, Alaa shams (May 2010).

Fig (6-27), and fig (6-28) illustrate the bad condition of the baths in the ground floor of El-Shenawy palace

Source: (Researcher)

6-6. Methodology of Green vision for El-Shenawy palace – Mansoura:

As a part of this research, the research proposes a green vision for El-Shenawy palace to be a **green heritage building**, the green proposal adopts merging the green practices in the conservation strategy to :

- Increase the energy efficiency of the building in the operation period.
- Increase the water efficiency of the building.
- Increase the quality of indoor environmental quality.
- Ensure that all restoration works will be approved to the standards and don't have a negative impact on environmental as possible.
- Manage the waste during the project and operation period.
- Sustain the heritage building and its value during the project and the operation.

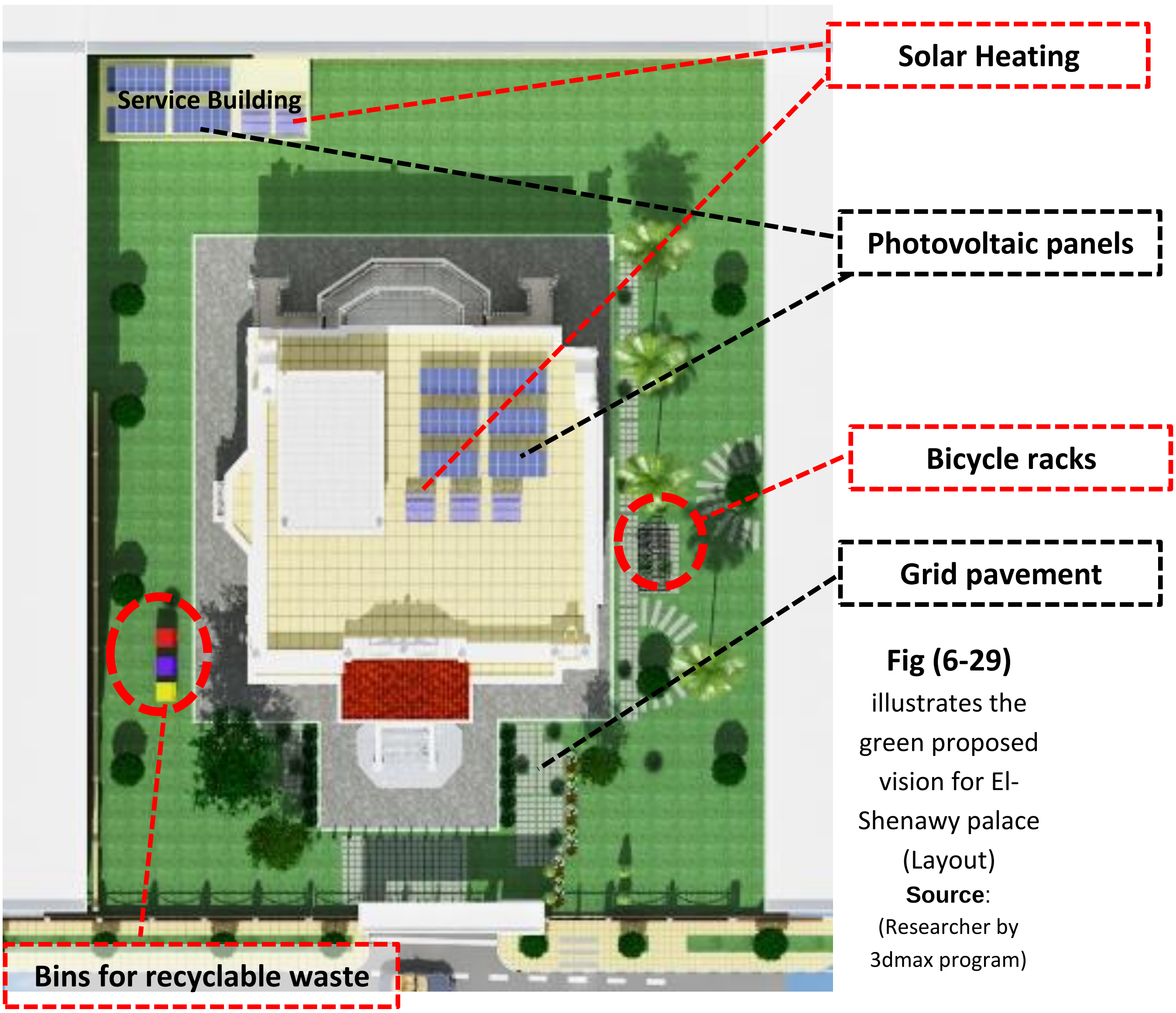


Fig (6-29) illustrates the green proposed vision for El-Shenawy palace (Layout)
Source: (Researcher by 3dmax program)

Fig (6-30) illustrates El-Shenawy palace after the green proposed vision (Perspective shot).
Source: (Researcher by 3dmax program).

The research adopts its green proposal based on the final usage that has been recently decided by the Ministry of Antiquities as **a cultural center** to compare the measurements of the study between the concept of the project which proposed by the ministry (**as a base line**) and the green proposed concept by the research.

The green proposed vision for El-Shenawy palace - Mansoura aims to merge the principles of the green building practices into the restoration and rehabilitation strategies of the palace, then the research uses the proposed Green Heritage Building Rating system tool to assess the green proposed vision for El-Shenawy palace

Under each category, the research demonstrates the strategy that will be used to achieve the credits, and then evaluate it according to the criteria and requirements of each credit, to calculate how many points will be awarded in each credit, total points for each category, then what the level of certification can be awarded under the Green Heritage Building Rating system – GPRS according to the total points that will be achieved.

6-6-1. Sustainable Site, Accessibility, and Ecology category

The strategy of **"Sustainable Site, Accessibility, and Ecology category"** depends on the followings:

- For Heat island reduction use the option 3 (Non-Roof and Roof):
    - **For Non-roof**, the proposal will use the existing plants in the front and back garden of the palace and install a new native plants, using an open- grid stone pavement system (the both of them landscape and paving materials will achieve more than 50% if the site area), the old paving materials not have heritage values.
    - **For roof**, the proposal will use a new roof white tiles that have SRI equal or greater than 82 for 100% of the roof area.
    - The proposal will approve the credit strategy from the Ministry of Antiquities.
    - Two points could be awarded in this credit.
- For Transport infrastructure connection, the palace is located at El-Gomhoria St, near mass transit for that it will be awarded 1 point.
- For Proximity to amenities, the palace is located near restaurants, shops, sporting club.

Fig (6-31). Pedestrian crossing
Source: http://previews.123rf.com/images/lehui/lehui1504/lehui150400045/39268772-Zebra-crossing-by-top-view-Stock-Photo.jpg

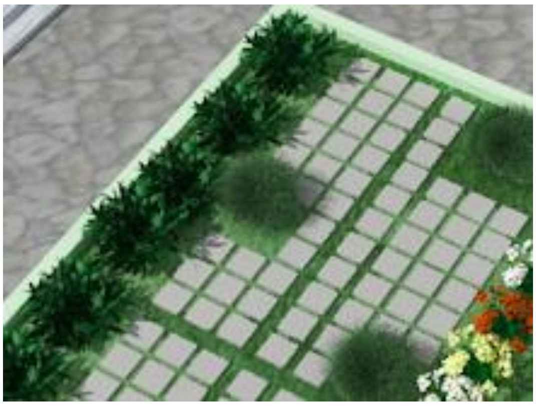


Fig (6-32). The proposed Grid stones Pavement
Source: (researcher) by 3dmax

- The visitors of the palace can connect with the nearest amenities and services via pedestrians sidewalks, the proposal will submit a request to the traffic authority to set pedestrian crossing road point in front of the Palace's gate that can ensure safely crossing for pedestrians to another side of El-Gomhoria St.
- One point can be awarded in this credit
- No credits could be awarded in Alternative methods of transport.
- For Cycle storage, there are expected maximum 200 visitors/employees[1] daily at the building, 5% of 170 equal 10 cycle racks, the proposal will prepare 10 metal cycle racks near the side eastern façade of the palace that will be near to the employee entrance.
  - The proposal will approve the credit strategy from the Ministry of Antiquities.
  - One point only could be awarded in this credit. No showers could be added to meet the requirements of this credit.

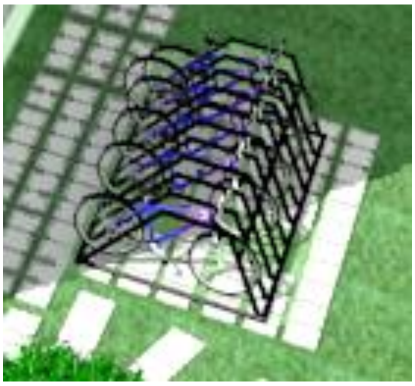


Fig (6-33). The proposed cycle Rack

Source: (Researcher by 3dmax program).

- No credits could be awarded in Protection and Enhancement of Ecological Features and Habitat.
- For Respect for sites of historic or cultural interest, there are no heritage streets, squares, or alleyways can be conserved to obtain five points, but the proposal can be awarded two points if the heritage building that facing the palace will be conserved by restored its high valued facades. See fig (6-34).

Fig (6-34). The heritage building that facing the palace.

Source: (CULTNAT organization)

[1] According to the meeting with Dr. Mohamed Taman (the director of Islamic and Coptic antiquities in Ad-Dakahlyia Governorate), he said that there are expected maximum 200 visitors/employees (70 employees + 130 visitors daily as a maximum).

	Sustainable Site, Accessibility, and Ecology ,weight is 5% from the total	Points Non-Residential
1.1.	Heat Island Reduction.	2/2
1.2.	Transport infrastructure connection.	1/1
1.3.	Proximity to amenities	1/1
1.4.	Alternative methods of transport	0/1
1.5.	Cycle Storage	1/2
1.6.	Protection and Enhancement of Ecological Features and Habitat.	0/1
1.7.	Respect for sites of historic or cultural interest.	2/5
TOTAL		7/13

6-6-2. Energy Efficiency category

The strategy of **" Energy Efficiency "** depends on the followings:

- The proposal uses a simulation model "**Revit[1] program**" to calculate the baseline of energy performance for the palace, then calculate the amount of reduction after adding photovoltaic panels and solar heating system.
- The Revit has performed the energy analysis for the both buildings individually, the palace and the service building where includes (W.Cs and cafeteria). For calculating the total energy consumption, the research will sum the both outcomes of the two buildings in the followings steps.
- According to the fig (6-35) and (6-36), the total electricity consumption per year of the two building:

= 273393 + 17505= **290898** kWh/ yr.

[1]**Revit** : is building information modeling software for architects, structural engineers, MEP engineers, designers and contractors. It allows users to design a building and structure and its components in 3D, and access building information from the building model's database

- The proposal will use photovoltaic panels (that have 10% for medium efficiency systems) on the flat roofs of the palace and the service building, and a solar heating system.

  The total electricity generated from photovoltaic panels on the two buildings

  = 73006 + 12896 = **85902** kWh/ yr

  According to the building simulation results, the total fuel (Natural gas) needs for the water heating =

  29,125 ,MJ × 1000/3600 = **8090.28** kWh/ yr.

- The proposal installs solar heating systems on the both roofs of the palace and the service building. These systems will generate all the energy required for water heating.
- The amount of saving of the energy from photovoltaic panels and solar heating system =

  (Total electricity consumption+ fuel needed for heating)

  (Total electricity generated by photovoltaic + total energy generated by solar heating systems)

  = (85902+8090.28)/(290898+8090.28)=

  = 93992.28/298988.28 = **31.4**%

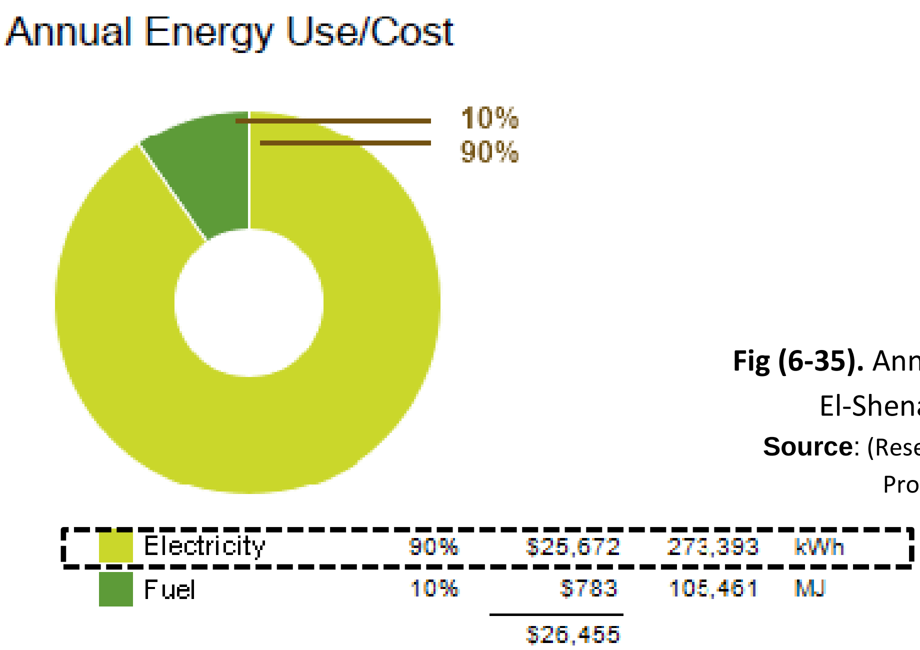


Fig (6-35). Annual Energy use of El-Shenawy palace

Source: (Researcher from Revit Program).

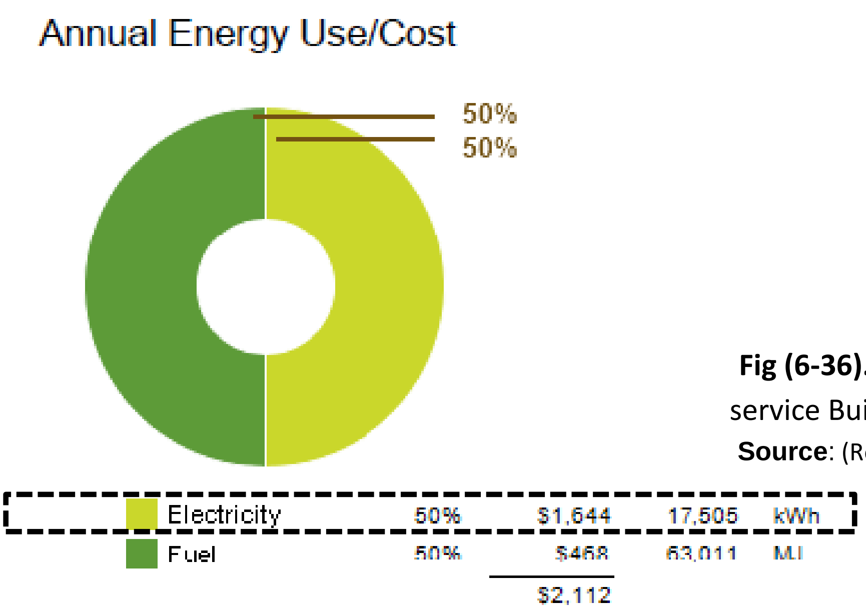


Fig (6-36). Annual Energy use of the service Building of El-shenawy palace
Source: (Researcher from Revit Program).

Renewable Energy Potential

Roof Mounted PV System (Low efficiency):	36,503 kWh / yr
Roof Mounted PV System (Medium efficiency)	73,006 kWh / yr
Roof Mounted PV System (High efficiency):	109,508 kWh / yr
Single 15' Wind Turbine Potential:	874 kWh / yr

*PV efficiencies are assumed to be 5%, 10% and 15% for low, medium and high efficiency systems

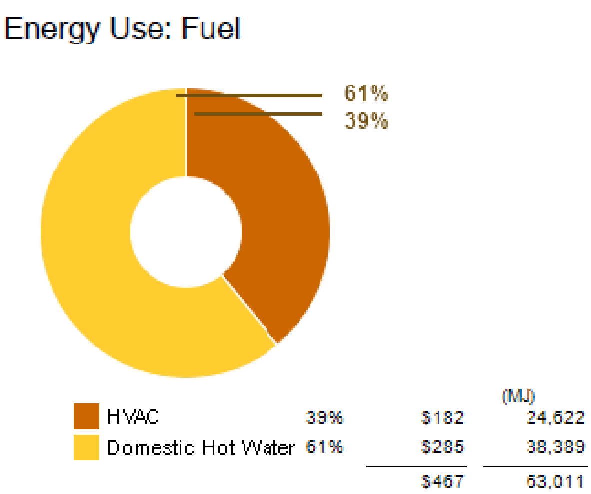
Fig (6-37). Renewable Energy Potential of El-Shenawy Palace
Source: (Researcher) from Revit Program

Renewable Energy Potential

Roof Mounted PV System (Low efficiency):	6,448 kWh / yr
Roof Mounted PV System (Medium efficiency)	12,896 kWh / yr
Roof Mounted PV System (High efficiency):	19,344 kWh / yr
Single 15' Wind Turbine Potential:	874 kWh / yr

*PV efficiencies are assumed to be 5%, 10% and 15% for low, medium and high efficiency systems

Fig (6-38). Renewable Energy Potential of the service Buildings



evit Program

Fig (6-39). The total energy needed for Domestic hot water. The program assumed that there is a fuel needed for HVAC systems, but the project would not need fuel for HVAC.
Source: (Researcher from Revit Program).

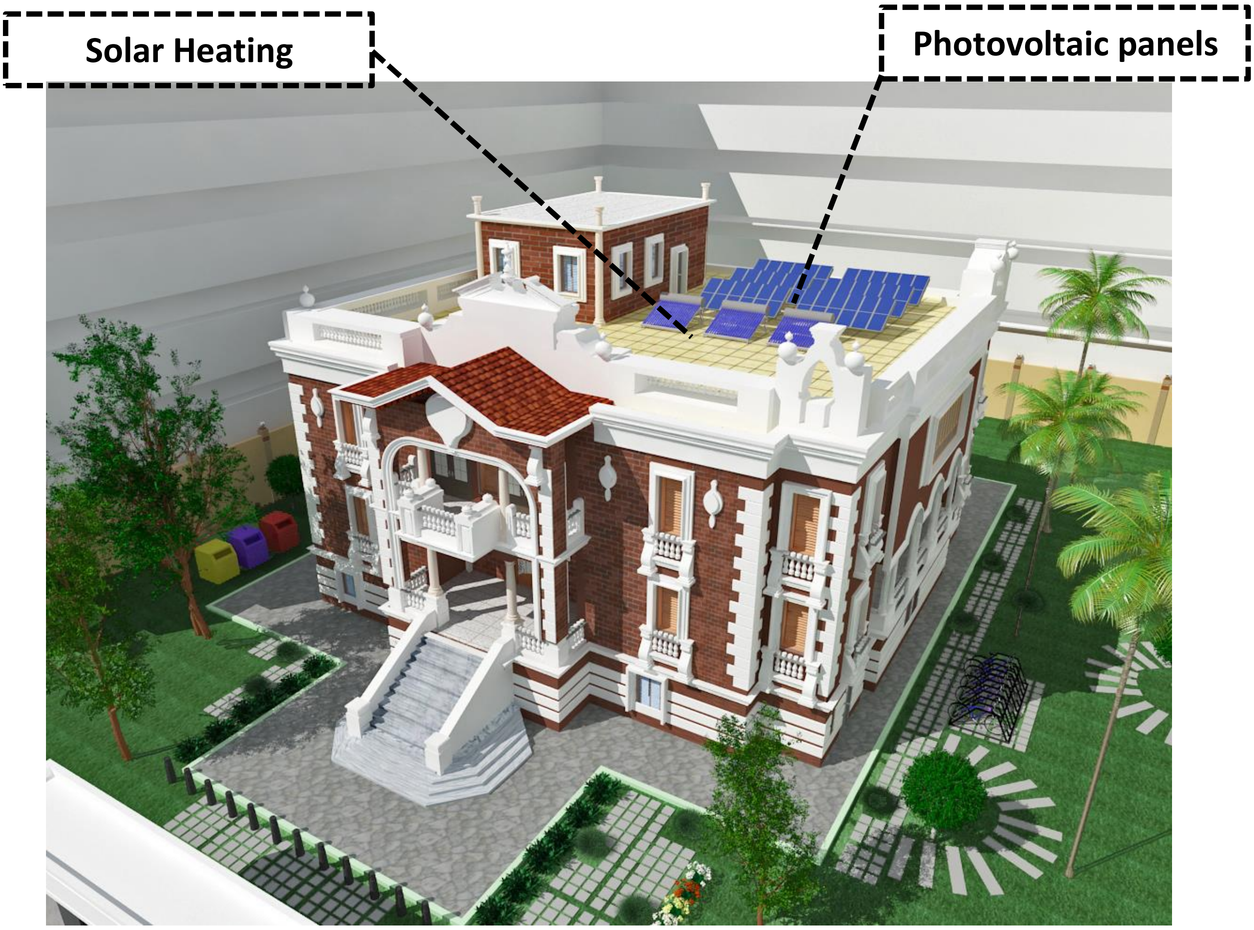


Fig (6-40). The location of the phtovolatic panels and solar heating system on the roof of the palace

Source: (Researcher by 3dmax Program) .

The location of the photovoltaic panels and solar heating on the roof of the two building, they will be hidden from the street level and not cause negative effect of the public views of the heritage palace.

- The proposal of the energy efficiency doesn't include any replacement of the glazing of the heritage windows with high efficient glazing to preserve the value of heritage windows.
- For Minimum Energy Performance level, the proposal via simulation model achieves 31.4% above the base line, which exceeds than the level of 10% that is required to achieve the mandatory credit.
- The proposal will install sub-meters for all occupied areas, and install meters for renewable resources (Photovoltaic panels and solar heating system), that will meet the requirement for mandatory credit.

