PRINCIPLES IN GREEN ARCHITECTURE:
AN INQUIRY INTO THE EVALUATION CRITERIA OF GREEN AWARDS

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SEVDA HASSAN NAZHAD DAMATI

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submitted by **SEVDA HASSAN NAZHAD DAMATI** in partial fulfillment of the requirements for the degree of **Master of Architecture in Architecture Department, Middle East Technical University** by,

Prof. Dr. Canan Özgen _____
Dean, Graduate School of **Natural and Applied Sciences**

Prof. Dr. Güven Arif Sargın _____
Head of Department, **Architecture**

Prof. Dr. Cânâ Bilsel _____
Supervisor, **Architecture Dept., METU**

Examining Committee Members:

Assoc. Prof. Dr. Ali Murat TANYER _____
Architecture Dept., METU

Prof. Dr. Cânâ Bilsel _____
Architecture Dept., METU

Assoc. Prof. Ayşe TAVUKÇUOĞLU _____
Architecture Dept., METU

Assoc. Prof. Dr. Zeynep ULUDAĞ _____
Architecture Dept., Gazi University

Dr. Nergis KURAL _____
METU-Independent Architect

Date: 01.03.2013

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last Name: SEVDA HASSAN NAZHAD DAMATI

Signature

ABSTRACT

PRINCIPLES IN GREEN ARCHITECTURE: AN INQUIRY INTO THE EVALUATION CRITERIA OF GREEN AWARDS

Hassan Nazhad Damati, Sevda

M.Arch, Department of Architecture

Supervisor: Prof. Dr. Cânâ Bisel

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The present thesis focuses on "green awards" in architecture. It aims at searching out the principles of "green architecture" through a comparative analysis of leading awards in this domain. In order to represent the essence of the green movement in general, the process which it passed through the decades in response to the existing impacts of human activities on the environment is first reviewed. The concepts of green, ecological and sustainable architecture are discussed in this context. Then the international award programs established to promote environmentally appropriate practices in architectural design and construction are studied. Four awards selected among others are analyzed in detail with a special focus on the evaluation criteria. The criteria are compared with each other with the objective to find out recurrent parameters of green architecture in different awards, and a set of criteria is obtained from the comparative analysis of the awards. In the fourth chapter, case studies selected among the nominated projects in the awards are analyzed in detailed by using the evaluation criteria obtained. As a result of this study on the green awards and selected projects of best practice, the principles which define a green building or project are discussed in the conclusion.

Key Words:

"Green movement", "green architecture", "ecological architecture", "sustainable architecture", "green awards", "green principles"

ÖZ

YEŞİL MİMARLIK İLKELERİ:
YEŞİL ÖDÜLLERİN DEĞERLENDİRME ÖLÇÜTLERİ ÜZERİNE BİR ARAŞTIRMA

Hassan Nazhad Damati, Sevda

Yüksek Lisans, Mimarlık Bölümü

Tez yöneticisi: Prof. Dr. Cânâ Bisel

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Yeşil Mimarlık ödüllerine odaklanan bu tezde, bu ödüllerin değerlendirme ölçütleri üzerinde bir kıyaslamalı analiz çalışması yapılarak bu ödüllerle tanımlanan "yeşil mimarlık" ilkelerinin açıklığa kavuşturulması amaçlanmaktadır. İlk bölümde, yeşil hareketin özünü anlamak üzere, insan etkinliklerinin çevre üzerindeki yıkıcı etkilerine karşı bir tepki olarak ortaya çıkan bu hareketin onyıllar boyunca gelişimi genel olarak incelenmekte, "yeşil mimarlık", "ekolojik mimarlık" ve "sürdürülebilir mimarlık" kavramları bu bağlamda tartışılarak tanımlanmaktadır. Ardından çevreye duyarlı mimari tasarım ve yapı uygulamalarını teşvik etmek üzere oluşturulmuş olan yeşil mimarlık ödülleri ve bunların arasından seçilen dört ödül programı ve bu ödüllerin değerlendirme ölçütleri ayrıntılı olarak incelenmektedir. Bu ölçütler üzerinde yapılan kıyaslamalı analiz sonucunda, farklı ödüllerde tekrarlanan parametreler elde edilmiştir. Kıyaslamalı analiz çalışması sonucunda yeni bir ölçüt dizgesi elde edilmiştir. Dördüncü bölümde ise, dört yeşil mimarlık ödülünü temsilen seçilen dört en iyi mimari tasarım ve uygulama projesi bu ölçütler kullanılarak analiz edilmiştir. Sonuç bölümünde, yeşil mimarlık ödülleri ve projeler üzerinden yeşil mimarlık ilkeleri tartışılmaktadır.

Anahtar Kelimeler:

"Yeşil hareket", "yeşil mimarlık", "yeşil ödüller", "yeşil mimarlık ilkeleri", "yeşil tasarım"

To My Dear Husband

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CHAPTER 1

INTRODUCTION

1.1 Definition of the problem

To live in harmony with nature and also protect the environment, natural resources and ecosystems have become vital for the human kind since the value of these natural assets and non-renewability of the resources were understood. Social movements focused on both ecology and human health and rights have been on the agenda.