- No CFCs will be used in the palace or its service building, the proposed HVAC system using HCF., that will meet the requirement for mandatory credit.
- For Energy Efficiency Improvement, according to the simulated model via Revit program, the design case will achieve 31.4% reduction than the baseline level. Seven points could be awarded in this credit.
- All appliances that will be purchased to be used in the cultural center will be high efficient appliances, fig (6-41) illustrates the electricity consumption of the Misc Equipment (Appliances) for the two buildings. Three points could be awarded in this credit.

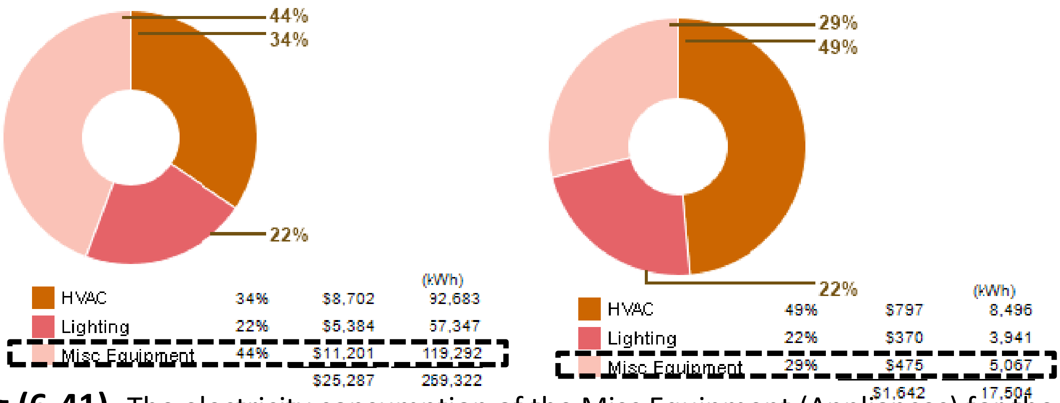


Fig (6-41). The electricity consumption of the Misc Equipment (Appliances) for the two building

Source: (Researcher from Revit Program).

- For Internal and external lighting no points could be awarded.
- For vertical transportation systems no points could be awarded.
- For Peak Load Reduction, the proposal meet the requirement, 29.5% from the total electricity consumption from renewable resources, for peak load times (80% from total electrical load), the electrical load has not achieved more than 50.5% (80%-29.5%). One point could be awarded in this credit.
- The renewable resources on-site (photovoltaic panels and solar heating systems) will generate 31.4 % from the total electricity consumption. Ten points could be awarded in this credit, the project team will obtain an approval from the Ministry of Antiquities about the plan of installation the renewable resources in the palace.
- For Environmental Impact no points could be awarded.

- Provide for a simple and easily-followed Operations Manual for all Mechanical, Electrical and Plumbing (MEP) apparatus, equipment, device, and sub-system. One point could be awarded in this credit.
- For Optimized balance of Energy and Performance no points could be awarded.
- **The total points could be awarded in the Energy efficiency category are 22 points.**

	Energy Efficiency weight is 30% from the total	Points Non-Residential
2.M.1	Minimum Energy Performance Level	M
2.M.2	Energy Monitoring & Reporting	M
2.M.3	Ozone depletion avoidance	M
2.1.	Energy Efficiency Improvement	7/10
2.2.	Energy Efficient Appliances	3/3
2.3.	Internal and external Lighting	0/3
2.4.	Vertical Transportation Systems.	0/2
2.5.	Peak Load Reduction.	1/1
2.6.	Renewable Energy Sources.	10/10
2.7	Environmental Impact.	0/4
2.8	Operation and Maintenance.	1/1
2.9	Optimized balance of Energy and Performance.	0/3
TOTAL		22/37

6-6-3. Water Efficiency category

The strategy of **" Water Efficiency "** depends on the followings:

- Carrying out the strategy of "The plan of 2016" that related to the baths and W.Cs of the Palace as a following: " All the W.Cs and Baths inside the palace will be restored including their heritage water fixtures and tiles. For the broken items or Irreparably damaged fixtures, the project will install fixtures and materials similar to original ones with the prohibition of use them by visitors and employees to protect their values, and prevent the moisture of walls and ceiling from the leakage of old pipes. ", that proposal will be submitted for approval to the Ministry of Antiquities.

-


Fig (6-42), Fig (6-43). The heritage fixtures of Bathrooms of El-Shenawy Palace
Source: (Researcher)

Fig (6-44). The master bathroom of El-Shenawy Palace in first floor in 2009.
Source: (Researcher)

Fig (6-45). one of the bathroom of El-Shenawy Palace in ground floor

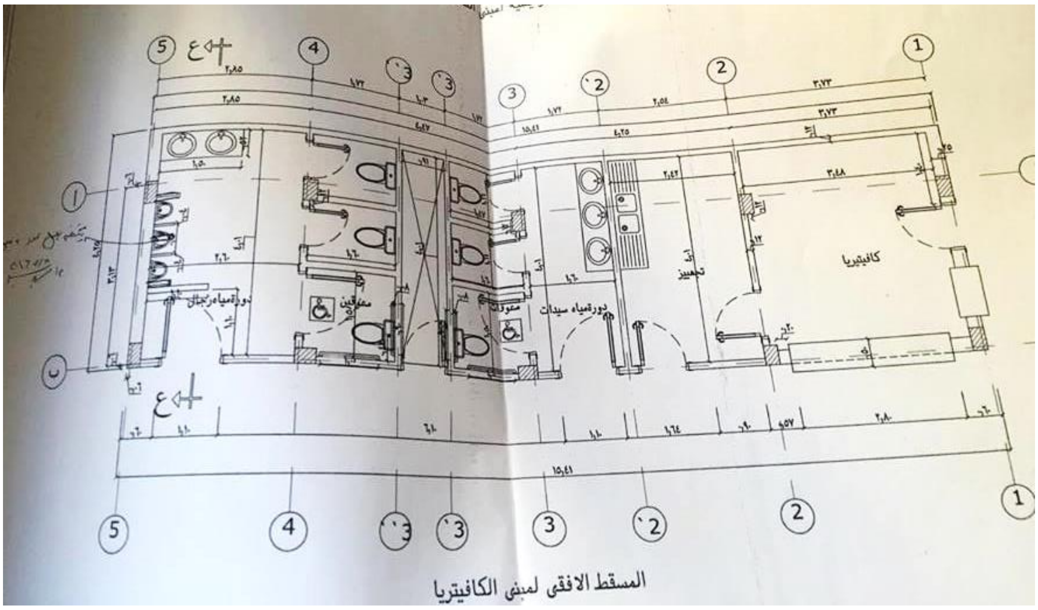


Fig (6-46). the proposed plan of the Building service by the Ministry of Antiquities

Source: Ministry of Antiquities.

- The employees and visitors can use the W.Cs and kitchen in the service building that is located at back garden, the service building's fixtures as followings:
    - High efficient toilet (1.28 gallons per flush) instead using the commercial toilet (1.6 gallons per flush).
    - High efficient urinal/ EPA urinal (0.5 gallons per flush) instead using a conventional urinal (1 gallon per flush).
    - Conventional public lavatory (0.5 gallons per minute/ one user) instead using public lavatory (2.2 gallons per minute)
    - Low- flow kitchen sink (1.8 gallons per minute/one user) instead using kitchen sink (2.2 gallons per minute)

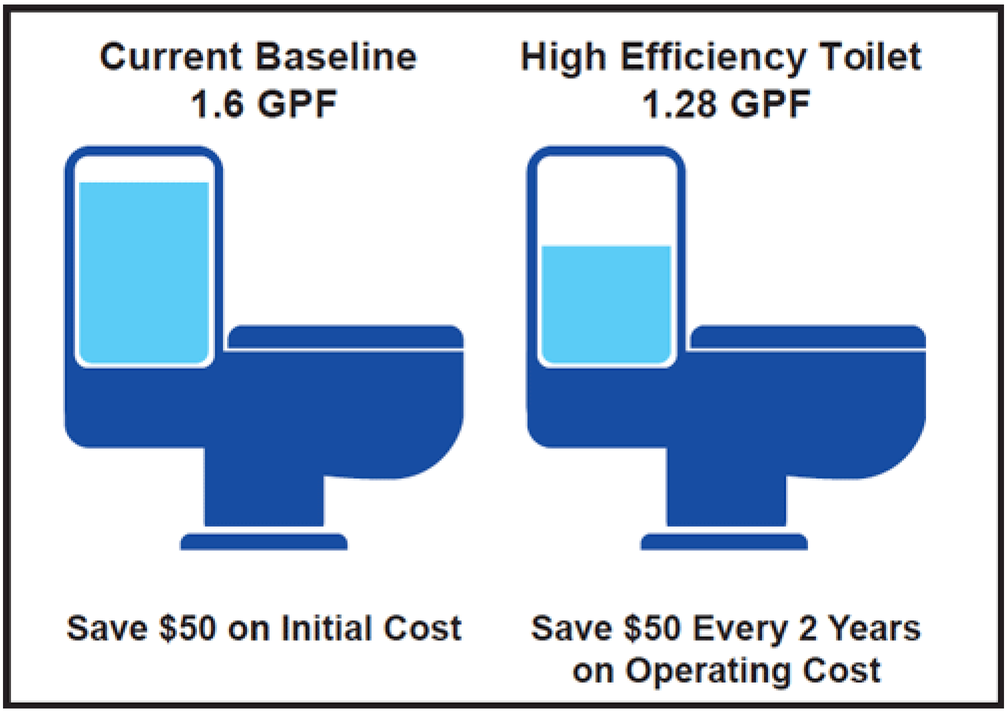


Fig (6-47). The comparison between the conventional and an efficient toilet

Source: http://www.sustainablesupply.com/SSC%20Extra%20Images/green-restroom-toilet-flush.gif (access on 15 May 2016)

- According to the following calculations of the base line and the design case,

  The percentage of saving of water consumption =

  The design case / the base line = 241512 /**381936= 56.16%**
- The percentage of saving of water consumption will meet the mandatory requirement of the credit **" Minimum Water Efficiency**", and awarded 8 points in the credit " **Indoor Water Efficiency Improvement**"
- Install water meters for measure the total water consumption to meed the mandatory requirement of the credit "Water **Use Monitoring**".
- For **Outdoor Water Efficiency Improvement**, the proposal seeks the following:
  - Treated the gray water that results from lavatory fixtures in W.Cs, and transformed them via colored pipes to hidden tanks on the roof of service building to reuse it in irrigations, the total quantity of gray water = 1080 gallons * 3.785 = 4087.8 liters per week. This quantity will not be sufficient to the need of landscape area; the

remaining quantity of water will be taken from potable water because there isn't non-potable water supplement in the city.
  - Use drip irrigation systems to reduce the water consumption for irrigation.
  - Using native plants that don't consume a high quantity of water that will meet that landscape demand is less 3 liters/m2/day.
  - Set an Irrigation Operation and Maintenance plan for the palace gardens.
  - The total points awarded in this credit = 5 points.
- For **Water Feature Efficiency**, 4 points will be awarded for not having swimming pools and the archeological fountain of the palace doesn't work.
- No credits could be awarded in the credit **Water Leakage Detection.**
- For **waste water management**, the proposal seeks the followings:
  - No un-treated water will enter the local environment; the gray water that will use for irrigation is a treated water that will comply with the Egyptian Environmental Laws.
  - Ten points could be awarded in this credit.
- For **Sanitary Used Pipes**, the proposal seeks the followings:
  - Don't use any old sanitary pipes; all the baths and W.Cs in the palace will not be used.
  - The new pipes for W.Cs and Café will be certified sanitary pipes material which secures water quality, and sustainability for human use.
  - The new sanitary pipes will be tested before use that will ensure the high level of installation.
  - Four points could be awarded in this credit.

Calculate the base line:

The proposal assumes that the palace has 200 persons (130 visitors+ 70 employees) as a maximum.

According to step 3 from the techniques part from the credit "3M.1- Minimum Water Efficiency",

The gender ratio is half male and half female, for that:

- For employees, there are 35 male + 35 female 6 days per week.
- For visitors. There is 50 male + 50 female. 7 days per week.

According to the tables (5-63), (5-64), (5-66), (5-67).

- The proposal assumed that the cultural center will be opened all days of the years, the employees will be worked 6 days per week. In the weekend (Thursday and Friday), 50% of employees are off, and those will attend to the culture center on the next day.
- The total weekly water consumption of WC is =
  (35×1×1.6 + 35×3×1.6) * 6 days + (65×0.1×1.6 + 65× 0.5× 1.6) * 7 days = 1344 + 437 = **1781** gallons per week.
- The total weekly water consumption of urinal =
  (35×2×1.0) * 6 days + (65×0.4×1.0) * 7 days = **602** gallons per week.
- The total weekly water consumption of lavatory Faucet =
- (35×3×2.2 + 35×3×2.2) * 6 days + (65×0.5×2.2 + 65× 0.5× 2.2) * 7 days = 2772+1001= **3773** gallons per week.
- The total weekly water consumption of Kitchen sink =
  (70× 1× 2.2) * 6 days = **924** gallons per week.
- The total weekly water consumption of hydrojet bidet =
  (35×1× 0.8+35× 3× 0.8) * 6 days + (65× 0.1× 0.8+65× 0.5× 0.8) * 7 days =672+205= **877** gallons per week.

The total annual water consumption (Base Line)=
(1781+602+3773+924+877)* 48 weeks per year = **381936** gallons per year.

<u>Calculate the design case:</u>

According to the proposal of using high efficient fixtures as mentioned in the strategy of this credit, the design case's water consumption based on the same number of employees and visitors and the same days worked, the design case's water consumption is:

- The total weekly water consumption of WC is =

(35×1×1.28 + 35×3×1.28) * 6 days + (65×0.1×1.28 + 65× 0.5× 1.28) * 7 days = 1076+ 350= **1426** gallons per week.

- The total weekly water consumption of urinal =
  (35×2×0.5) * 6 days + (65×0.4×0.5) * 7 days = **301** gallons per week.
- The total weekly water consumption of lavatory faucet =
- (35×3×0.5 + 35×3×0.5) * 6 days + (65×0.5×0.5 +65× 0.5× 0.5) * 7 days = 630+228= **858** gallons per week.
- The total weekly water consumption of Kitchen sink =
  (70× 1× 1.8) * 6 days = **756** gallons per week.
- The total weekly water consumption of hydrojet bidet = **1128** gallons per week.

The total annual water consumption (design case)=
(1426+301+858+756+1128)* 48 weeks per year = **241512** gallons per year.

	Water Efficiency weight is 35% from the total	Points Non-Residential
3M.1	**Minimum Water Efficiency.**	**M**
3.M.2	**Water Use Monitoring.**	**M**
3.1	**Indoor Water Efficiency Improvement.**	**8/8**
3.2	**Outdoor Water Efficiency Improvement recommend to be replaced by (Water Efficient Landscaping).**	**5/9**
3.3	**Water Feature Efficiency.**	**4/4**
3.4	**Water Leakage Detection:**	**0/6**
3.5	**Waste water management.**	**10/12**
3.6	**Sanitary Used Pipes.**	**4/4**
TOTAL		**31/43**

6-6-4. Materials and Resources category

The strategy of "Materials **and Resources"** depends on the followings:

- Set a schedule of Principal Project Materials which lists all new significant building materials to be used in the restoration and greening project of the palace to meet the mandatory credit.

- Make a report about the asbestos and any other hazardous and toxic materials exists in the palace to assess the bad impacts on the visitors and employees, then the team of the project will decide the replacement policy of the hazardous materials. This report will be approved by the Ministry of Antiquities.
- For Regionally procured materials:
  - The proposal set a strategy for using new regionally materials are extracted and manufactured in Egypt with a total value not less than 50% of the total of new materials value.
  - The new materials report will be approved by the Ministry of Antiquities.
  - Two points would be awarded in this credit.
- No points could be awarded in the credit "Use of recycled materials".
- No points will be awarded in the credit "Use of higher new durability materials".
- For Designing for durability and resilience:
  - Put carpets in the dense traffic areas and on the main wooden staircase to protect the Oak parquet floors of the internal spaces of the palace.

Fig (6-48), The carpet covered the wooden staircase before 2005.
Source: (Researcher)

  - Ensuring good ventilation for the internal spaces of the palace to protect them from the effects of moisture and vegetation by a mix system of ventilation (naturally and mechanically).
  - Install bollards to restrict vehicles to cross the drop-off areas within 3 m from the external building façade.
  - The plan of protecting vulnerable and high value parts of the building will be approved by the Ministry of Antiquities.

	Materials and Resources weight is 5% from the total	Points Non-Residential
4M.1	**Presentation of a *Schedule of Principal Project Materials***	**M**
4M.2	**Elimination of exposure of building occupants to asbestos and to any other hazardous and toxic materials.**	**M**
4.1	**Regionally procured materials**	**2/3**
4.2	**Use of recycled materials:**	**0/4**
4.3	**Use of higher new durability materials.**	**0/2**
4.4.	**Designing for durability and resilience**	**6/6**
4.5	**Environmental Impact of Materials**	**0/4**
TOTAL		**8/19**

6-6-5. Indoor Environmental Quality category

The strategy of **"Indoor Environmental Quality"** depends on the followings:

- For Minimum Ventilation and Indoor Air quality, according to the model simulated and the design case proposed, all the spaces will have mixed – mode ventilations, naturally through opening windows and mechanically through the HVAC systems that comply with ASHRAE 62.
  - The installation of HVAC system plan of the heritage palace is based on:
    - The design of HVAC system depends on achieve adequate ventilation and thermal comfort for visitors and employees without harming or losing the values of the heritage palace.
    - The proposal designed the main horizontal paths of ducts in the underground floor, defined four points for vertical ducts for supply the palace rooms in the ground and first floors.
    - Select the location of paths of the vertical ducts outside the internal rooms in the corners of roofed Balconies or in the less valued parts of the external facades, each duct

will supply two rooms with cooled /heated air and ventilation, that will reduce the number of ducts required and the need for removal many parts from walls, and ceilings.

- The HVAC plan will be submitted to the ministry of Antiquities for approval.
- This plan could meet the requirements of the mandatory credit.

- The proposal has a strategy to prohibit the smoking inside the palace's site. That will meet the mandatory requirement of the "Control of Smoking in and around the Building".
- The potable water used in the building will be taken from the potable water of Municipality that complies with local health regulations.
- For Enhanced Indoor quality strategy, the proposal will install CO2 sensors at all return points of the HVAC system; these sensors will alert occupants when the additional fresh air is required. Three points could be awarded in this credit.

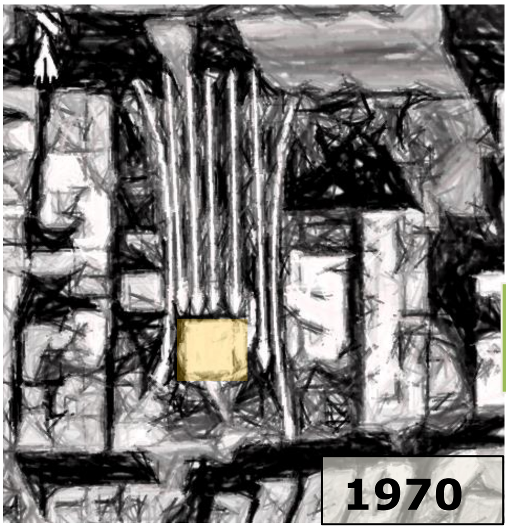


Fig (6-49),a sketch for the wind flow to the palace's site in 1970s

Source: (Researcher)

Fig (6-50),a sketch for the wind flow to the palace's site in 2016

Source: (Researcher)

- For thermal comfort, all spaces in the palace have been modeled in Revit, according to the ASHRAE 55, the proposal installs HVAC system to ensure thermal comfortable for all employees and visitors in all spaces of the palace. This could award one point in this credit.

- For safety, the proposal will install fire detection and alarm system for all the spaces of the palace. Two points could be awarded in this credit.
- There is no point will be awarded in interior lighting credit for difficulty for redistributed the lighting units in the palace's rooms to be controlled individually.

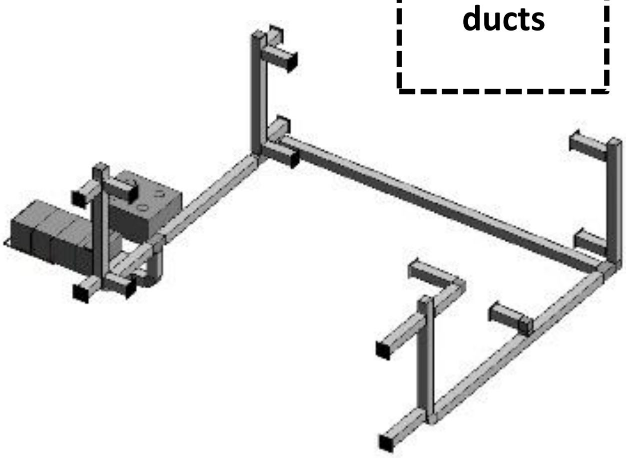


Fig (6-51), 3D drawing for the proposed HVAC system for the palace
Source: (Researcher by Revit program)

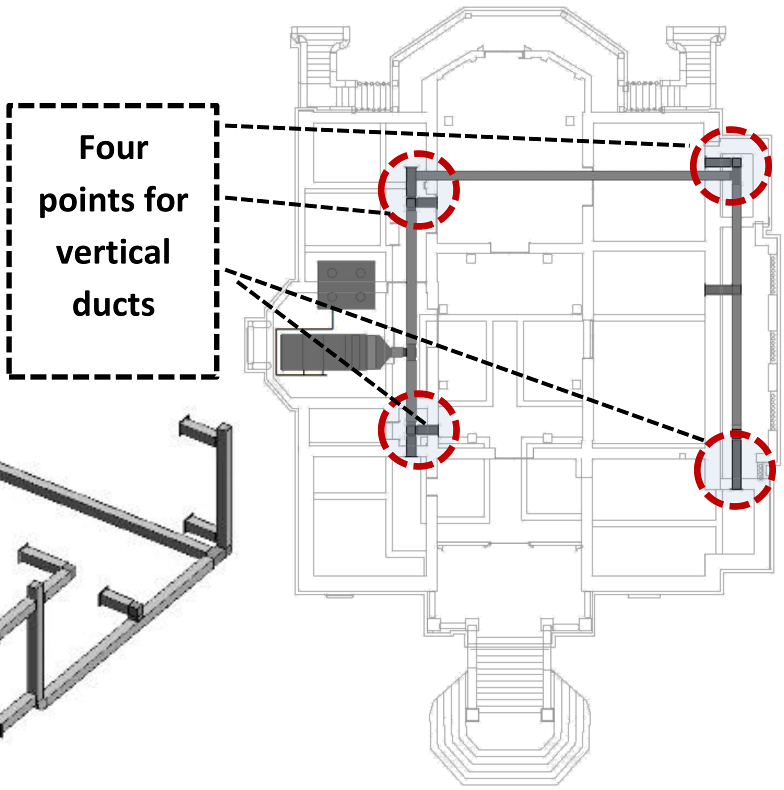


Fig (6-52), the horizontal paths of ducts in the underground level "attached with the celling"
Source: (Researcher by Revit program)

	Indoor Environmental Quality weight is 10% from the total	Points Non-Residential
5M.1	**Minimum Ventilation and Indoor Air Quality:**	**M**
5M.2	**Control of Smoking in and around the Building:**	**M**
5M.3	**Control of Legionella and other health risks:**	**M**
5.1.	**Enhanced Indoor quality strategy**	**3/3**
5.2.	**Thermal Comfort**	**1/2**
5.3	**Safety**	**2/2**
5.4.	**Interior Lighting**	**0/2**
5.5.	**Daylight**	**0/2**
5.6.	**Controlling emissions from building materials**	**0/2**
TOTAL		**6/13**

6-6-6. Management, Waste, and Pollution category

The strategy of **"Management, Waste, and Pollution"** depends on the followings:

- Obtain an approval on the restoration design and implementation plan for the palace from the Ministry of Antiquities.
- Implementing all the recommendation the Ministry of Antiquities to preserve the heritage value of the urban fabric of the palace.
- Set an Integrated Plan and Method Statement for site operations.
- Meet all relevant national Health & Safety regulations for workers during restoration and greening project.
- Separate the flammable and toxic materials in specific external container and prevention of soil pollution in these areas.
- Provide a building user guide containing the necessary technical and non-technical information for the palace employees / visitors to enable the efficient and responsible operation of the palace. Three points could be awarded in this credit.

- Provide a Periodic Maintenance Schedule; it will be approved by the Ministry of Antiquities. Two points could be awarded in this credit.
- For project waste management :
- Set a project waste management plan that includes strategies for reducing, and, where possible, re-using and recycling the waste arising from site operations. Two points could be awarded in this item.
- Provide three containers for site Materials waste for glass, bricks, and wood. Two points could be awarded in this item.
- Provide three bins for recyclable waste inside the palace in the main hall, and three containers outside the building to collect recyclable waste, the project should select their location to don't have a negative impact on the heritage value of the palace. Two points could be awarded in this credit.
- One point will be awarded for using grid paving system.
- One point will be awarded for all rainfall is run-off from the roof to the landscape areas to infiltrate to groundwater.
- Set a Management plan for project waste and pollutions, could award one point for the project.

Fig (6-53), Three containers for site Materials waste
Source: http://tkdfx112.wix.com/expedite-demolition-and-waste-management (access on 15 May 2016)

Fig (6-54), three containers outside the building to collect recyclable waste
Source: (Researcher by 3dmax program)

	Management, Waste, and Pollution weight is 10% from the total	Points Non-Residential
6M.1	**Presentation of the Greening and restoration design and implementation plan for heritage building.**	**M**
6M.2	**Compatibly with the recommendations of Urban Harmony organization or their Committees.**	**M**
6M.3	**Presentation of an Integrated Plan and Method Statement for site operations**	**M**
6M.4	**Compliance with all relevant national Health & Safety regulations for workers during restoration and greening project.**	**M**
6M.5	**Separation of flammable and toxic materials**	**M**
6.1.	**Providing a Building User Guide.**	**3/3**
6.2.	**Providing a Periodic Maintenance Schedule.**	**2/2**
6.3	**Project Waste Management**	**4/7**
6.4.1.	**Operational waste (for non-residential buildings only)**	**2/2**
6.5.	**Managing Surface Water Runoff**	**2/3**
6.6.	**Minimizing Pollution during restoration and greening project.**	**1/1**
TOTAL		**14/18**

6-6-7. Innovation category

The strategy of **"Innovation"** depends on the followin7s:

- For Exceeding Benchmarks, the indoor water using reduction is **55.69%**, the maximum rate in the related credit is 50%. One point could be awarded related to this item.
- For innovation, Develop an educational program, to inform building users, visitors, students, and researchers about positive environmental & human health benefits, giving tours of the building, adding signage.

	Innovation weight is bonus	Points Non-Residential
7.1	**Exceeding Benchmarks:**	**1/6**
7.2	**Innovation**	**1/4**
TOTAL		**2/10**

6-6-8. The rating level of the green proposal for El-Shenawy palace

The total points awarded for this proposal is calculated according to the following table:

Table (6-1), The Green Pyramid for Heritage Building scheme's Category Weightings

Green Pyramid Category	The awarded points		Category Weighting	The awarded category weighting
1: Sustainable Site, Accessibility, Ecology	**7/13**	**53.8%**	**5%**	**2.7**
2: Energy Efficiency	**22/37**	**59.45%**	**30%**	**17.8**
3: Water Efficiency	**31/43**	**72%**	**35%**	**25.2**
4: Materials and Resources	**8/19**	**42.1%**	**5%**	**2.1**
5: Indoor Environmental Quality	**6/13**	**46.15%**	**10%**	**4.6**
6: Management, Waster , and Pollutions	**14/18**	**77.78%**	**10%**	**7.8**
7: Innovation	**2/10**	**2**	**Bonus**	**2**
Total				**62.2**

Source: (researcher)

The greening and restoration proposal for El-Shenawy palace is awarded 62.2 **points** under the Green Heritage Building Scheme in GPRS, that is classified the palace under **Gold Pyramid level** (60-79). See fig (6-45).

Fig(6-45). The Gold Pyramid Certification in the Green Pyramid rating system.

Source: (Researcher based on the logo of the green pyramid rating system).

Conclusions:

- Through the applied study, the research has merged the principles of the green building practices in the conservation strategies of the heritage buildings, that's lead to conserve the building, maintain it, and apply the green practices without harming or losing the heritage value of the building.
- According to the green heritage Building scheme in GPRS, the proposal of El-Shenawy palace has been awarded the gold pyramid certification (grade : 62.2).
- The research used a simulation model "Revit program" in set plans for :
  - Energy efficiency category (included most of the category's credits)
  - outdoor water efficiency credit
  - enhance indoor quality strategy credit,
  - thermal comfort credit,
  - safety credit,
  - And interior lighting credit.
- The renewable resources could be considered the main source for achieving a great reduction in the total energy consumption in the heritage buildings (where replacing glazing or added more insulation are prohibited) besides using high efficient appliances and LED's for Lighting systems.
- Using high efficient water fixtures has a great effect on the total reduction of the water consumption, but that needs to make a balance between the values of heritage fixtures and the reductions needed. In the Applied study, the research has stopped using the old fixtures after restoring them, and construct new W.Cs to meet the needs of the users.

CONCLUSIONS AND RECOMMENDATIONS

- **CONCLUSIONS**
- **RECOMMENDATIONS**

CONCLUSIONS AND RECOMMENDATIONS

General Conclusions:

This chapter presents the general results and conclusions of the theoretical, analytical and applied studies of the research, as well as the proposal for green heritage buildings rating system.

- The research produces a green heritage rating system under the Green Pyramid Rating system, it can assess the green heritage building in Egypt.
  - It aims to sustain these buildings, applying the green buildings practices, taken into account preserving the heritage value of those buildings.
  - This tool based on the new construction scheme of the green pyramid rating system, adopted its categories, the calculation system the total awarded point, and the rating levels.
  - The new scheme has changed the weighting of the categories; it has increased the weighting of both of the water category and energy efficiency category for the challenges that are facing the Egyptian state in the energy and water.
  - The tool has performed some modification on the credits of the new construction scheme of GPRS to be compatible with heritage buildings, and added new credits (after made required modification to be compatible with the Egyptian buildings conditions) to the scheme from "LEED O+M , BREEAM non-domestic refurbishment and fit-out, and BREEAM domestic refurbishment".
  - There are some special requirements related to heritage building in the two BREEAM schemes have been taken into account in the green heritage building scheme of GPRS.
  - Most of the non-compatible credits with the heritage buildings or the Egyptian buildings conditions in the four schemes (LEED, two schemes of BREEAM, and new-construction of GPRS) have been avoided in the Green Heritage Building scheme of GPRS.
  - The research adopted all the recommended credits that have resulted from the comparison study of four case studies, and incorporate them into the proposed scheme.
  - The green techniques that can be used to apply the green practices in the heritage buildings will be attached to the credits

of the scheme; they were derived from the techniques that were used in the four cases in chapter 4.

- BREEAM has launched two schemes for residential and non-residential buildings, the research will incorporate the credits for residential and non-residential buildings into one rating system scheme.

- BREEAM rating systems have assessed many heritage buildings in the UK and all over the world, however, it doesn't set unified minimum standards that should be applied to all listed buildings in the UK schemes. BREEAM believes that each of the UK regions and conservation areas have different characteristics and circumstances, and all regions have local planning authority defines its standard for its conservation areas. For that BREEAM has entrusted this task for each local authority that heritage building has been followed. This concept has been adopted in the Green Heritage Building scheme in GPRS, there are 25 credits required approval about the proposed plan "to how the credits will be achieved" from the Urban Harmony Organization or its representatives in the Egyptian Governorate (for listed heritage buildings), or the Ministry of Antiquities (for listed buildings as monuments).
- Through the applied study, the research has merged the principles of the green building practices in the conservation strategies of the heritage buildings, that's lead to conserve the building, maintain it, and apply the green practices without harming or losing the heritage value of the building. According to the green heritage Building scheme in GPRS, the proposal of El-Shenawy palace has been awarded the gold pyramid certification.
- In the applied study, the research used a simulation model "Revit program" in set plans for :
  - Energy efficiency category (included most of the category's credits)
  - outdoor water efficiency credit
  - enhance indoor quality strategy credit,
  - thermal comfort credit,
  - safety credit,
  - and interior lighting credit.
- The research highlights through its study on the concept of the green Heritage Buildings, and through producing a specified rating system that can assess green heritage buildings only.

- The research has set a definition for the Green heritage building as: "**It is a heritage building that has been refurbished and modified to be a green building without harming its heritage features or losing its values, or lead to be out of the list (if it has been listed by the national authority**".
- The sustainability of the heritage building will be achieved when the conservation strategies and operation performance are taken into account the three pillars of the sustainability, the environment system and don't exhaustive the environment resources as well as achieving high functional value to serve the society and generate more income to its owners and the national economy.
- The practices of enhancing the efficiency of the operation performance of the existing buildings can be applied to the heritage buildings if taken into account preserving the values of heritage buildings as well as performing some modification on these practices to be compatible with the local circumstances.
- The option for using the renewable technologies was ruled out for the most of the projects of the case studies in chapter 4, it will harm the heritage features of the heritage buildings, especially using photovoltaic panels on the sloped roofs of heritage buildings that will affect the quality and character of existing public views. Due to the different climate between Egypt and (USA & UK), and the most of the heritage buildings in Egypt don’t have slope roofs, the photovoltaic panels could be used on their flat roofs without harming the heritage values or affecting the quality and character of existing public views these buildings.
- As illustrated in the applied study (chapter 6), the renewable resources could be considered the main source for achieving a great reduction in the total energy consumption in the heritage buildings (where replacing glazing or added more insulation are prohibited) besides using high efficient appliances, LED's for Lighting systems, and use control lighting systems.
- The preservation of heritage glasses and doors has a priority than achieving the requirements of energy efficiency performance as installing more efficient doors or double glazed windows in Heritage Buildings.
- Using high efficient water fixtures has a great effect on the total reduction of the water consumption, but that needs to make a balance

between the values of heritage fixtures and the reductions needed. In the Applied study, the research has stopped using the old fixtures after restoring them, and construct new W.Cs to meet the needs of the users.

- The original design of the most of the heritage buildings was taken into account achieving adequate ventilation and comfortable thermal rates for users, but the current high density of the cities with Multi-stories buildings that are surrounding the heritage buildings from different sides has a bad impact on the wind flow to those building and achieving the natural ventilation that was originally designed to meet it, that leads to achieve current low rates in ventilations and thermal comfort, and need installation of mechanical or mix-mode systems to meet these standard rates.

Recommendations:

About Green Pyramid Rating system:

- From the research study of the Green Pyramid Rating System and comparing it with the others International Rating Systems as LEED, and BREEAM schemes, the New-Construction Scheme has most the green Criteria that's needed to apply in the New- Constructions in Egypt, it needs periodic updates to be more vital and have the updated additions and modifications as the other international schemes.

- The Green Pyramid Rating System has more compatible to the Egyptian Buildings conditions, the Egyptians Codes and Regulations, and the Egyptian challenges in the resources of Energy and water.
  Applying GPRS on the Egyptian new and existing buildings will ensure achieving effective results than the applicable of the international schemes in Egyptian Buildings.

- There is a growing demand on the applicable of the LEED rating system in Egypt, there are nearly new two LEED certified buildings yearly in Egypt in the recent years. The research recommends to the Egyptian State via Ministry of Housing and the Ministry of Financial to seek to encourage applying the Green Pyramid Rating System in the New Constructions by making financial incentives and reduction in taxes and soft fees to investors of the sector of real-estate and the owners.

- To apply the green Heritage Buildings scheme in Egypt, there is a need to launch related-regulations and laws to organize the process of the approval of reports that needed from the urban Harmony Organization and the Ministry of Antiquates.

- The proposal of Green heritage buildings rating system is based on the predicated performance as BREEAM schemes, the research recommends launching another scheme that can assess ongoing performance of the heritage building, and its operations.

- There is a current need to learn the architecture students how they can use the simulation models to analysis the results of the Energy efficiency, water efficiency, and indoor environmental quality of the buildings, then they can take correct design decisions based on these analysis results in the new and existing buildings.

About listing heritage Buildings in Egypt

- The criteria for listing the heritage Buildings in Egypt is similar to those that applied in the USA and the UK, the owners of the listed building in USA, may be able to obtain many of financial incentives, that will encourage them to preserve their properties and not destruction them as (Federal Historic preservation grants, easement donation, federal tax incentives for rehabilitation, and 20% rehabilitation tax credit which is received to the listed building's owner after the conservation officer has approved that all works have been carried out in the heritage building with the heritage character of the building),
  the research recommends the Egyptian government to face the illegal demolition of the listed heritage building by provide financial incentives to the owners of listed building as 20% rehabilitation tax credit to encourage them to conserve and reinvest their properties, and not destruction them, put the heritage assets on the investment map for investment, and providing financial facilities as loans through the central Bank of Egypt.
- There is a current need to learn the architecture students how they can conserve their culture heritage, they can study the problems of the

culture heritage of their cities and set strategies to document, conserve, develop, and invest these assets, as well as transform them into Green Heritage Buildings.

- Set a heritage education program consisting of student tours and public outreach to the city's heritage buildings, the research also recommends to set a green education program consisting of student tours and public outreach to the certified green buildings that are located in Egypt.

Future studies:

- The research recommends to deeply study "**GBC historic building rating system- Italy**" and comparing it with the proposed rating system of this research "**Green Heritage Building scheme –GPRS**" after GBC historic building rating system assessed and certified several heritage buildings in Italy.

- The research recommends to submit the results of this research to the Ministry of Housing, and Egyptian Green Building Council, they and other researchers can perform some modifications on the proposed Green Heritage building scheme to launch the existing building scheme for rating the residential and non-residential existing buildings in Egypt.

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APPENDIX A.

BREEAM Domestic Refurbishment scheme

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BREEAM Domestic Refurbishment scheme

Management category

Management weight is 12% from the total			
Issue ID	**Credit**	**Points**	**% from Total**
Hea 01	**Home Users Guide**	3	27%
Description	- Provision of a home users guide for the home owners and tenants to know how to operate their home effectively, the guide containing information about the home energy efficient features, smoke detectors, information about water saving features and their use and benefits, transport facilities, Material and waste, emergency information, and local amenities.		
Hea 02	**Responsible Construction Practices**	2	18%
Description	- This credit encourages refurbishment projects to be managed in an environmentally and socially ways.		
Hea03	**Construction Site impacts**	1	9%
Description	- Reducing the site energy CO2 consumption and site water consumptions by managing and monitoring them with other construction site impacts of the project.		
Hea 04	**Security**	2	18%
Description	- To award the first credit, the retained external doors and windows should comply with minimum security requirements and the newly added are appropriately certified. To award the second credit, implementing the principles and guidance of secured by design.		
Hea 05	**Protection and Enhancement of Ecological Features**	1	9%
Description	- Protection of ecological features of the site award the project one credit. - Implementing the recommendation made by qualified ecologist award the project another one credit "as an exemplary credit".		
Hea 06	**Project Management**	2	18%
Description	- Awarded one credit if assigning the responsibilities and role of the project team. Awarded the second credit if arrange a handover meeting and implementing 2 methods of aftercare. - If the project has BREEAM accredited professional (AP) or BREEAM assessor from an early stage, the project award another one credit as "an exemplary credit".		
Total points of Credits		**11**	**100%**

Health and Wellbeing category

Health and Wellbeing weight is 17% from the total			
Issue ID	**Credit**	**Points**	**% from Total**
Man 01	**Daylighting**	**2**	**17%**
Description	- Awarded one credit if the project maintain good daylighting levels, and awarded the second credit, if achieve minimum daylighting standards.		
Man 02	**Sound Insulation**	**4**	**33%**
Description	- **The BREEAM domestic scheme set specific criteria for heritage buildings that are assessed under this scheme**: pre-completion should be carried out before and after refurbishment, tests carried out by Suitably Qualified Acoustician to determine whether the sound insulation values for historic buildings have been met the sound insulation values, for example, the building will be awarded one credit if the sound insulation will not be worst before refurbishment, two credits if the sound insulation is 3 dB higher than before refurbishment, 5 dB award the project 3 credits, 8 dB award 4 credits.		
Man 03	**Volatile organic compounds (VOCs)**	**1**	**8%**
Description	- Awarded one credit for avoiding the use of VOCs in decorative paints and varnished, wood panels, timber structure, wood flooring, floor covering, ceiling tiles, wall covering, adhesive for wallcovering, and other materials that used in the refurbishment, they should meet the standard requirements.		
Man 04	**Inclusive Design**	**2**	**17%**
Description	- Awarded one credit for achieving minimum accessibility, and awarded two credits for achieving advanced accessibility.		
Man 05	**Ventilation**	**2**	**17%**
Description	- Most of the heritage buildings are constructed of porous materials that absorb moisture that causing damage and problem with condensation and mold. Heritage buildings typically suffering from air infiltration leading to discomfort and heat loss. All of the upgrading of ventilation works should meet all requirements of guides of conservation in heritage buildings. - One credit is awarded if the minimum ventilation requirements and ventilation rates in all spaces are sufficient to allow structural moisture to be dealt with effectively. - Second credit is awarded if pressure testing was carried out before and after refurbishment, and monitoring the temperature and humidity before and after refurbishment.		
Man 06	**Safety**	**1**	**8%**
Description	- Awarded one credit for implementation fire and of carbon monoxide detection and alarm systems.		
Total points of Credits		**12**	**100%**

Energy category

Issue ID	Credit	Points	% from Total
Ene 01	**Improvement in Energy Efficiency Rating**	**6**	**20%**
Description	- Improving the energy efficiency rating of the building, if the improvement of energy efficiency rating[1] equal 5, the building awarded 0.5 credit, if it would be 60, the project awarded 6 credits - Determine the energy efficiency rating before improvement and after improvement from SAP[2] or EPC[3] report.		
Ene 02	**Energy Efficiency Rating Post Refurbishment**	**4**	**14%**
Description	- Achieving high levels of energy efficiency rating, if the energy efficiency rating of the project is equal or greater than 85, the project can award 4 credits.		
Ene 03	**Primary Energy Demand**	**7**	**24%**
Description	- Determine the annual primary energy demand of the building post refurbishment (kWh/m2/year) from SAP. if the primary energy demand from 371 to 400, the project award 0.5 credit, if the primary energy demand equal or less than 120, the project award 7 credits.		
Ene 04	**Renewable Technologies**	**2**	**7%**
Description	- This credit aims to encourage local energy that generate from renewable sources. The project can awarded 1point if the energy generated from low or zero carbon technologies is at least 10% from annual energy demand of the building, plus 220-250 kWh/m2/year is produced from renewable technologies.		
Ene 05	**Energy Labelled White Goods**	**2**	**7%**
Description	- Using an energy efficient white goods that reducing CO2 emissions. The first credit can be awarded if the building using fridges and freezers that label under the EU Energy efficiency labeling scheme, the second credit could be awarded if using washing machines, dishwashers, washer-dryers that label under the EU Energy efficiency.		
Ene 06	**Drying space**	**1**	**3%**
Description	- This credit aims to reduce energy by reduction the energy that using to dry clothing by creates an internal or external space with posts and footing for drying clothes. More than 4 m of dry line for 1-2 bedrooms, if it is an internal space, it should have a controlled ventilation to prevent mold growth.		

[1] **The Energy Efficiency Rating** measures the overall energy efficiency of a residential building ranging from 1 to 100 (the higher the number, the higher the energy efficiency.

[2] Energy performance certificate (EPC) which provides information on the energy efficiency of the building and recommendations for improvement.

[3] **The Government's standard Assessment Procedure (SAP)** is used for accounting the energy used in: space heating and cooling, hot water provision, and fixed lighting.

Ene 07	**Lighting**	**2**	**7%**
Description	- One credit can be awarded, if the building achieves the energy efficient space external lighting requirements, another credit can be awarded if the maximum average wattage across the total floor area of the internal lighting of the building is 9 watts/m2.		
Ene 08	**Energy Display Devices**	**2**	**7%**
Description	- One credit if using energy meter to measure electricity or fuel consumption and display data to occupants, two credits can be awarded if the electricity and fuel that use to provide heating can be measured by energy meter.		
Ene 09	**Cycle Storage**	**2**	**7%**
Description	- This credit encourages occupants to use cycle to reduce using car journeys and fuel consumptions and CO2 emissions. To award the credits, the number of cycle storage should be meet the criteria, for awarded 2 credits, should create 2 cycles storage per residential unit if it has 2-3 bedrooms. The location, access, size, type and roof cover of storage, should be met the requirements.		
Ene 10	**Home Office**	**1**	**3%**
Description	- Providing a suitable room has a sufficient services "telephone point, power sockets, window and adequate ventilation". Min. size space should be provided 1.8m to allow a desk, chair and bookshelf. This room reduce need to commute to work, the residents are able to work from their home		
Total points of Credits		**29**	**100%**

Water category

Water weight is 11% from the total			
Issue ID	**Credit**	**Points**	**% from Total**
Wat01	**Internal water use**	**3**	**60%**
Description	- Reducing the internal water use of the building that aims to minimize to the consumption of potable water in sanitary application, by using low water use fittings and water recycle systems. - Water consumption more than 150 litres/person/day – no credit would be awarded. - From 140 to 150 – would be awarded 0.5 credits. - From 129 to less than 140 – 1 credit. - From 118 to less than 129 - 1.5 credits. - From 107 to less than 118 - 2 credits. - From 96 to less than 107- 2.5 credits. - Less than 96- 3 credits.		

Wat02	**External water use**	**1**	**20%**
Description	- One credit would be awarded if the building doesn't have an individual or communal garden space. **Or** - The building has a rainwater collection system for irrigation. The tanks volume should meet the requirements to be awarded the credit. For example, the building that has 1-2 bedrooms with private garden should have tank with capacity minimum 100 liters. The building that has more than 3 bedrooms should have tank with minimum 200litres.		
Wat03	**Water meter**	**1**	**20%**
Description	- Awarded one credit if install a water meter for measuring usage of potable water.		
Total points of Credits		**5**	**100%**

Materials category

Issue ID	Credit	Points	% from Total
Mat 01	**Environmental Impact of Materials**	**25**	**55.5%**
Description	- Up to 25 credits can be awarded for the embodied impact and the thermal performance of external walls, internal walls, windows and upper and ground floors. The assessment can be executed via Mat 01 calculator depending on the Green Guide rating of new materials and the impact of those materials on improving the thermal performance of the materials that make-up these elements. This credit aims to encourage keeping retained elements that will be assessed via green guide calculator as very low impact.		
Mat 02	**Responsible Sourcing of Materials**	**12**	**26.7%**
Description	- All new materials will be used in the building must be legally harvest and traded timber "as prerequisite for all projects", up to 3 credits for sustainable procurement plan, and up to 12 credits for using recycled materials ,and post-consumer and pre-consumer materials.		
Mat 03	**Insulation**	**8**	**17.8%**
Description	- All new insulation will be used at external walls, ground floor, roof, and building services must be assessed as prerequisites. - The first 4 credits will be awarded if the insulation index for new insulation is equal or greater than 2. The second 4 credits can be awarded if the 80% or more of new thermal insulation used in the building elements is responsible sourced.		
Total points of Credits		**45**	**100%**

Waste category

Issue ID	Credit	Points	% from Total
Was 01	**Household waste**	**2**	**40%**
Description	- One credit can be awarded if there are three internal recycling containers are provided or one internal recycle container if recycling is sorted post collection. - Second credit can be awarded if creating an external private space for garden waste and has a container for kitchen waste.		
Was 02	**Refurbishment Site Waste Management**	**3**	**60%**
Description	- Credits can be awarded for the implementation pf site waste management plan that its requirements differ depending on the cost of the project.		
Total points of Credits		**5**	**100%**

Pollution category

Issue ID	Credit	Points	% from Total
Pol 01	**Nitrogen Oxide Emissions**	**3**	**37%**
Description	- Credits can be awarded depending on the amount of NOx emissions (that arising from the operation of space heating and hot water systems) can be reduced. One credit if NOx emissions are equal or less than 100 mg/kWh, two credits if they are equal or less than 70 mg/kWh, equal or three credits if they are less than 40 mg/kWh.		
Pol 02	**Surface water runoff**	**3**	**37%**
Description	- Awarded the first credit if any new hardscaping areas are permeable or impermeable surface drains onto permeable surface. Two credits can be awarded if all run off from the roof for rainfall have been managed onsite using source control methods. Three credits can be awarded by reducing total run-off volume by 75% through an appropriate drainage strategy for the site.		
Pol03	**Flooding**	**2**	**25%**
Description	- To award the credits, a flood risk assessment should be taken to define the building site, if it has low, medium or high flood risk. Two credits are awarded if achieve avoidance from flooding by keep the water away from the floor level of the building. If avoidance not possible, the credits can be awarded by implementing a full flood resistance strategy.		
Total points of Credits		**8**	**100%**

Innovation category

Issue ID	Credit	Points	% from Total
Inn 01	**Innovation**	**10**	**100%**
Description	- Up to a maximum of 10 credits are available for a collection of innovative products or techniques used in the refurbishment process. - One innovation credit can be awarded for each individual BREEAM issue exemplary performance level complied with		

APPENDIX B.

BREEAM 2014 Non-domestic Refurbishment and fit-out

APPENDIX B

BREEAM 2014 Refurbishment and Fit-Out scheme.

Management category

Issue ID	Credit	Points
Man 01	**Project brief and design**	4
Description	- Stakeholder consultation covering project delivery and relevant third parties. - Sustainability champion appointed to facilitate the setting, monitoring and achievement of BREEAM performance target(s) for the project.	
Man 02	**Life cycle cost and service life planning**	4
Description	- Recognizing and encouraging the use of life cycle costing and service life planning and the sharing of data to raise awareness and understanding.	
Man 03	**Responsible construction practices**	6
Description	- The principal contractor demonstrates sound environmental management practices and consideration for neighbours across their activities on-site. - Site related energy, water and transport impacts are monitored and reported to ensure ongoing compliance during the Refurbishment, Handover and Close Out stages and to improve awareness and understanding for future projects.	
Man 04	**Commissioning and handover**	4
Description	- Schedule of commissioning including optimal timescales and appropriate testing and commissioning of all building services systems and building fabric in line with best practice. - Inspecting, testing, identifying and rectifying defects via an appropriate method. - Provision of a non-technical Building User Guide and user/operator training timed appropriately around handover and proposed occupation.	
Man 05	**Aftercare**	3
Description	- Provision of the necessary infrastructure and resources to provide aftercare support to the building occupier(s). - Seasonal commissioning activities will be completed over a minimum 12 month period, once the building becomes substantially occupied. - The client or building occupier commit to carrying out a post occupancy evaluation (POE) exercise one year after initial building occupation and to disseminate the findings in terms of the building's post occupancy performance.	
Total points of Credits		**21**

Health and Wellbeing category

Issue ID	Credit	Points
Hea 01	**Visual comfort**	**Up to 7**
Description	- Potential for disabling glare has been designed out of all relevant building areas. - Good practice daylighting levels have been met. - Floor space in relevant building areas has an adequate view out to reduce eye-strain and provide a link to the outside. - Internal and external lighting systems are designed to avoid flicker and provide appropriate illuminance (lux) levels. - Internal lighting is zoned to allow for occupant control.	
Hea 02	**Indoor air quality**	**5**
Description	- Minimising sources of air pollution through careful design specification and planning. - Building ventilation strategy is designed to be flexible and adaptable to potential future building occupant needs and climatic scenarios.	
Hea 03	**Safe containment in laboratories**	**2**
Description	- Production of an objective risk assessment of the proposed laboratory facilities. - Containment devices such as fume cupboards meet best practice safety and performance requirements and objectives. - Containment level 2 and 3 laboratory facilities to meet best practice safety and performance criteria where specified.	
Hea 04	**Thermal comfort**	**3**
Description	- Thermal modelling carried out to appropriate standards. - Projected climate change scenario(s) considered as part of the thermal model. - The thermal modelling analysis has informed the temperature control strategy for the building and its users.	
Hea 05	**Acoustic performance**	**Up to 4**

Description	- The building meets appropriate acoustic performance standards and testing requirements in terms of:
	  - Sound insulation
	  - Indoor ambient noise level
	  - Reverberation times.	

Hea 06	**Safety and security**	**1**
Description	- Provision of effective measures which support safe access to and from the building. - Security needs are understood and taken into account in the design and specification.	
Total points of Credits		**22**

Energy category

Issue ID	Credit	Points
Ene 01	**Reduction of energy use and carbon emissions**	Up to 15
Description	- Recognise improvements in the energy performance of the refurbished building over existing building performance in relation to heating and cooling energy demand, primary energy consumption and carbon dioxide emissions. - Encouraging steps taken to reduce energy demand through building design and systems specification.	
Ene 02	**Energy monitoring**	2
Description	- Energy metering systems are installed to enable energy consumption to be assigned to end uses. - Sub-meters are provided for high energy load and tenancy areas.	
Ene 03	**External lighting**	1
Description	- Specification of energy efficient light fittings for external areas of the development and controls to prevent use during daylight hours or when not needed.	
Ene 04	**Low carbon design**	3
Description	- Analysis of the existing building is undertaken to identify opportunities for, and encourage the adoption of, passive design solutions, including free cooling. - A feasibility study has been carried out to establish the most appropriate on-site/near-site low or zero carbon (LZC) energy source(s) for the building/development and is specified.	
Ene 05	**Energy efficient cold storage**	2
Description	- The refrigeration system, its controls and components have been designed, installed and commissioned in accordance with appropriate codes and standards and demonstrates a saving in indirect greenhouse gas emissions (CO_2 eq.) over the course of its operational life.	
Ene 06	**Energy efficient transportation systems**	3
Description	- An analysis of the transport demand and usage patterns is undertaken to determine the optimum number and size of lifts, escalators and/or moving walks. - Energy efficient installations are specified.	
Ene 07	**Energy efficient laboratory systems**	5
Description	- Client engagement to determine occupant requirements and define laboratory performance criteria to optimise energy demand of the laboratory facilities. - Specification of best practice energy efficient equipment and measures as appropriate.	
Ene 08	**Energy efficient equipment**	2

Description	- Identification of the building's unregulated energy consuming loads which have a major impact on the total unregulated energy demand. - Demonstrate a meaningful reduction in the total unregulated energy demand of the building.	
Ene 09	**Drying space**	**1**
Description	- Provision of adequate internal or external space and equipment.	
Total points of Credits		**34**

Transport category

Issue ID	Credit	Points
Tra01	**Public transport solutions**	**Up to 5**
Description	- Recognition for projects where proximity to good public transport networks has been reviewed and where poor, alternative measures have been implemented, thereby helping to reduce transport-related pollution and congestion.	
Tra 02	**Proximity to amenities**	**Up to 2**
Description	- Recognition of projects where proximity of, and accessibility to, local amenities which are likely to be frequently required and used by building occupants has been reviewed.	
Tra 03	**Cyclist facilities**	**Up to 2**
Description	- Provision of compliant cycle storage spaces and facilities to encourage safe and healthy cycling.	
Tra 04	**Maximum car parking capacity**	**Up to 2**
Description	- To ensure change of use projects review provision of car parking spaces to optimise car parking capacity and encourage alternatives to car travel.	
Tra 05	**Travel plan**	**1**
Description	- To promote sustainable reductions in transport burdens by undertaking a site specific travel assessment/statement and developing a travel plan based on the needs of the particular site.	
Total points of Credits		**12**

Water category

Issue ID	Credit	Points
Wat 01	**Water consumption**	5
Description	- Reducing the demand for potable water through the provision of efficient sanitary fitting, rainwater collection and water recycling systems	
Wat 02	**Water monitoring**	1
Description	- Specification of a water meter/s on the mains water supply to encourage water consumption management and monitoring to reduce the impacts of inefficiencies and leakage.	
Wat 03	**Water leak detection**	2
Description	- Recognition of leak detection systems capable of detecting a major water leak on the mains water supply - Flow control devices that regulate the supply of water to each WC area/facility to reduce water wastage.	
Wat 04	**Water efficient equipment**	1
Description	- Identifying a building's total unregulated water demand and mitigating or reducing consumption through systems and/or processes.	
Total points of Credits		**9**

Materials category

Issue ID	Credit	Points
Mat 01	**Life cycle impacts**	Up to 6
Description	- Reductions in the building’s environmental life cycle impacts through the reuse of materials and the use of tools to analyse the life cycle impact of any new materials using robust environmental information assessment of the main building elements.	
Mat 02	**Hard landscaping and boundary protection**	0
Description	- There is no standalone hard landscaping and boundary protection issue applicable to this scheme. Hard landscaping and boundary protection is assessed within Mat 01 Life cycle impacts.	
Mat 03	**Responsible sourcing of materials**	4

Description	- Materials sourced in accordance with a sustainable procurement plan. - Key building materials are responsibly sourced to reduce environmental and socio-economic impacts.	
Mat 04	**Insulation**	**1**
Description	- Recognition of the use of thermal insulation which has a low embodied environmental impact relative to its thermal properties.	
Mat 05	**Designing for durability and resilience**	**1**
Description	- The building incorporates measures to reduce impacts associated with damage and wear-and-tear. - Relevant building elements incorporate appropriate design and specification measures to limit material degradation due to environmental factors.	
Mat 06	**Material efficiency**	**1**
Description	- Opportunities and measures have been identified and taken to optimise the use of materials.	
Total points of Credits		**13**

Waste category

Issue ID	Credit	Points
Wst 01	**Project waste management**	**7**
Description	- Development of a pre-refurbishment audit to identify options for reuse and recycling. - Actions to reuse or directly recycle materials. - Development of a refurbishment resource management plan. - Reducing project waste related to on-site construction and off-site manufacture/fabrication. - Diverting non-hazardous construction (on-site and dedicated off-site manufacture/fabrication), demolition and excavation waste (where applicable) generated by the project from landfill.	
Wst 02	**Recycled aggregates**	**1**
Description	- Percentage levels of recycled or secondary aggregate specified against set targets.	
Wst 03	**Operational waste**	**1**
Description	- Provision of suitable space and facilities to allow for segregation and storage of operational recyclable waste volumes generated by the assessed building/unit, its occupant(s) and activities.	
Wst 04	**Speculative floor and ceiling finishes**	**1**

Description	- Specification of floor and ceiling finishes only where agreed with the occupant or for tenanted areas where the future occupant is not known, carpets, other floor finishes and ceiling finishes are installed in a show area only to reduce wastage.	
Wst 05	**Adaptation to climate change**	**1**
Description	- Encourage consideration and implementation of measures to mitigate the impact of more extreme weather conditions arising from climate change over the lifespan of the building.	
Wst 06	**Functional adaptability**	**1**
Description	- Encourage consideration and implementation of measures to accommodate future changes to the use of the building and its systems over its lifespan.	
Total points of Credits		**12**

Land use and Ecology category

Issue ID	Credit	Points
LEO 01	**Site selection**	**0**
Description	- Not applicable to this scheme.	
LEO 02	**Protection of ecological features**	**1**
Description	- Recognition of where existing features have been protected prior to and during site operations.	
LEO 03	**Minimising impact on existing site ecology**	**0**
Description	- Not applicable to this scheme.	
LEO 04	**Enhancing site ecology**	**2**
Description	- Recognition of steps taken to enhance site ecology through the advice of a suitably qualified ecologist.	
LEO 05	**Long term impact on biodiversity**	**2**
Description	- The production of a long term landscape and habitat management plan to encourage measures that improve the site's long term biodiversity.	

Total points of Credits	5

Pollution Ecology category

Issue ID	Credit	Points
Pol 01	**Impact of refrigerants**	3
Description	- Avoidance or reduction of the impact of refrigerants through specification and leak prevention/detection.	
Pol 02	**NOx emissions**	Up to 3
Description	- Reduction in emissions of nitrous-oxides (NOx) arising from the building's space and water heating systems.	
Pol 03	**Flood risk management and reducing surface water run-off**	5
Description	- Identifying the buildings flood risk and adopting flood resilience or resistance measures through refurbishment or fit-out works. - Surface water run-off is managed to be no worse as a result of refurbishment works. - Watercourse pollution prevention systems are in place.	
Pol 04	**Reduction of night time light pollution**	1
Description	- External light pollution is eliminated through effective design or the removal of the need for unnecessary external lighting.	
Pol 05	**Reduction of noise pollution**	1
Description	- Measures to reduce the likelihood of disturbance arising as a result of noise from fixed installations on the development.	
Total points of Credits		**10**

Innovation category

The following is required to demonstrate compliance;
Up to a maximum of 10 credits are available in aggregate from a combination of the following:

Exemplary level of performance in existing BREEAM issues

1. Where the building demonstrates exemplary performance by meeting defined exemplary level performance criteria in one or more of following BREEAM assessment issues:

    a. Man 03 Responsible construction practices
    b. Man 05 Aftercare
    c. Hea 01 Visual comfort
    d. Hea 02 Indoor air quality
    e. Ene 01 Reduction of energy use and carbon emissions
    f. Wat 01 Water consumption
    g. Mat 01 Environmental impact of materials
    h. Mat 03 Responsible sourcing of materials
    i. Wst 01 Project waste management
    j. Wst 02 Recycled aggregates
    k. Wst 05 Adaptation to climate change
    l. Pol 03 Flood risk management and reducing surface water run-off

Please refer to the relevant BREEAM issue within this Scheme Document for the exemplary level performance assessment criteria.

Approved innovations

2. One innovation credit can be awarded for each innovation application approved by BRE Global, where the building complies with the criteria defined within an Approved Innovation Application Form.

APPENDIX C.

Green Pyramid rating system
Version 2011

APPENDIX C.

Green Pyramid Rating System – New Construction scheme

CATEGORY 1: SUSTAINABLE SITE		
	Credit	**Points**
1M.1	**Presentation of the Project Design and Implementation Plan**	**M**
1.1.	**Credit Points for Site Selection**	
1.1.1.	**Site selection in desert areas to encourage development in the desert outside the Nile Valley:**	**1**
Description	- A credit point is obtainable with documentary evidence that the project is in a desert area.	
1.1.2	**Redeveloping informal areas:**	**1**
Description	- A credit point is obtainable for projects that redevelop and re-plan informal areas to achieve maximum benefit from land use, provide services, and distribute population density in these areas..	
1.1.3	**Redeveloping Brownfield sites:**	**1**
Description	- A credit point is obtainable for projects that redevelop a brown field site in order to achieve maximum benefit from such areas and to rationalize land use. Where remediation of the site has been necessary, documentary evidence should be provided that the site was properly remediated (including an Environmental Site Assessment).	
1.1.4	**Compatibility with the National Development Plan:**	**1**
Description	- A credit point is obtainable for compatibility with the National Development Plan in order to achieve maximum benefit from the existing infrastructure, protect green land and spaces, preserve natural resources, provide green areas and services and distribute population density.	
1.2	**Accessibility**	
1.2.1	**Transport infrastructure connection:**	**1**
Description	- A credit point is obtainable for demonstrating a suitable connection with existing public transport systems.	
1.2.2	**Catering for remote sites:**	**1**
Description	- Where the site is currently remote a credit point is obtainable for presenting a suitable method for connecting it with the nearest urban area (including establishing the required infrastructure).	

1.2.3	**Alternative methods of transport:**	**1**
Description	- A credit point is obtainable for demonstrating strategies to reduce reliance on private automobile use and encourage the use of greener methods of transport.	
1.3	**Ecological balance**	
1.3.1	**Protection of habitat:**	**1**
Description	- A credit point is obtainable for demonstrating a suitable strategy for conserving or restoring natural areas to provide habitat and promote biodiversity, including the preserving / replanting of trees found on site.	
1.3.2	**Respect for sites of historic or cultural interest:**	**1**
Description	- A credit point is obtainable for demonstrating a suitable strategy for conserving and protecting remains of historic or cultural interest that are part of or nearby the site.	
1.3.3	**Minimising pollution during construction:**	**1**
Description	- A credit point is obtainable for demonstrating a strategy to minimise pollution from construction operations (including generation of dust and pollutants).	

CATEGORY 2: ENERGY EFFICIENCY Mandatory Minimum Requirements6		
	Credit	**Points**
2M.1	**Minimum Energy Performance Level:**	**M**
Description	- Demonstrate a Minimum Energy Performance Level 10% above an appropriate simulated base case model. The base case model is to be produced in accordance with the Egyptian Energy Efficiency Code and using the methods outlined in Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007 (or equal approved standard).	
2M.2	**Energy Monitoring and Reporting:**	**M**
Description	- Demonstrate provision of accessible energy sub-meters, clearly labelled and with instructions, for all occupied areas. Sub-meters should enable monitoring and recording of a minimum of 90% of the estimated annual consumption of each fuel type, with separate meters for equipment that exceeds 10 kW.	
2M.3	**Ozone Depletion avoidance:**	**M**
Description	- Demonstrate that all refrigerants and gaseous fire suppression agents within the Project have an Ozone Depletion Potential (ODP) near zero.	

2	**Credit Points for Energy Efficiency**	
2.1	**Energy Efficiency Improvement:**	
Description	- A maximum 10 credit points are obtainable for demonstrating (using the methodology outlined in 2M.1, above) further reductions in energy consumption from the base case determined in item 2M.1 (above). Points awarded are accumulative, and are shown opposite:	
	Reduction	
	5-10%	**1**
	11-15%	**1**
	16-20%	**1**
	21-25%	**1**
	26-27%	**1**
	28-30%	**1**
	31-35%	**1**
	36-40%	**1**
	41-45%	**1**
	46-50%	**1**
2.2	**Passive External Heat Gain\loss Reduction:**	
Description	- A maximum 7 credit points are obtainable for demonstrating reductions in annual external heat gain\loss (from the base case determined in item EF-01) through use of passive design measures in the building. Points awarded are accumulative, and are shown opposite:	
	Reduction	
	5-10%	**1**
	11-20%	**1**
	21-30%	**1**
	31-35%	**1**
	36-40%	**1**
	41-45%	**1**
	46-50%	**1**
	-	
2.3	**Energy Efficient Appliances:**	
Description	- Credit points are obtainable for demonstrating that the building occupier will be provided with formal documentary guidelines on the purchase and use of Energy Efficient Appliances for the building, with reference to rating schemes such as Energy Star (USA) or the Energy Efficiency Labelling Scheme (EU).	**3**
2.4	**Vertical Transportation Systems:**	
Description	- Credit points are obtainable for demonstrating that:	
	- stairs are visible from the main entrance or from the main building lifts; have a minimum lighting level of 150 lux measured at the walking surfaces; any artificial lighting used within the stairs must be supplied with colour corrected lamps with minimum Colour Rendering Index CRI=80.	**1**
	- all lifts within the building are energy efficient – i.e. operate in stand-by mode during off-peak periods; include a regenerative drive system for buildings over 3 stories; and use LED lighting and LCD display features.	**1**
	- All escalators and travelators are energy efficient – i.e. have an automated stop/start function linked to occupancy sensors to enable standby mode when there is no passenger demand; and use LED strip lighting.	**1**

2.5	**Renewable Energy Sources:**	
Description	- Credit points are obtainable for demonstrating that:	
	- an on-site and/or off-site renewable energy feasibility study has been undertaken;	**1**
	- A minimum of 5% of the project's non-renewable energy use will be provided by on-site generated renewable energy.	**1**
	- A maximum 8 credit points are obtainable for demonstrating that a percentage of total energy demand is supplied through renewable energy, utilizing on-site or off-site sources. Points awarded are accumulative, and are shown opposite:	
	% Total	
	1-4%	**1**
	5-8%	**1**
	9-12%	**1**
	13-15%	**1**
	16-20%	**1**
	21-25%	**1**
	26-29%	**1**
	over30%	**1**
2.6	**Renewable Energy Sources:**	
Description	- Credit points are obtainable for demonstrating that:	
	- an on-site and/or off-site renewable energy feasibility study has been undertaken;	**1**
	- a minimum of 5% of the project's non-renewable energy use will be provided by on-site generated renewable energy.	**1**
	- A maximum 8 credit points are obtainable for demonstrating that a percentage of total energy demand is supplied through renewable energy, utilizing on-site or off-site sources. Points awarded are accumulative, and are shown opposite:	
	% Total	
	1-4%	**1**
	5-8%	**1**
	9-12%	**1**
	13-15%	**1**
	16-20%	**1**
	21-25%	**1**
	26-29%	**1**
	over30%	**1**
2.7	**Environmental Impact:**	
Description	- The weighted average of all refrigerants and fire suppression systems media has an equivalent Global Warming Potential (GWP) that meets or is less than the requirements of Egyptian Environmental Law. Credit points are obtainable for demonstrating that:	
	- Points awarded as follows:	
	- The weighted average of all refrigerants shall have a GWP of 12 or less;	**1**
	- The Project has installed a permanent refrigerant leak detection system;	**1**
	- The Project has installed an automatic refrigerant pump-down system to a dedicated storage tank with isolation valves;	**1**
	- All gaseous fire suppression systems have a GWP of 2 or less.	**1**

٢.٨	**Operation and Maintenance:**	**1**
Description	- Credit points are obtainable for providing for a simple and easily-followed Operations Manual for all Mechanical, Electrical and Plumbing (MEP) apparatus, equipment, device, and sub-system.	
2.9	**Optimized balance of Energy and Performance:**	
Description	- Credit points are obtainable for demonstrating design optimization studies and implementation of the following: - Natural Vs. Artificial Lighting; - Optimization between Minimum Thermal Cooling loads and Maximum Day Lighting, using Window-Wall Ratio (WWR) and Skylight-Roof Ratio (SRR); - Acceptable Indoor air quality at all operation profiles; - Optimization between building Passive systems and the anticipated Minimum Thermal Cooling.	**1** **1** **1** **1**
2.10	**Energy and Carbon Inventories:**	
Description	- Credit points are obtainable for providing an inventory of energy and carbon for each Mechanical, Electrical and Plumbing (MEP) system, including transportation to Site, installation, testing and commissioning and operation	**2**
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 2: ENERGY EFFICIENCY		**50**

CATEGORY 3: WATER EFFICIENCY		
	Credit	**Points**
3M.1	**Minimum Water Efficiency:**	**M**
Description	- Demonstrate, by means of a parametric analysis report, that the building's predicted potable water consumption will be no greater than that of a simulated base case model. The base case model and subsequent analyses referred to in the following sections to be produced using a suitable Building Water Calculator.	
3.M.2	**Water Use Monitoring:**	**M**
Description	- Demonstrate that efficient, regularly calibrated, easily accessible and clearly labelled water meters are provided and capable of monitoring the water consumption.	

3.1	**Indoor Water Efficiency Improvement:**	
Description	- A maximum 8 credit points are obtainable for demonstrating that the proposed building has achieved a sensible reduction in indoor potable water consumption (not including irrigation) than the water use baseline calculated for the building compared to the base-case in 3M.1 (above). Calculations are based on using efficient, accessible, and clearly labelled water metering devices, and estimated occupant usag, and the use of conserving (saving) water and sanitary devices (fixtures) rather than the conventional ones (lavatory faucets, showers , kitchen sinks, water closets, and urinals). - Points awarded are accumulative, and are shown opposite. Reduction <10% 10-20% 21-30% 31-40% 41-50%	 **2** **1.5** **1.5** **1.5** **1.5**
3.2	**Outdoor Water Efficiency Improvement recommend to be replaced by (Water Efficient Landscaping):**	
Description	- A maximum 9 credit points credit points are obtainable for demonstrating that: - An Irrigation Operation and Maintenance plan has been developed; - A water-efficient irrigation system is incorporated into landscape design; - Landscape irrigation demand is less than 5 litres/m2/day average; - Landscape irrigation demand is less than 3 litres/m2/day average; - 100% exterior irrigation demand is met using Exterior Water Allowance; - Reused grey water is maximized OR a recycled water mainline loop has been installed in anticipation for the availability of reused grey water; - Color coding of pipes is used to distinguish recycled water from potable. - Use of water treated and raw water resources by a public agency specifically for non-potable uses.	 **2** **1** **1** **1** **1** **1** **1** **1**
3.3	**Efficiency of Water-based Cooling systems:**	
Description	- A maximum 4 credit points are obtainable for demonstrating that the Water-based Cooling system for the proposed building shows a saving in consumption compared to the base-case model in 3M.1 (above). Points awarded are accumulative, and are shown opposite. Saving 25-50% 51-75% 76-100%	 **2** **1** **1**
3.4	**Water Feature Efficiency:**	
Description	- Credit points are obtainable for demonstrating that (select one of the followings): a) EITHER that the Project has no exterior water features or swimming pools; b) OR that all external water features or swimming pools are provided with adequate retractable shading covers or pool blankets.	 **4** **2**

3.5	**Water Leakage Detection:**	
Description	- A maximum 6 credit points are obtainable for demonstrating the provision of: - Easily accessible and clearly labelled water meters that are capable of monitoring the water consumption of major uses of water; - A leak detection system that covers all main water distribution pipes within the project.	**3** **3**
3.6	**Efficient water use during construction:**	
Description	- Credit points are obtainable for demonstrating the use materials such as pre-mixed concrete for preventing loss during mixing	**3**
3.7	**Waste water management:**	
Description	- A maximum 12 credit points are obtainable for demonstrating that: - No un-treated water will enter the local environment (for example, into surfaces, deep wells, rivers, and enclosed lakes) or affect neighboring developments; all in accordance with National Environmental Laws. (Obligatory Issue), supporting documentation should include: drawings showing the proposed systems and relevant calculations, specifications and data sheets - Ensuring that the reused treated waste water generation quality must comply the standards as prescribed in the Egyptian Environmental Laws (In case the water quality cannot be ensured, provide necessary treatment of raw water for achieving the desired concentration for various applications). (Obligatory Issue) - Reduce potable water use for building sewage conveyance by use of non-potable water (captured rainwater, or recycled grey water).	**6** **4** **2**
3.8	**Sanitary Used Pipes:**	
Description	- Ensure the type of sanitary pipes material are obtainable for demonstrating that: - Optimal choice for certified sanitary pipes material which secures water quality, cleanliness and sustainability for human use. - Tested sanitary systems which ensure the high level of installation.	**2** **2**
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 1: WATER EFFICIENCY		**50**

CATEGORY 4: Materials and Resources		
	Credit	**Points**
4M.1	- Presentation of a Schedule of Principal Project Materials which lists all significant13 building materials to be used on the Project. Information to be provided on the quantity, cost, and origin of the materials and transportation to site.	**M**
4M.2	- Elimination of exposure of building occupants to asbestos and to any other hazardous and toxic materials.	**M**

4.1	**Regionally procured materials (to reduce the environmental impact of transportation).**	

Description	- Credit points are obtainable for demonstrating that building materials are extracted and manufactured in Egypt. Points awarded as follows (select one of the followings):
	  - Value of regional materials is not less than 25% of total materials value;
	  - Value of regional materials is not less than 50% of total materials value;
	  - Value of regional materials is not less than 75% of total materials value.
		
		1
		2
		3

4.2	**Materials fabricated on site:**	
Description	- A credit points is obtainable for demonstrating the use of building materials (such as bricks) that are fabricated on site.	**1**
4.3	**Use of readily renewable materials:**	

Description	- Credit points are obtainable for demonstrating that building materials are readily renewable. Such materials include earth materials, natural stone, palm tree products, bamboo, wool, cotton for insulation, agrifiber, linoleum and products made from crop fibres, such as rice and barley straw. Points awarded as follows (select one of the followings):
	  - Value of regional materials is not less than 5% of total materials value;
	  - Value of regional materials is not less than 10% of total materials value;
	  - Value of regional materials is not less than 20% of total materials value.
		
		1
		2
		3

4.4	**Use of salvaged materials:**	

Description	- Credit points are obtainable are obtainable for demonstrating that salvaged or re-used building materials have been used, as follows(select one of the followings)::
	  - Value of salvaged materials is not less than 25% of total materials value;
	  - Value of regional materials is not less than 50% of total materials value;
	  - Value of regional materials is not less than 75% of total materials value.
		
		1
		2
		3

4.5	**Use of recycled materials:**	
Description	- Credit points are obtainable (with evidence) for the - use of recycled materials, as follows: a) aSteel: at least 50% of all structural steel (by weight) has a minimum of 25% post-consumer recycled content or is reused (for structural steel buildings) OR at least 75% of all reinforcing or stressing steel (by weight) has a minimum of 90% post-consumer recycled content (for concrete-framed buildings). b) Concrete: demonstrate that the overall amount of Portland cement used has been reduced by the use of supplementary cementitious materials such as fly ash, ground granulated blast furnace slag; c) Aggregates; demonstrate that at least 20% of all aggregates used on site (by volume), in structural and non-structural applications are recycled. d) Other Materials: demonstrate that materials of at least 10% of the total material costs are constituted of at least: 30% post-consumer recycled content, 80% post-industrial content, and 50% agricultural waste by-products.	a) **1** b) **1** c) **1** d) **1**
4.6	**Use of lightweight materials:**	
Description	- A credit point is obtainable where it can be demonstrated that at least 25% (by value) of total materials are lightweight (e.g. hollow or compound) materials or elements (e.g. frames) in comparison with similar conventional materials.	**1**

4.7	**Use of higher durability materials:**	
Description	- A credit point is obtainable where it can be demonstrated that at least 25% (by value) of total materials have higher abrasion resistance and minimal maintenance costs in comparison with similar conventional materials.	**1**
4.8	**Use of prefabricated elements:**	
Description	- Credit points are obtainable for using totally or partly prefabricated elements (e.g. walls, cladding, frame, slabs) which reduce the need for construction skills and simplify dismantling for reuse. Points are available as follows (select one of the followings): - Value of prefabricated elements not less than 10% of total project value; - Value of prefabricated elements is not less than 30% of total project value; - Value of prefabricated elements is not less than 50% of total project value.	**1** **2** **3**
4.9	**Life Cycle Cost (LCC) analysis of materials in the project.**	
Description	- A credit point is obtainable for presenting a Life Cycle Cost (LCC) analysis of all significant14 building materials to be used on the Project.	**1**
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 4: MATERIALS AND RESOURCES		**20**

CATEGORY 5: Indoor Environmental quality		
	Credit	**Points**
5M.1	**Minimum Ventilation and Indoor Air Quality:**	
Description	- Undertake a verified observational survey of outdoor local air quality according to ANSI / ASHRAE 62. Demonstrate that the building mechanical system meets the following requirements: - Separation distances between outdoor air intakes and any exhausts or discharge points comply with local codes or ASHRAE (whichever is more stringent); - all exhausts are located outside of the defined public realm or as defined by local code, whichever is more stringent; - All occupied areas comply with the minimum thresholds set out in ANSI / ASHRAE 62 using the ventilation rate procedure or local code, (whichever is more stringent).	**M**
5M.2	**Control of Smoking in and around the Building:**	
Description	- Demonstrate that appropriate measures are incorporated into the building design to reduce exposure to tobacco smoke. Also demonstrate that smoking is prohibited throughout the building including car parks, and 25 m smoke free zones around all entrances, outdoor air intakes and operable windows. Train all security staff for smoking control within and outside buildings. Locate any dedicated external smoking areas away from public or high use pedestrian thoroughfares and install suitable facilities for collecting ash and cigarette ends; and install, in all dedicated external smoking areas, signage that lists the negative health impacts of smoking and details assistance for those aiming to stop.	**M**

5M.3	**Control of Legionella and other health risks:**	
Description	- Demonstrate that a Legionella Management Plan exists for all relevant water based systems, following the requirements and guidance in Approved Code of Practice and Guidance (L8), 3rd Edition 2000, UK Health and Safety Executive (or other approved) and integrate this plan into the Operations & Maintenance Manual (OMM).	
5.1	**Optimized Ventilation:**	
Description	- A credit point is obtainable for demonstrating an increase in the fresh air ventilation rate of 15% over the base case determined in item 5M.1 (above). - Credit points are obtainable for the provision of CO2 sensors installed at all return points with rate of Ventilation exceeds minimum requirements by 15%. Ensure the CO2 monitoring system has sensors located in the breathing zone and is capable of alerting occupants when additional fresh air is required. At a minimum CO2 levels must not exceed 1000ppm.	**1** **4**
5.2	**Controlling emissions from building materials:**	
Description	- Credit points are obtainable for demonstrating the use of low emission adhesives, sealants, and paints, coatings, flooring and ceiling systems, and certification that building materials and products containing formaldehyde have not been used -	**5**
5.3	**Thermal Comfort**	
Description	- Credit points are obtainable for demonstrating that all spaces within the building have been modelled to determine zonal cooling demand and designed to have separately controllable thermal zones, Provision for these zones and various types of building should be in accordance with ANSI / ASHRAE 55 adapted for Egyptian Climatic Regions.	**2**
5.4	**Visual Comfort:**	
Description	- Credit points are obtainable for demonstrating that all spaces within the building have been modelled to determine the suitable lighting intensity to meet the required applications as per local codes; In addition the submission shall include the methodologies of controls for optimum energy saving in-conjunction with the analyses for compromising between day-lighting and artificial lighting. -	**2**
5.5	**Acoustic Comfort:**	
Description	- Credit points are obtainable for demonstrating that all spaces within the building have been modelled to determine suitable acoustic conditions and noise control strategies, all in accordance with National and Local Codes. -	**1**
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 5: INDDOR ENVIROMENTAL QUALITY		**20**

CATEGORY 6: Management		
	Credit	**Points**
6M.1	Presentation of an Integrated Plan and Method Statement for site operations	**M**
6M.2	Compliance with all relevant national Health & Safety regulations	**M**
6M.3	Where the Project involves demolition work, a Method Statement with clear evidence of the use of suitable methods of demolition.	**M**
6.1	**Credit Points for Site Provision**	
6.1.1.	**Containers for site materials waste:**	**2**
Description	- Credit points are obtainable for providing and appropriate number of separate specific and identified containers for different kinds of wastes with clear signs on each	
6.1.2	**Employing waste recycling workers on site:**	**1**
Description	- A credit point is obtainable for employing workers for daily recycling of waste materials on site.	
6.1.3	**Access for lorries, plant and equipment:**	**1**
Description	- A credit point is obtainable for providing proper access roads for lorries to reduce any negative impact on the environment during site operations.	
6.1.4.	**Identified and separated storage areas:**	**2**
Description	- Credit points are obtainable for providing site storage areas, separation of flammable and toxic materials and prevention of soil pollution in these areas.	
6.2 Credit Points for Site Environmental		
6.2.1	**Project Waste Management Plan:**	**1**
Description	- A credit point is obtainable for presenting a project Waste Management Plan that includes strategies from reducing, and, where possible, re-using and recycling the waste arising from site operations.	
6.2.1	**Engaging a company specialized in recycling and disposal:**	**2**
Description	- Credit points are obtainable for engaging a company specialized in building materials recycling and management and in proper disposal of waste.	
6.2.2	**Protecting water sources from pollution:**	**2**

Description	- Credit points are obtainable for safeguarding water sources from pollution arising from site operations.	
6.2.3	**Waste from mixing equipment:**	**2**
Description	- Credit points are obtainable for proper disposal of waste (including waste water from the mixing process) from mixing equipment without harm to the environment.	
6.2.4	**Control of emissions and pollutants:**	**2**
Description	- Credit points are obtainable for mitigating noise and exhaust emissions from machinery and equipment on Site.	
6.3	**Credit Points for Building User Guide**	
6.3.1	**Providing a Building User Guide:**	**3**
Description	- Credit points are obtainable for providing a building user guide containing the necessary technical and non-technical information for the building users / occupant to enable the efficient and responsible operation of the building.	
6.3.2	**Providing a Periodic Maintenance Schedule:**	**2**
Description	- Credit points are obtainable for the provision of a Periodic Maintenance Schedule, which should be comprehensive and regularly updated.	
TOTAL AVAILABLE CREDIT POINTS IN CATEGORY 6: MANAGEMENT		**20**

CATEGORY 7: Innovation	
	Credit
7.1	**Cultural Heritage:**
Description	- Credit points are obtainable for incorporating architectural, construction and technical solutions which excel in reflecting national and regional cultural heritage while contributing to the environmental performance of the building .
7.2	**Exceeding Benchmarks:**
Description	- Credit points are obtainable for demonstrating that the current benchmarks of GPRS have been exceeded by a significant margin and providing evidence that the improvement has an additional environmental benefit. One Credit Point is available for each Category (up to a maximum of four Credit Points).
7.3	**Innovation:**
Description	- Credit points are obtainable for innovative design or construction practices which have a significant measurable environmental benefit and which are not otherwise awarded points by GPRS.

APPENDIX D.

Check List of LEED operation and Maintenance V4

LEED v4 for Operations & Maintenance: Hospitality
Project Checklist

Project Name:
Date:

Y	?	N			
0	0	0	**Location and Transportation**		**15**
			Credit	Alternative Transportation	15
0	0	0	**Sustainable Sites**		**10**
Y			Prereq	Site Management Policy	Required
			Credit	Site Development-Protect or Restore Habitat	2
			Credit	Rainwater Management	3
			Credit	Heat Island Reduction	2
			Credit	Light Pollution Reduction	1
			Credit	Site Management	1
			Credit	Site Improvement Plan	1
0	0	0	**Water Efficiency**		**12**
Y			Prereq	Indoor Water Use Reduction	Required
Y			Prereq	Building-Level Water Metering	Required
			Credit	Outdoor Water Use Reduction	2
			Credit	Indoor Water Use Reduction	5
			Credit	Cooling Tower Water Use	3
			Credit	Water Metering	2
0	0	0	**Energy and Atmosphere**		**38**
Y			Prereq	Energy Efficiency Best Management Practices	Required
Y			Prereq	Minimum Energy Performance	Required
Y			Prereq	Building-Level Energy Metering	Required
Y			Prereq	Fundamental Refrigerant Management	Required
			Credit	Existing Building Commissioning— Analysis	2
			Credit	Existing Building Commissioning—Implementation	2
			Credit	Ongoing Commissioning	3
			Credit	Optimize Energy Performance	20
			Credit	Advanced Energy Metering	2
			Credit	Demand Response	3
			Credit	Renewable Energy and Carbon Offsets	5
			Credit	Enhanced Refrigerant Management	1
0	0	0	**Materials and Resources**		**8**
Y			Prereq	Ongoing Purchasing and Waste Policy	Required
Y			Prereq	Facility Maintenance and Renovations Policy	Required
			Credit	Purchasing- Ongoing	1
			Credit	Purchasing- Lamps	1
			Credit	Purchasing- Facility Management and Renovation	2
			Credit	Solid Waste Management- Ongoing	2
			Credit	Solid Waste Management- Facility Management and Renovation	2

Y	?	N			
0	0	0	**Indoor Environmental Quality**		**17**
Y			Prereq	Minimum Indoor Air Quality Performance	Required
Y			Prereq	Environmental Tobacco Smoke Control	Required
Y			Prereq	Green Cleaning Policy	Required
			Credit	Indoor Air Quality Management Program	2
			Credit	Enhanced Indoor Air Quality Strategies	2
			Credit	Thermal Comfort	1
			Credit	Interior Lighting	2
			Credit	Daylight and Quality Views	4
			Credit	Green Cleaning- Custodial Effectiveness Assessment	1
			Credit	Green Cleaning- Products and Materials	1
			Credit	Green Cleaning- Equipment	1
			Credit	Integrated Pest Management	2
			Credit	Occupant Comfort Survey	1
0	0	0	**Innovation**		**6**
			Credit	Innovation	5
			Credit	LEED Accredited Professional	1
0	0	0	**Regional Priority**		**4**
			Credit	Regional Priority: Specific Credit	1
			Credit	Regional Priority: Specific Credit	1
			Credit	Regional Priority: Specific Credit	1
			Credit	Regional Priority: Specific Credit	1
0	0	0	**TOTALS**	Possible Points:	**110**

Certified: 40-49 points, **Silver:** 50-59 points, **Gold:** 60-79 points, **Platinum:** 80+ points

APPENDIX E.

El-Shenawy Palace Energy Simulation Model Report- (Revit Program)

ElShenawy Palace Model

El-Shenawy Palace Energy Simulation

Analyzed at 5/13/2016 5:55:23 PM

Energy Analysis Result

Building Performance Factors

Location:	Al Manşūrah, Egypt
Weather Station:	1246871
Outdoor Temperature:	Max: 42°C/Min: 2°C
Floor Area:	1,276 m²
Exterior Wall Area:	1,027 m²
Average Lighting Power:	11.84 W / m²
People:	162 people
Exterior Window Ratio:	0.11
Electrical Cost:	$0.09 / kWh
Fuel Cost:	$0.78 / Therm

Energy Use Intensity

Electricity EUI:	216 kWh / sm / yr
Fuel EUI:	83 MJ / sm / yr
Total EUI:	862 MJ / sm / yr

Life Cycle Energy Use/Cost

Life Cycle Electricity Use:	8,201,802 kWh
Life Cycle Fuel Use:	3,163,851 MJ
Life Cycle Energy Cost:	$360,317

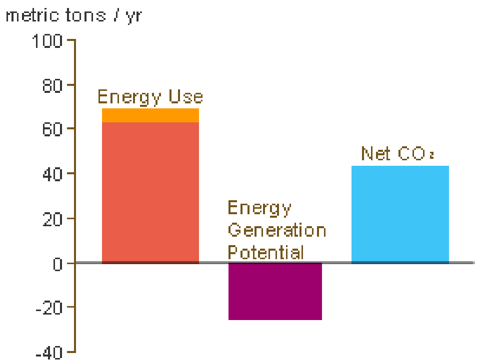
*30-year life and 6.1% discount rate for costs

Renewable Energy Potential

Roof Mounted PV System (Low efficiency):	36,503 kWh / yr
Roof Mounted PV System (Medium efficiency):	73,006 kWh / yr
Roof Mounted PV System (High efficiency):	109,508 kWh / yr
Single 15' Wind Turbine Potential:	874 kWh / yr

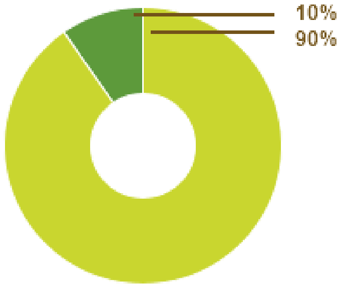
*PV efficiencies are assumed to be 5%, 10% and 15% for low, medium and high efficiency systems

Annual Carbon Emissions



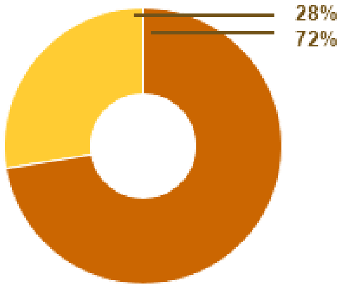
	(metric tons / yr)
Electricity Consumption	63
Fuel Consumption	5
Roof PV Potential (High Efficiency)	-25
Single 15' Wind Turbine Potential	0
Net CO_2	43

Annual Energy Use/Cost



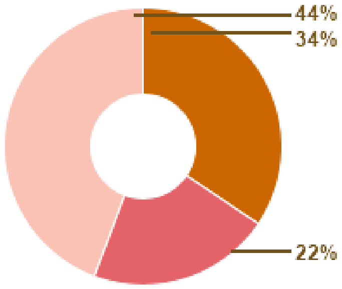
Electricity	90%	$25,672	273,393	kWh
Fuel	10%	$783	105,461	MJ
		$26,455		

Energy Use: Fuel



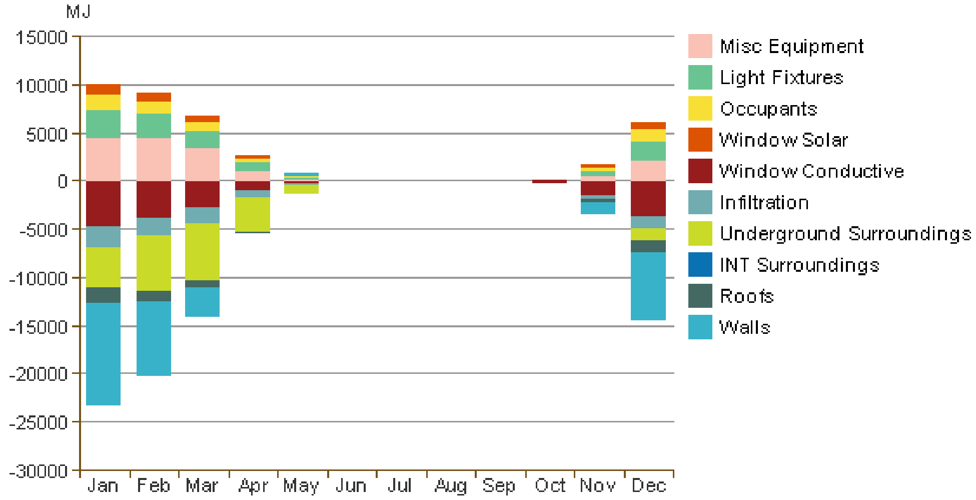
			(MJ)
HVAC	72%	$567	76,335
Domestic Hot Water	28%	$216	29,126
		$783	105,461

Energy Use: Electricity

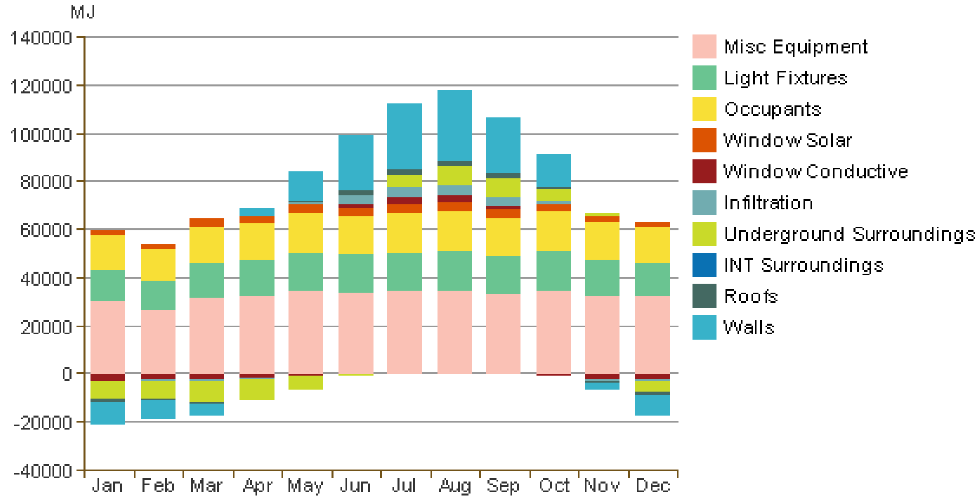


			(kWh)
HVAC	34%	$8,702	92,683
Lighting	22%	$5,384	57,347
Misc Equipment	44%	$11,201	119,292
		$25,287	269,322

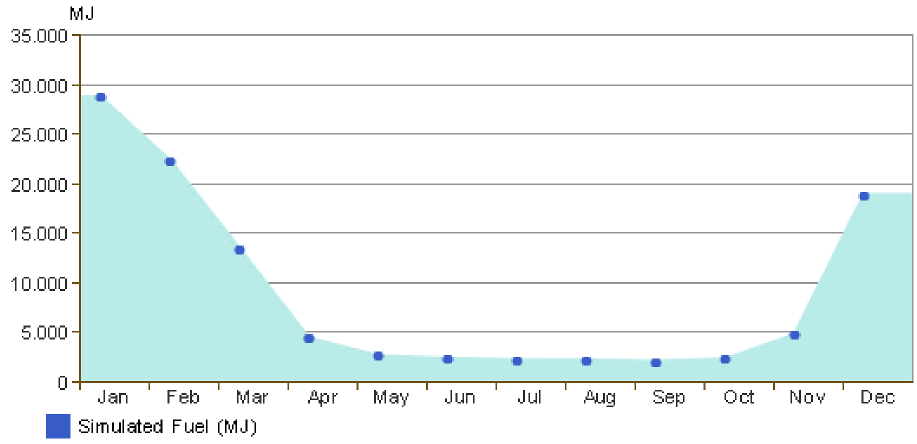
Monthly Heating Load



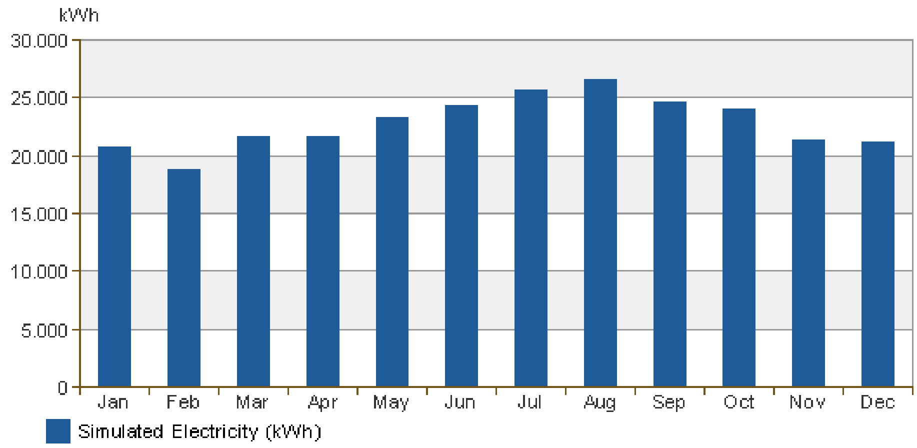
Monthly Cooling Load



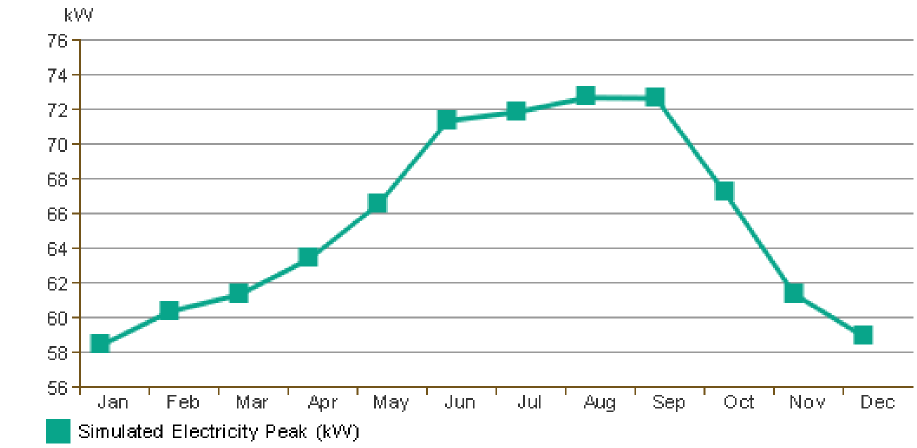
Monthly Fuel Consumption



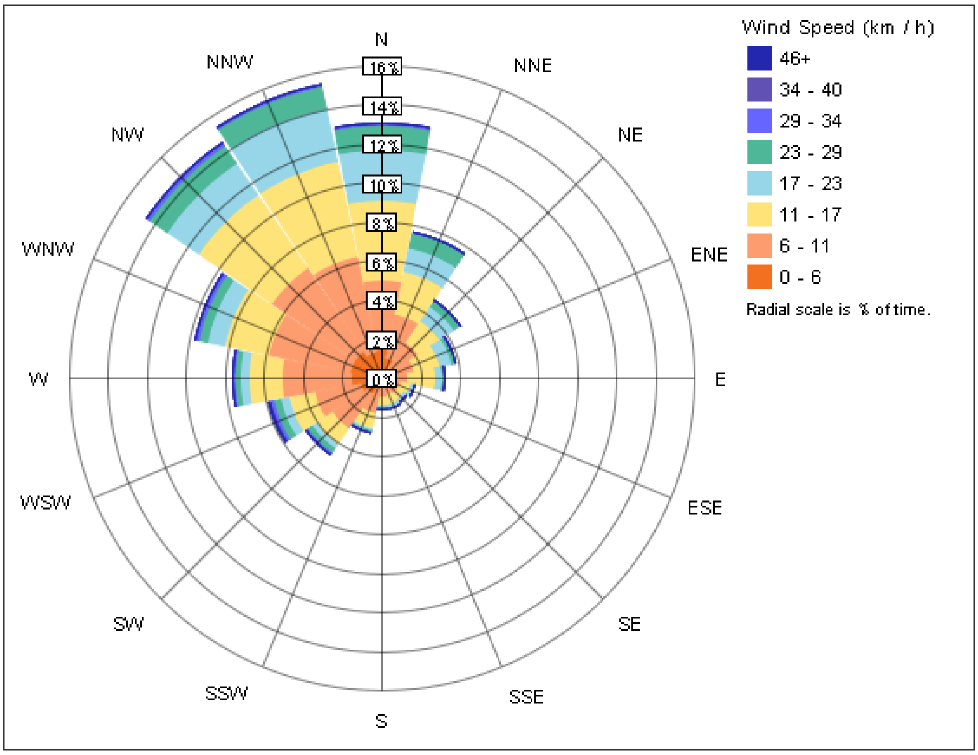
Monthly Electricity Consumption



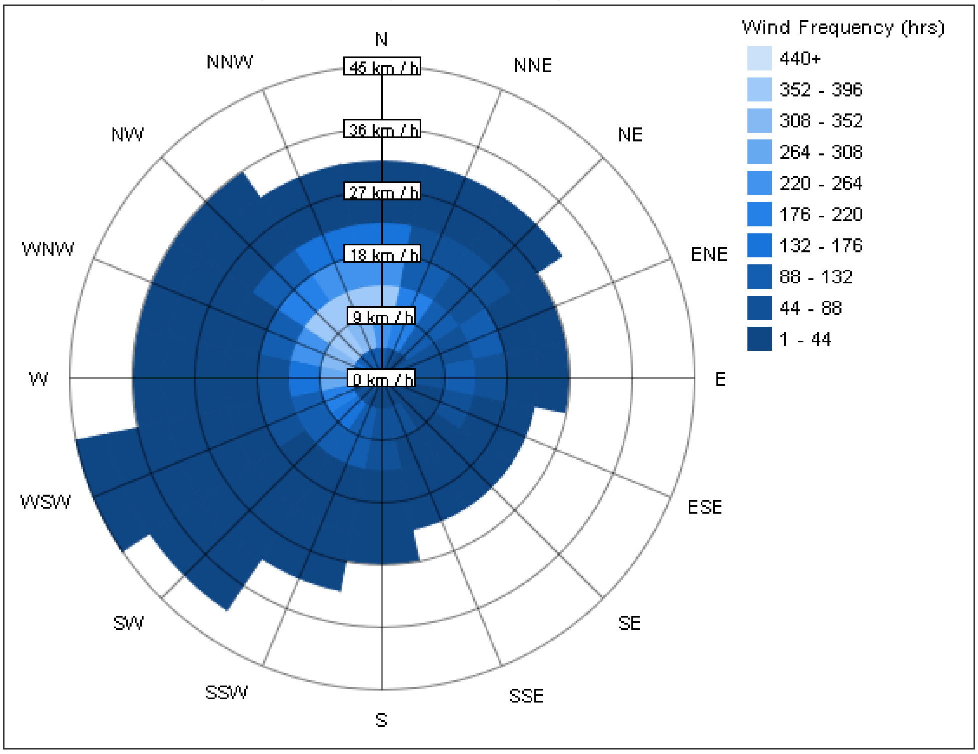
Monthly Peak Demand



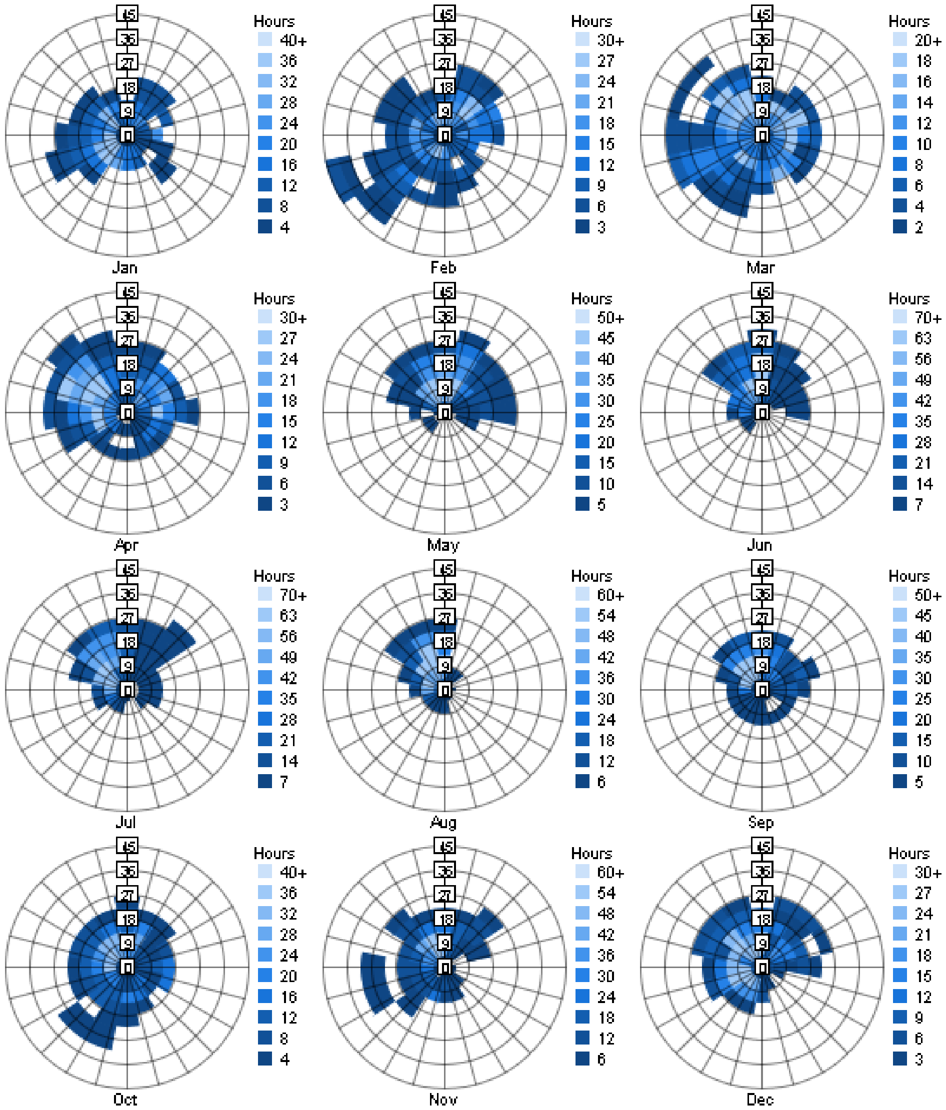
Annual Wind Rose (Speed Distribution)



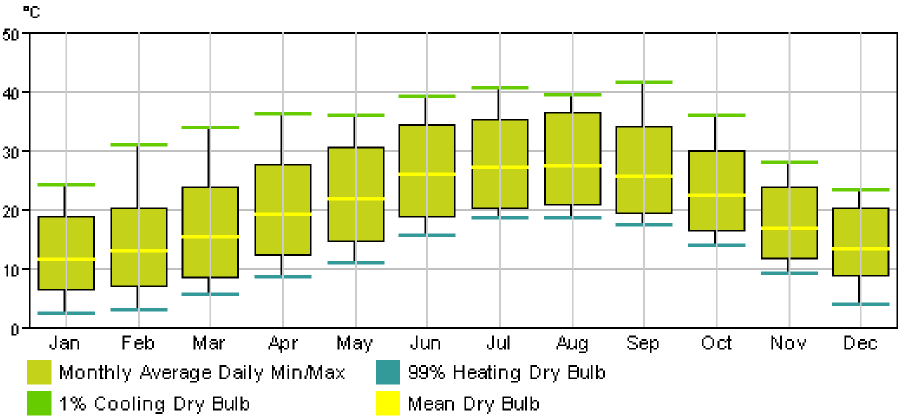
Annual Wind Rose (Frequency Distribution)



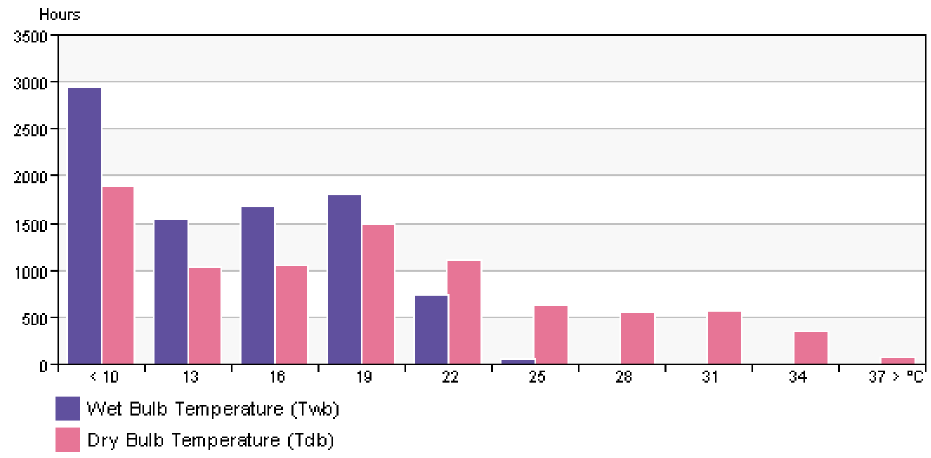
Monthly Wind Roses



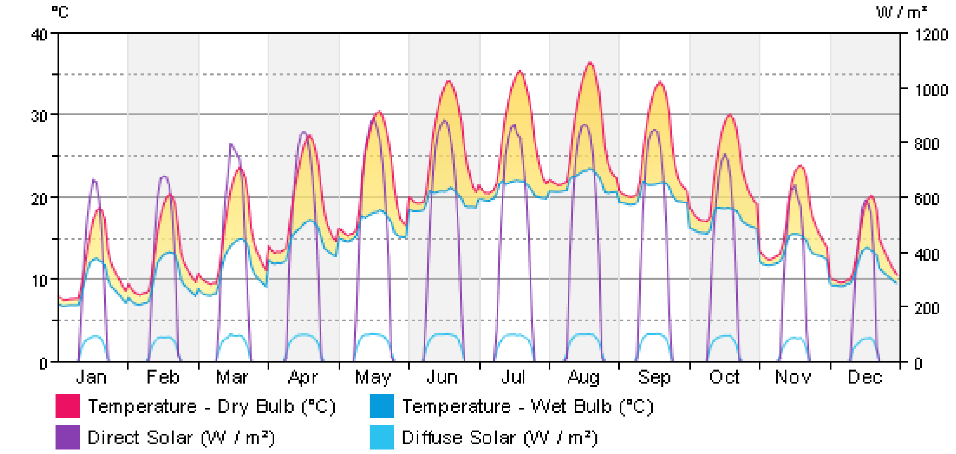
Monthly Design Data



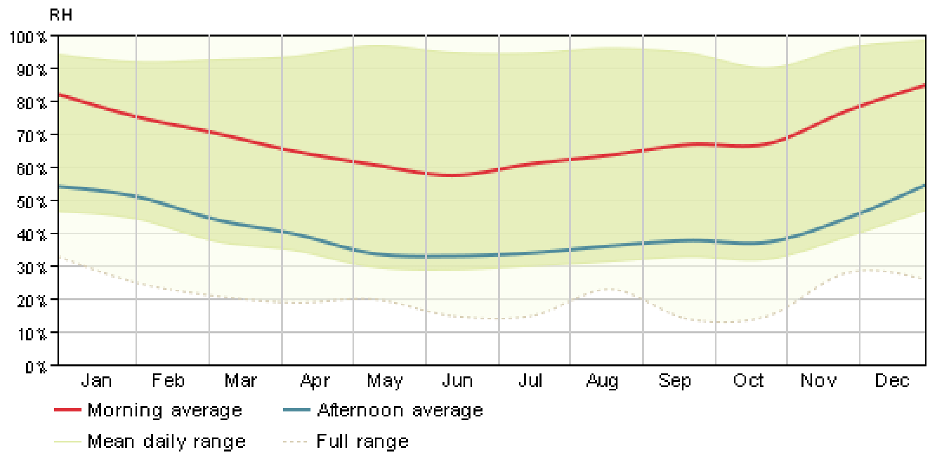
Annual Temperature Bins



Diurnal Weather Averages



Humidity



Energy Analysis Data

APPENDIX F.

The service Building of El-Shenawy Palace Energy Simulation Model Report (Revit Program)

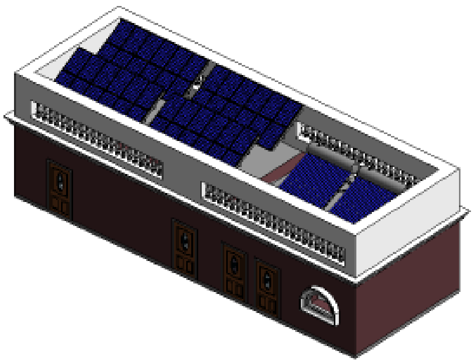
AUTODESK.

Cafetria

Cafetria Energy Analsis

Analyzed at 5/14/2016 12:19:54 AM

Energy Analysis Result



Building Performance Factors

Location:	Mansoura, Ad Daqahliyah
Weather Station:	1246871
Outdoor Temperature:	Max: 42°C/Min: 2°C
Floor Area:	75 m²
Exterior Wall Area:	112 m²
Average Lighting Power:	15.07 W / m²
People:	34 people
Exterior Window Ratio:	0.00
Electrical Cost:	$0.09 / kWh
Fuel Cost:	$0.78 / Therm

Energy Use Intensity

Electricity EUI:	256 kWh / sm / yr
Fuel EUI:	923 MJ / sm / yr
Total EUI:	1,847 MJ / sm / yr

Life Cycle Energy Use/Cost

Life Cycle Electricity Use:	525,178 kWh
Life Cycle Fuel Use:	1,890,349 MJ
Life Cycle Energy Cost:	$28,764

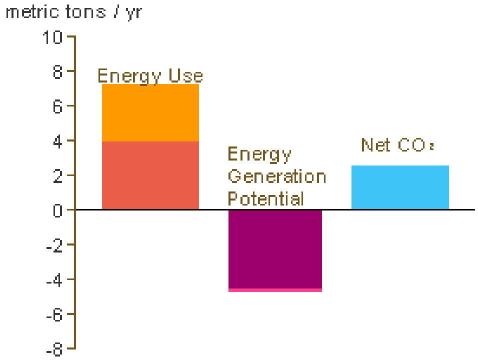
*30-year life and 6.1% discount rate for costs

Renewable Energy Potential

Roof Mounted PV System (Low efficiency):	6,448 kWh / yr
Roof Mounted PV System (Medium efficiency):	12,896 kWh / yr
Roof Mounted PV System (High efficiency):	19,344 kWh / yr
Single 15' Wind Turbine Potential:	874 kWh / yr

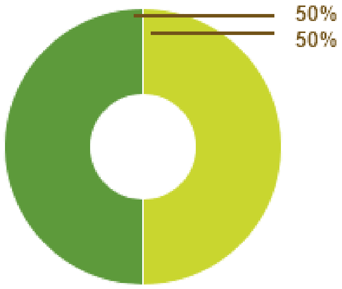
*PV efficiencies are assumed to be 5%, 10% and 15% for low, medium and high efficiency systems

Annual Carbon Emissions



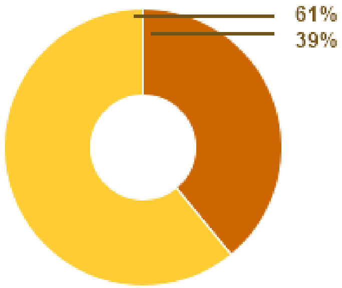
	(metric tons / yr)
Electricity Consumption	4
Fuel Consumption	3
Roof PV Potential (High Efficiency)	-4
Single 15' Wind Turbine Potential	0
Net CO_2	3

Annual Energy Use/Cost



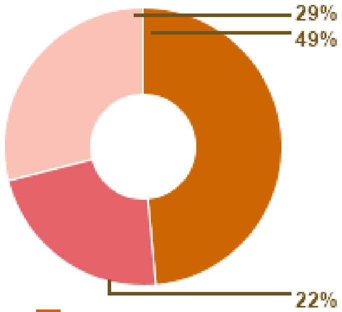
Electricity	50%	$1,644	17,505	kWh
Fuel	50%	$468	63,011	MJ
		$2,112		

Energy Use: Fuel



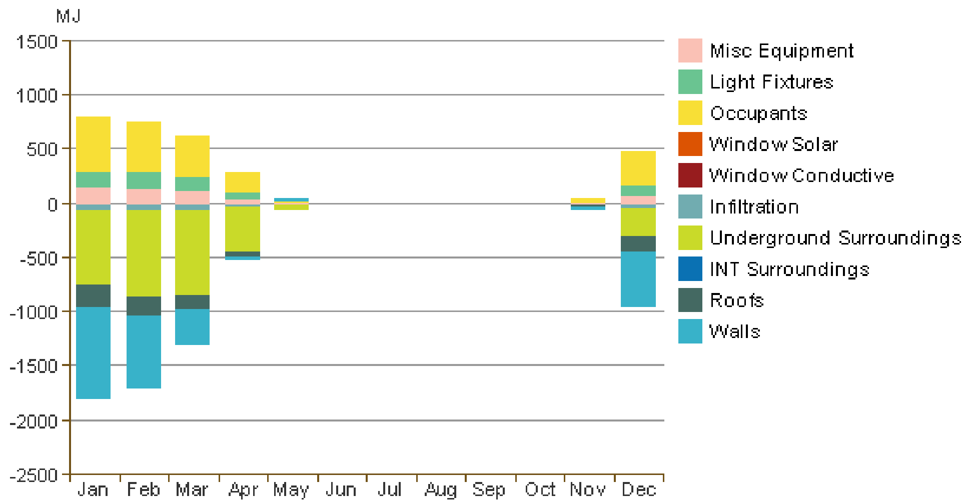
			(MJ)
HVAC	39%	$182	24,622
Domestic Hot Water	61%	$285	38,389
		$467	63,011

Energy Use: Electricity

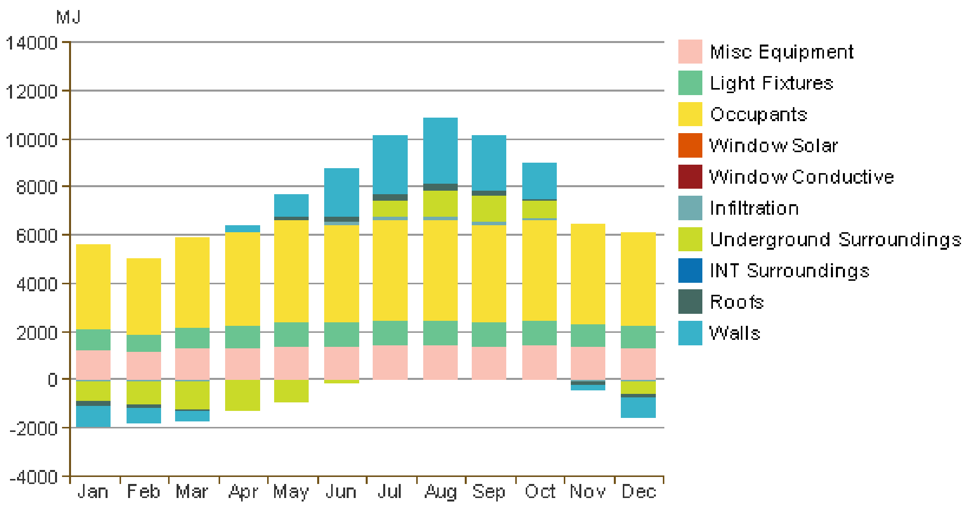


			(kWh)
HVAC	49%	$797	8,496
Lighting	22%	$370	3,941
Misc Equipment	29%	$475	5,067
		$1,642	17,504

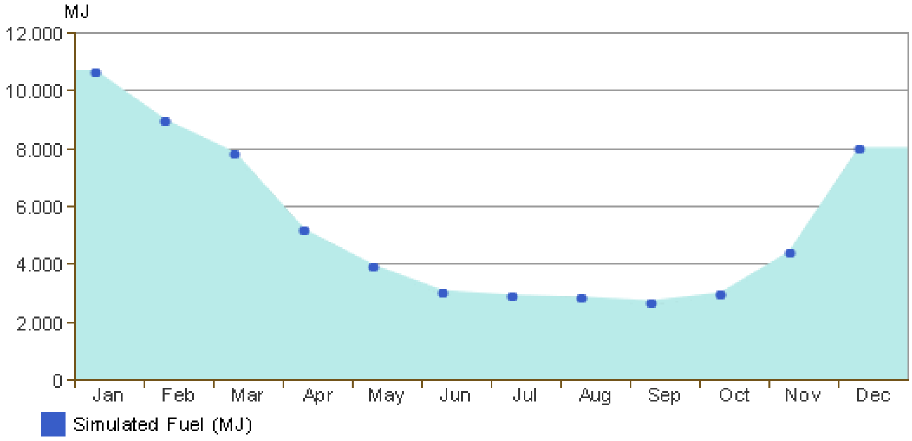
Monthly Heating Load



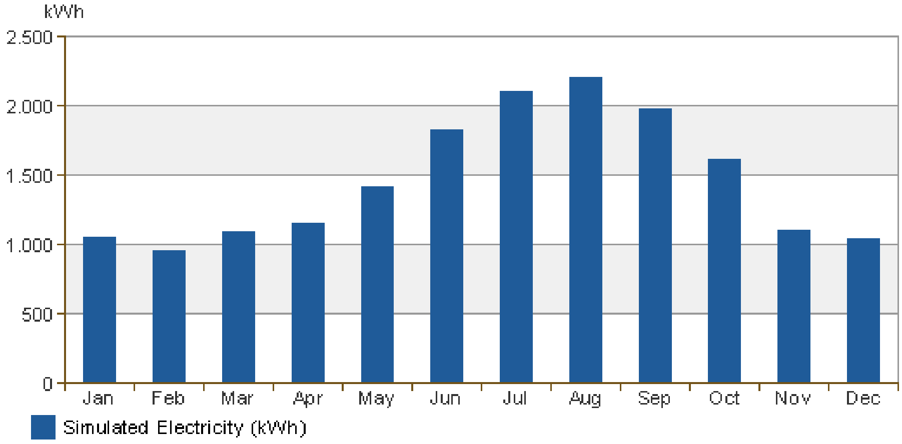
Monthly Cooling Load



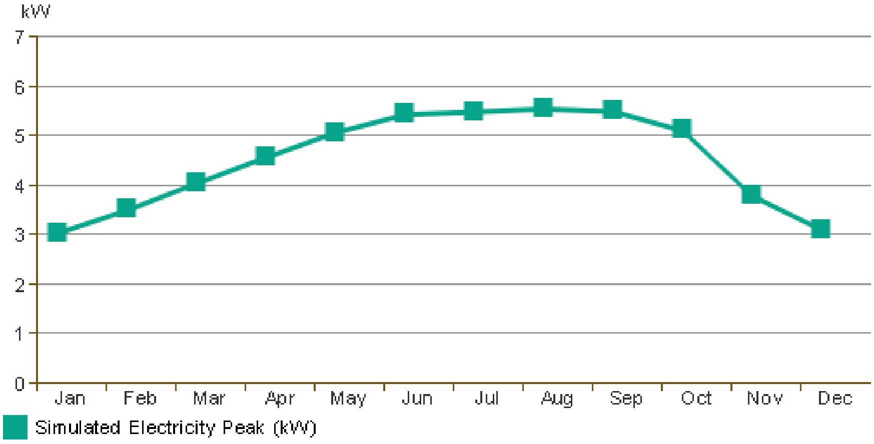
Monthly Fuel Consumption



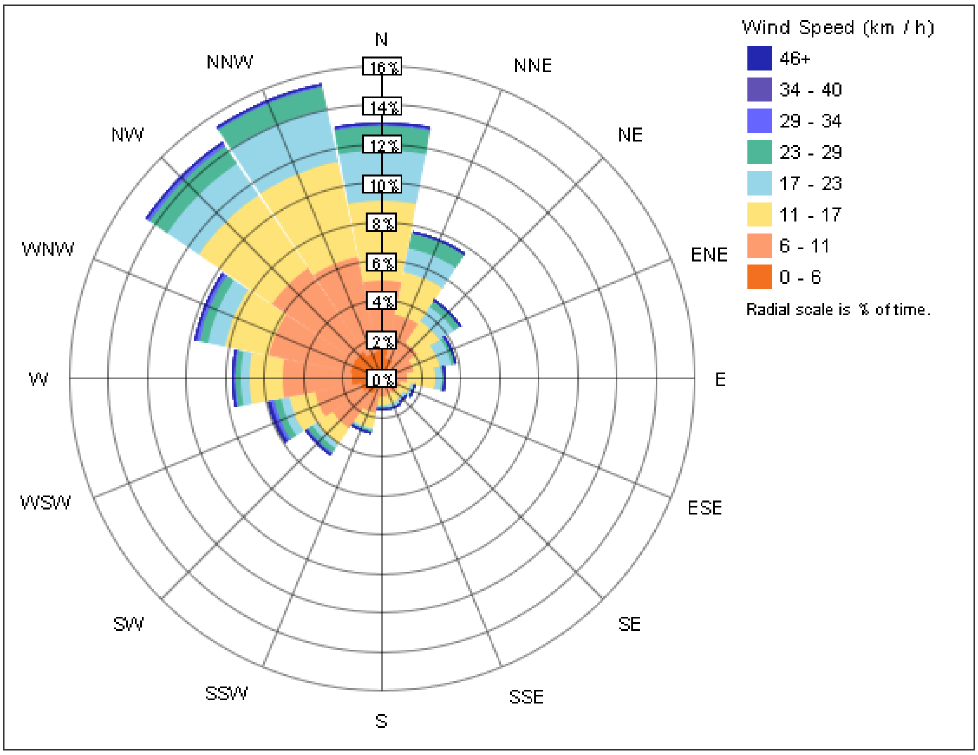
Monthly Electricity Consumption



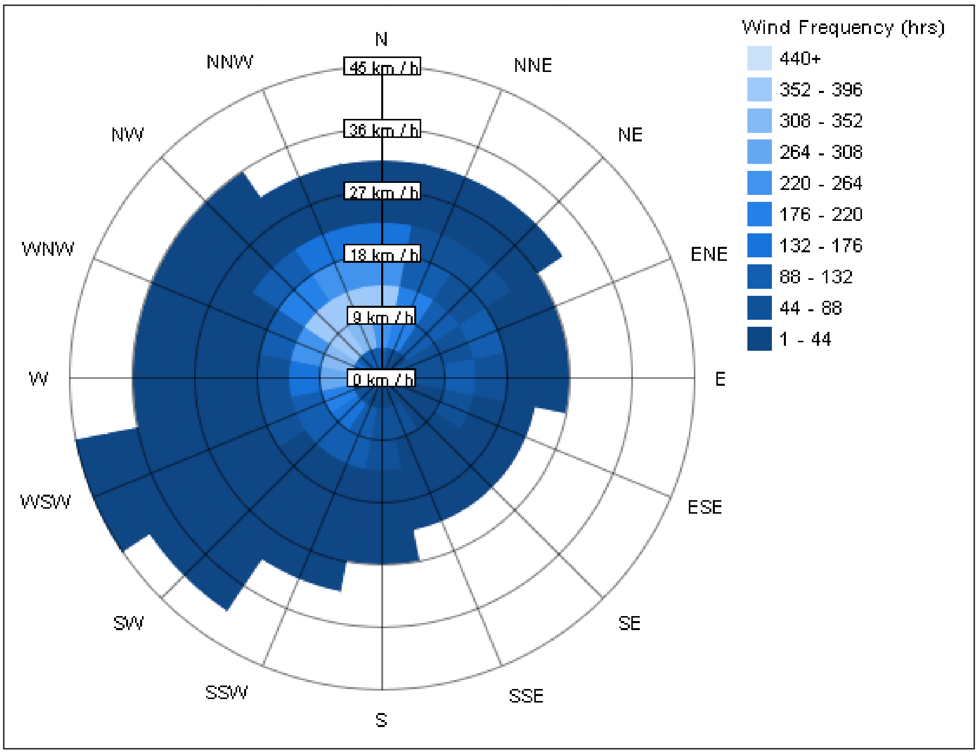
Monthly Peak Demand



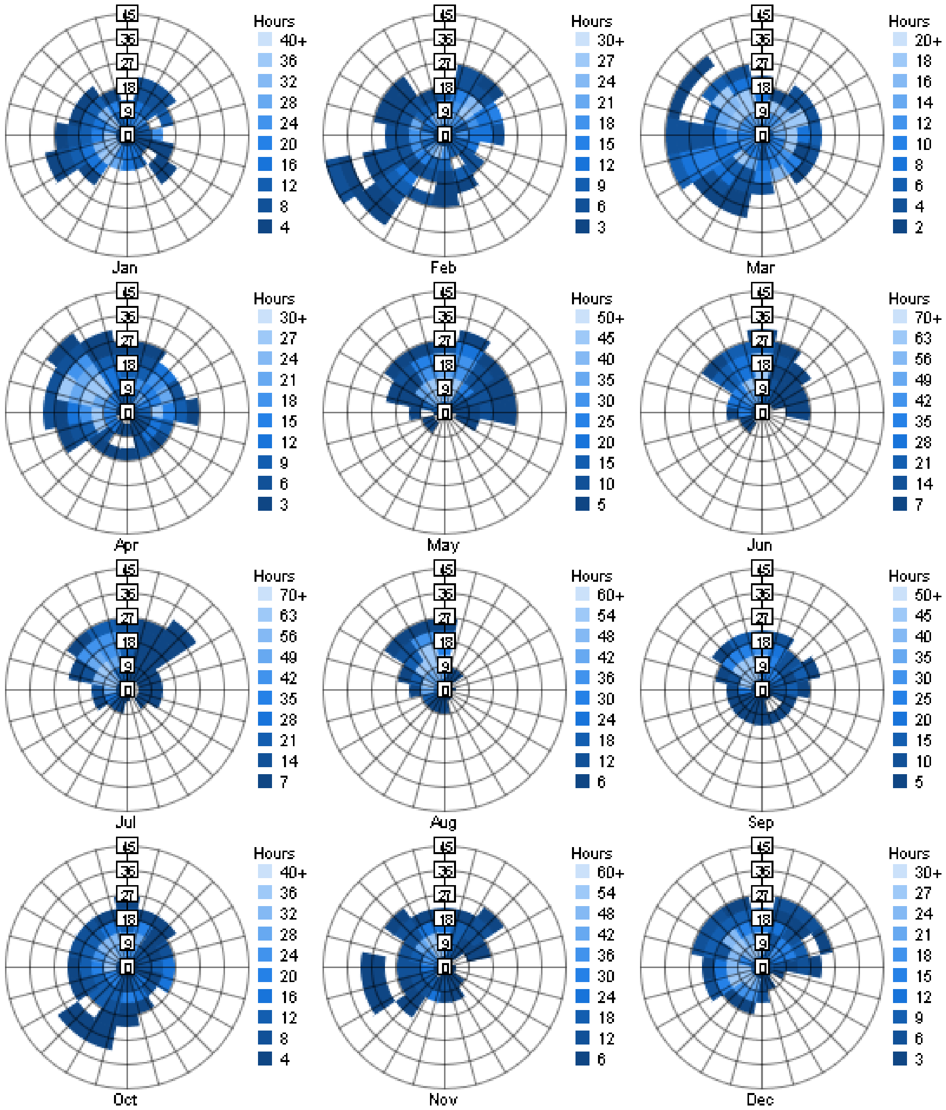
Annual Wind Rose (Speed Distribution)



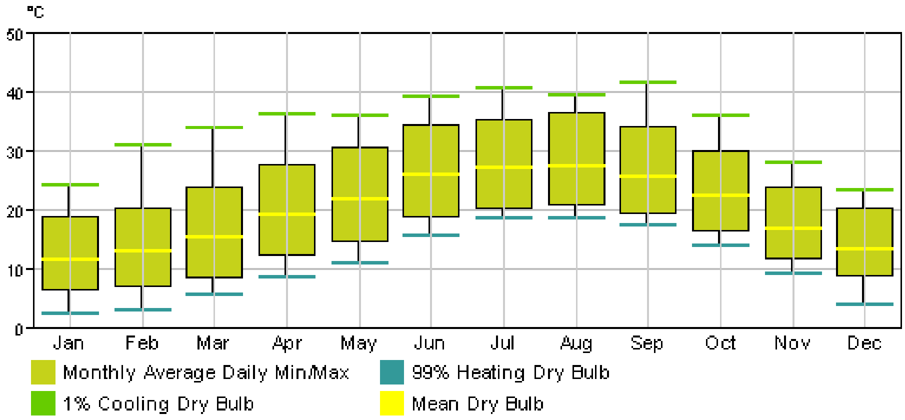
Annual Wind Rose (Frequency Distribution)



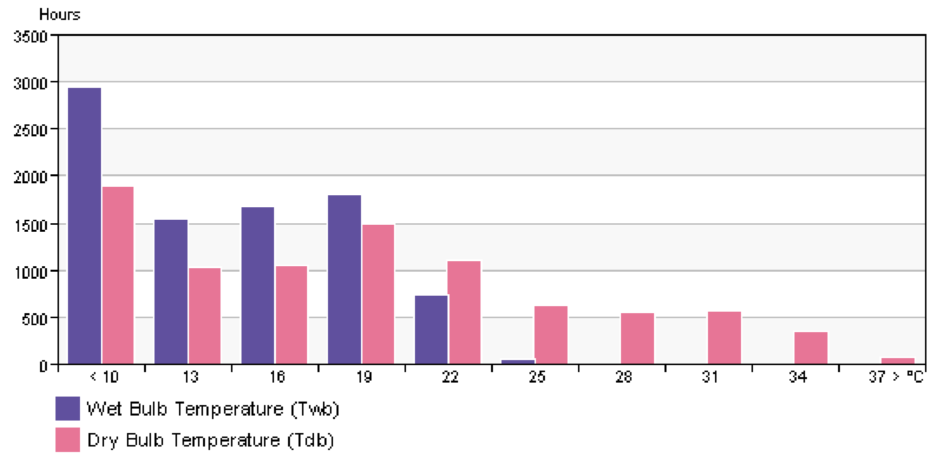
Monthly Wind Roses



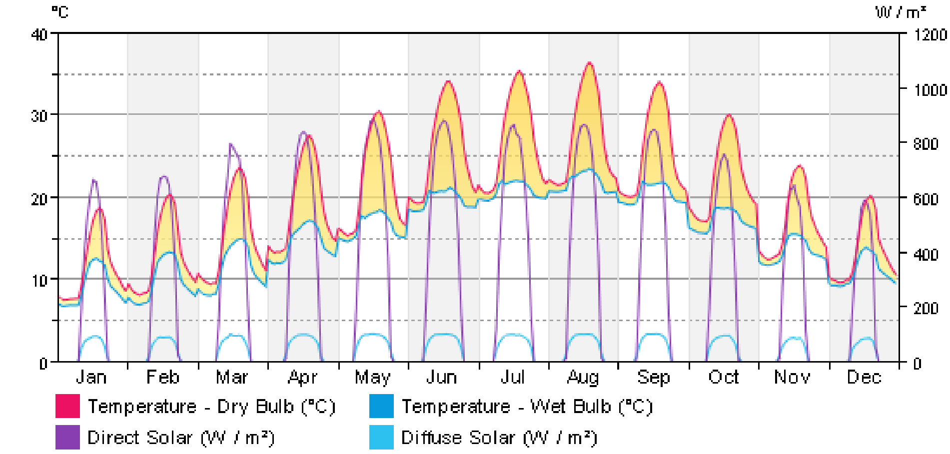
Monthly Design Data



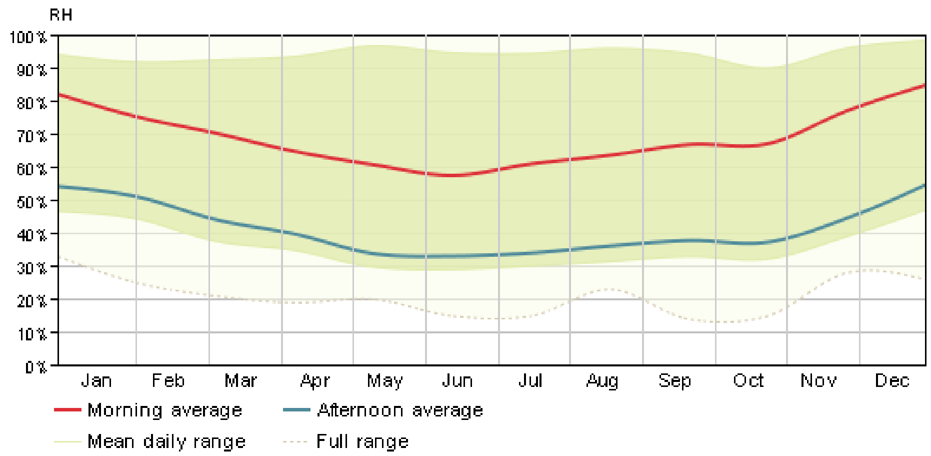
Annual Temperature Bins



Diurnal Weather Averages



Humidity



Energy Analysis Data

تجارب في مجال تحويل المباني التراثية لخضراء و دراسة كيفية إجراء تعديلات على المبنى التراثي لتحقيق الكفاءة في استهلاك الطاقة وتحقيق كافة المبادئ الأخرى للعمارة الخضراء دون التأثير سلبا على قيمه المختلفة في الباب الرابع، وتحليل معايير تقييم المباني القائمة الخضراء التي تم استخدامها في تقييم مباني تراثية عالميا لاستخلاص معايير تصلح للتطبيق على المباني التراثية في مصر للوصول لكود اخضر يصلح للتطبيق على المباني التراثية الخضراء في مصر في الباب الخامس. وتطبيق ذلك على احد المباني التراثية في مصر في الباب السادس.

مرحلة البحث النظري :-

الباب الأول : المباني التراثية في مصر

استعراض مفهوم التراث الثقافي والمباني التراثية ومعايير تسجيل المباني التراثية في مصر وبريطانيا والولايات المتحدة وكذلك استعراض استراتجيات التعامل مع المباني التراثية والأثر في مصر.

الباب الثاني : مفهوم المباني الخضراء وأنظمة تقييمها.

ويتم استعراض أسباب أزمة الطاقة على المستوى العالمي وعلى مستوى مصر ، مفهوم العمارة الخضراء ، التقنيات والنظم الحديثة البيئية للعمارة الخضراء، ، استعراض نبذة مختصرة عن انظمة تقييم المباني الخضراء الأكثر انتشارا حول العالم.

الباب الثالث: أنظمة تقييم المباني الخضراء والمباني التراثية الخضراء.

ويتم استعراض الانظمة التي تقوم بتقييم المباني التراثية الخضراء.

مرحلة الدراسات التحليلية :-

الباب الرابع: المباني التراثية الخضراء " دراسات تحليلية"

ويقوم البحث باستعراض أربعة نماذج لمبان تراثية سكنية وغير سكنية تم اعتمادها كمبان خضراء تحت مظلة أنظمة تقييم عالمية مختلفة ومن ثم يقوم البحث بإجراء دراسة تحليلية مقارنة بين الأربع نماذج للوصول لنتائج وتوصيات تصلح للتطبيق في الأبواب القادمة.

الباب الخامس: تحليل الأنظمة الدولية التي قامت بتقييم مباني تراثية للوصول لنظام تقييم للمباني التراثية الخضراء في مصر. ويتبنى البحث المنهج النوعي في تحليل معايير الأنظمة التي قامت بتقييم مباني تراثية للوصول لنظام تقييم يصلح لتقييم المباني الخضراء التراثية في مصر.

الدراسة التطبيقية :

الباب السادس: قصر الشناوي كمبنى تراثي اخضر.

ويتم وضع إستراتيجية تهدف لتحويل قصر الشناوي "مسجل كأثر إسلامي" إلى مبنى تراثي اخضر ، ومن ثم يتم تقييمه من خلال نظام تقييم المباني التراثية الخضراء الذي تم استنتاجه من الباب السابق.

نتائج وتوصيات

المشكلة البحثية :

تعاني مصر منذ ثورة يناير ٢٠١١، من ازمات عديدة في مجال الطاقة، والمياه ، وخلل في ميزان المدفوعات نتيجة الزيادة المضطردة في الاستيراد وتناقص الصادرات، مما يستلزم من الحكومة التوجه نحو تتبني المبادئ الخضراء في المباني الجديدة وفي مشاريع تطوير المباني القائمة، مما يؤدي لتقليل استهلاك الوقود، والمياه، واستهلاك المواد الخام والمواد التي يتم استيرادها من الخارج.

لا تشمل سياسات مشاريع الحفاظ على المباني التراثية في مصر على أية استراتجيات لتحسين كفاءة تشغيل المبنى واستهلاكه للطاقة والمياه وكذلك إدارة استهلاك المواد وإدارة النفايات الناتجة أثناء مشاريع الحفاظ وأثناء فترات التشغيل.

- أهداف البحث :-

والهدف الرئيسي لهذا البحث هو :

الهدف الرئيسي للبحث :

- **الوصول لأداة لتقييم المباني التراثية الخضراء في مصر تحتوي على معايير تقيس مدى موائمة المبنى التراثي للنظام البيئي أثناء إجراء أعمال الحفاظ وأثناء فترات التشغيل من خلال دمج مبادئ العمارة الخضراء في سياسات الحفاظ وتنمية المباني التراثية ، بمعنى تحقيق استدامة شاملة للمبنى التراثي تهدف للحفاظ عليه وتضمن بقائه لكي يلبي احتياجات الأجيال الحالية والمستقبلية مع تطبيق مبادئ العمارة الخضراء دون التأثير بالسلب على القيم الذي بحتويها المبنى التراثي.**

كذلك فإن للبحث أهدافا ثانويا :

١. إلقاء الضوء على مفهوم المباني التراثية الخضراء .
٢. تحسين كفاءة تشغيل المباني التراثية .
٣. تطوير سياسات حصر المباني التراثية في مصر وآليات التعامل معها من خلال دراسة سياسات تسجيل المباني التراثية في كل من الولايات المتحدة الأمريكية وبريطانيا.

الفروض البحثية:-

- الممارسات الخضراء لتحسين كفاءة تشغيل المباني القائمة، تصلح للتطبيق في المباني التراثية إذا روعي الحفاظ على قيم المبنى التراثي .

منهج البحث:-

اتبع البحث المنهج النظري الوصفي التحليلي المقارن ، من أجل تحقيق أهداف الدراسة، أعتمد البحث بصفة أساسية على منهج استقراء الدراسات النظرية السابقة من خلال دراسة مفهوم المباني التراثية المسجلة واستعراض معايير تسجيلها في كل من الولايات المتحدة وبريطانيا ومصر في الباب الأول، أما الباب الثاني فيستعرض الأزمات التي تواجه مصر حاليا، ومفهوم المباني الخضراء ومعاييرها، استعراض الأنظمة التي قامت بتقييم مباني تراثية عالميا في الباب الثالث، تحليل

اسم البحث: **نحو مباني تراثية خضراء في مصر**

مقدمة بحثية :

تزخر مصر بكم هائل من المباني التراثية ذات القيمة المتميزة، وتعاني اغلب هذه المباني من تدهور وإهمال وسوء استثمار وإهمال للصيانة، واغلب النماذج التي يتم إجراء أعمال حفاظ لها، لا تراعي اتخاذ التدابير اللازمة لكي يكون المبنى التراثي أكثر موائمة للبيئة " سواء خلال أعمال الترميم والتشغيل" مما يؤدي لقصور وفشل في تحقيق المعنى الشمولي للحفاظ عليه ومن ثم استداماته.

منذ السبعينيات من القرن العشرين، واجه العالم أزمات عديدة في مجال الطاقة، مما كان له الأثر في تركيز الدراسات البحثية عن كيفية تخفيض كمية الطاقة التي يتم استهلاكها. ففي الولايات المتحدة الأمريكية، يستهلك قطاع المباني ٧٢% من إجمالي الكهرباء المستهلكة، و ٣٩% من كمية الطاقة المستخدمة، ٤٠% من المواد الخام، وينتج قطاع المباني أيضا ٣٠% من إجمالي النفايات والمخلفات، و ٣٨% من انبعاثات ثاني أكسيد الكربون.[١]

ولذلك ظهر مفهوم العمارة الخضراء بقوة على الساحة العالمية خلال العقدين الماضيين، حيث ان معايير تصميم وبناء المباني الخضراء تسعى للحد من الكثير من التأثيرات السلبية على مستخدمي المبنى والبيئة.

ويتم تطبيق المعايير الخضراء في المباني المنشأة حديثا في مرحلة التصميم، ومرحلة البناء، ومرحلة ما بعد البناء أثناء فترات التشغيل. كما يتم تطبيقها في المباني القائمة من خلال إجراء بعد التعديلات على المباني لتصبح مبانٍ خضراء.

معظم المباني التراثية المعتمدة كمبان خضراء في جميع انحاء العالم تم تقييمها من خلال أدوات تقييم خاصة بتقييم المباني القائمة الخضراء، وبعض منها قام بوضع بعض المعايير التي يشترط استيفائها في حالة تقييم مباني تراثية مثل " **BREEAM Domestic Refurbishment scheme**" و " **BREEAM ٢٠١٤ Refurbishment and fit-out scheme** " والبعض الآخر لا يتضمن أي معايير أو محددات في حالة استخدامه في تقييم مباني تراثية مثل **LEED O+M**، مما قد يؤدي الى فقد القيم التراثية التي تتميز بها تلك المباني اثناء عملية تحويلها لمبان خضراء، ويتعتبر مبنى Ecotrust في مدينة اريجون في الولايات المتحدة الأمريكية احد النماذج لمباني تراثية خضراء تم رفض تسجيلها في قائمة التراث المحلي نظرا لأنها فقدت بعض القيم المميزة لها اثناء عملية تحويل المبنى التراثي لمبنى اخضر.

[١] Green Building Education Services(٢٠٠٩)," **LEED Principles and Green Associate- Study Guide**", Third Edition, ", Lewisville, USA, page ١٢.

الملخص العربي:

نحو مباني تراثية خضراء في مصر

ملخص البحث :

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قسم الهندسة المعمارية

كلية الهندسة

ملخص الرسالة (   ) بالمكتبة   الادارة العامة للمكتبة

الكلية	الهندسة	القسم	الهندسة المعمارية	رقم :
الاسم	**مهند علي محمد فوده**	الدرجة العلمية	الدكتوراه	التاريخ:
اسم الرسالة	**نحو مباني تراثية خضراء في مصر**			

الملخص:

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عناوين الموضوع:المباني التراثية الخضراء – قصر الشناوي – المنصورة – المباني ذات القيمة المميزة- المباني الخضراء – انظمة تقييم المباني الخضراء

الإهـــداء

إلى من الهمني أسمى معاني الجلد والصبر والمثابرة في طلب الحق ...إلى أبي حفظه الله

إلى من علمتني الحب والعاطفة والرأفة بخلق الله ..إلى من تحتويني دوماً بحنانها ...إلى أمي حفظها الله

الى من كان يناديني بالدكتور المهندس وانا ذو ستة عشر عاما لا ارى من مستقبلي شيئا ..

ها انا ياجدي قد حققت ما كنت تصبو اليه .. إلى روح جدى الحبيب عبد السلام جمعة

إلى من تتذكرني دوماً في دعائها وتغمرني دوماً بحنانها ...جدتي رجاء حفظها الله

إلى أخوتي التوأم الاعزاء مهاب ومحمد

الى استاذتي العظيمة التي منحتني قوة لم اصدُق اني كنت املكها ودعمتني بلا نهاية و بلا حدود ..

الى أ.د.لميس الجيزاوي

إلى أصدقائي وأحبائي الاقرباء مني والبعيدين عن عيني .. والى حبيبتي التي ستشاركني حياتي المستقبلية..

الى مناضلوا التراث في شتى بقاع المحروسة.. و الى محمد بك الشناوي صاحب القصر الذي انشأه في المنصورة لنضاهي به الأمم فخربناه ..ليتك تعلم اني قد حاربت من اجل قضية قصرك طويلا ومازلت ..وحتى يحين انجاز ما وعدت على ارض الواقع، صنعت رسالتي تلك ..

الى شهداء الوطن الذي استشهدوا فداءا لنا، فماتوا هم لنحيا نحن ..

والى الوطن العزيز ذاته "مصر" ... ليتك تعلمين كم احبك ..

إلى كل هؤلاء اهديكم محبتي وجهدي المتواضع .

الباحث

مهند فوده في يونيو ٢٠١٦

اهداء خاص ..

الى اولادي الذين لا اعرف اسمائهم بعد ..

والى احفادي الذين سيأتون الى وطن نسى ان يدخر لهم موارد يحيون منها وقد استنفذ معظم تراثه وتاريخه .. من اجلكم انتم ولاجيال من بعدكم، انجزت رسالتي تلك..،

الشـكر والتقدير

الحمد لله عز وجل على عظيم نعمته وفضله على أن أعانني ووفقني ويسر لي إتمام هذا البحث ، أسأله سبحانه وتعالى أن يجعل هذا العمل في ميزان حسناتي وأن تجد فيه أمتي ووطني ومدينتي ما ينفعها ويصلح حالها.

أتقدم بخالص الشكر والعرفان والامتنان إلى الأساتذة المشرفين:

أ.د/لميس سعد الجيزاوي أستاذ ورئيس قسم العمارة–كلية الهندسة– جامعة المنصورة

أ.د/ محمد محمد العزب استاذ العمارة

أ.د.م. ابراهيم رزق حجازي الاستاذ المساعد بقسم الهندسة المعمارية–جامعة المنصورة

لما بذلاه من كل جهد وعون لي لإنجاز هذا البحث.

كما أتقدم بأسمى آيات الشكر والتقدير إلى أعضاء لجنة المناقشة الأفاضل

الى أ.د. ايهاب فاروق راشد استاذ العمارة باكاديمية الشروق – القاهرة

أ.د.م. شريف أحمد شتا الأستاذ المساعد بقسم الهندسة المعمارية –جامعة المنصورة

واشكر كل من عاونني على إنجاز هذا العمل من الأساتذة الأفاضل و الزملاء

م. محمد السعيد (هندسة ميكانيكية) **م.هدى ابراهيم انور**

د. محمد حسين طمان (مدير الاثار الاسلامية والقبطية بالدقهلية)

د. محمد شوقي ابو ليلة **د/ منى عوض الوزير** **م/أسماء حسن** **م/ محمود رمضان**

اقرار

يقر الباحث/ **مهند علي محمد فوده**بالالتزام بقوانين جامعة المنصورة وانظمتها وتعليماتها و قراراتها السارية المفعول المتعلقة باعداد رسائل الدكتوراه عندما قمت باعداد الرسالة العلمية تحت عنوان/

نحو مباني تراثية خضراء في مصر

تحت اشراف:-

أ.د لميس سعد الجيزاوي
أ.د. محمد محمد طه العزب
أ.م.دابراهيم رزق حجازي

كأحد المتطلبات لنيل درجة الدكتوراه في الهندسة تخصص الهندسة المعمارية و الاقرار بحداثة موضوع الرسالة البحثية و أنه لم يسبق تناول الموضوع و العناوين البحثية بصورته النهائية الكاملة أو نشرة في أي رسائل أو أطاريح أو كتب أو أبحاث أو أي منشورات علمية و ذلك بما ينسجم مع الامانة العلمية المتعارف عليها في كتابة الرسائل و الأطاريح العلمية وقبول عدد (١) بحث للنشر بعنوان/

تحسين كفاءة استهلاك الطاقة في المساكن التراثية الخضراء

في مجلة علمية متخصصة و هي مجلة كليه الهندسة جامعة المنصورة و أن البحث المذكور مستخرج من الرسالة المذكورة بعالية وأن أسماء جميع السادة المشرفين موجودة علي البحث.

وهذا اقرار مني بذلك ...

المقر

م. **مهند علي محمد فوده**

المشرفون

عنوان الرسالة:Towards Green Heritage Buildings in Egypt

نحو مباني تراثية خضراء في مصر

اسم الباحث:مهند علي محمد فوده

الدرجة العلمية المطلوب الحصول عليها:دكتوراه الفلسفة في الهندسة (الهندسة المعمارية)

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جامعة المنصورة
كلية الهندسة
قسم الهندسة المعمارية

نحو مباني تراثية خضراء في مصر

Towards Green Heritage Buildings in Egypt

بحث مقدم إلى

قسم الهندسة المعمارية

كجزء من المتطلبات للحصول غلى

درجة دكتوراة الفلسفة في الهندسة المعمارية

الباحث

مهند علي محمد فوده

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