With the beginning of the Industrial Revolution in the mid-eighteenth century mainly in Britain, technological changes appeared. New materials such as iron and steel and new energy sources such as coal and steam engine, petroleum and electricity started to be used. New machines were invented and factory system and manufacturing became organized. The new technological changes increased the exploitation of natural resources and also manufactured materials.[1]

The emergence of factories in and around cities, resulted in the increase of their population and sizes, the over-exploitation of natural resources, increase in air, water and soil pollution (and declination of air, water and soil quality) and also increase in waste volume (industrial chemical discharges) in the industrialized areas and urban spaces. Consequently, the need for protecting the nature and increasing the life quality became an urgent issue. Environmentalist movements emerged in the post World War II period and have intensified their activities at the turn of the millennium.

Some naturalists such as John Muir and Henry David Thoreau contributed philosophically to the movement in the late eighteenth century which was called conservationism until the 1950s in the United States of America. Thoreau focused on the man-nature relationship and Muir believed in an "inherent right of nature." These philosophies as well as the conservationist principles formed the fundamentals of the Environmentalism in the US.

Beginning in the early 1900s, and especially after the World War II (1939-1945) and globalization following the increasingly cheap post war fuels, first wave of passive solar energy ended and air and water and land pollution was widely spread.[2] Utilization of new industrial processes resulted in serious impacts in the surrounding environment; much greater was the influence of the new modern life. Over population and emergence of new cities and related services increased the need for resources and the natural resources were under increasing pressure. It was the time that wider public awareness and attempts emerged and the attention was drawn to the existing threats to the environment and human well being. The human kind has been looking for the solutions and also decreasing the environmental impacts since then.

A direct responsibility in the emergence of the new urban environment is by architecture, as an essential former of the human life and its environment. But a new way of thinking and designing is needed far away from the old ones. A tendency and push toward a new paradigm

[1] Encyclopedia Britannica Academic Edition, "Industrial Revolution", http://www.britannica.com/EBchecked/topic/287086/Industrial-Revolution (accessed: March 15, 2012)

[2] Colin Porteous, *The New Eco-Architecture, Alternatives from the Modern Movement*, (London: Spon Press, 2002), p121

shift is observed. There has also been a paradigm shift in architecture that has been summed up and popularized by the term "green architecture," although other terms "environmentally friendly architecture" and "sustainable architecture" have also been employed with slight differences in parallel with different approaches in green movement.[3]

Once green movements and their discourses found increasing support from the societies, different governments and institutions supported the new paradigm shift and this was implemented differently. In some cases, it was transformed into a political issue and a base for political decisions. Several meetings were held and many parties and institutions became established. Their aim was to increase awareness towards environment and define the new conceptual framework. In parallel with the societal requirements, a number of institutions of architecture and construction sector started different certification and award programs in order to promote best practices in architecture.

The present thesis, which focuses on the green awards in architecture, studies the parameters and evaluation criteria set by the leading awards in this domain. The thesis study aims to find out whether these parameters and criteria overlap with each other, defining the fundamental principles of "green architecture."

Many concepts and expressions have been used in the development of the movement which may be used interchangeably as in the case of "ecological", "sustainable" and "green" concepts especially in the architecture discipline. Although their meanings are different, they represent the development of the green movement in the discipline through the decades.

1.1.1 Ecological design

The living organisms have a vital relationship with each other and also with their natural environment. The scientific study of these relations is called "ecology" which has a Greek origin as *οἶκος* meaning "house" and *-λογία* meaning "study of". Data on composition, distribution, changing states, amount and number of organisms in ecosystems are the interests of ecologists.[4]

The German scientist Ernst Haeckel used the term "ecology" as *Ökologie* from Greek *Oikos* for the first time in 1866 and defined it as "the comprehensive science of the relationship of the organism to the environment", although Greek philosophers in ancient times had notes on this concept. The term was introduced into English in 1873.[5]

Ecological studies are seeking explanations for life processes, distribution of organisms, natural resources and energy movement in living communities and also successful development of ecosystems. Therefore, ecology is an interdisciplinary science.

In the late centuries along with the rapid growth in the human population on the earth and the change in economic conditions in result; the decrease in the amount of non-renewable resources; large amounts of damage caused to ecosystems, global warming[6], soil erosion, and also acid rains[7], the planet became forced to experience an "environmental crisis" as called by the proponents of the environmental movement, and as the result of developing cities and industrialization. The aim of this movement has been basically to face with this crisis, and

[3] Osman Attmann, *Green Architecture: Advanced Technologies and materials*, (New York: Mc Graw Hill, 2010), p23
[4] Wikipedia, "Ecology", http://en.wikipedia.org/wiki/Ecology (accessed: July 07, 2012)
[5] Attmann, op.cit., p32
[6] It is the rise in the average temperature of earth's atmosphere which is caused by increasing greenhouse gases produced by human activities such as burning fossil fuels and deforestation.
[7] It is invented by English chemist Robert Agnus for the first time in 1852, called acid disposition by scientists. It is caused by airborne acidic pollutant which has destructive results.

consequently most of the disciplines became involved and forced to search for ways of reversing the situation.[8]

Architecture which is one of the disciplines responsible from the production of the human built environment plays an essential role in the face of the environmental crisis. The age of ecology followed the industrial and technological era, due to a new paradigm shift in architecture at the turn of the 21st century. An environmental awareness focusing on the relationship between the human kinds, the natural and man-made environments appeared in the face of the ecological destructions.

As stated in *Green Architecture* by James Wines:

> [T]he science of ecology has provided a radically expanded view of the natural environment, insights into its working processes that never existed before, and the inspirational foundation for a new architectural iconography.[9]

He also believes that "even the most advanced advocates of ecological design are still struggling with ways to integrate environmental technology, resource conservation, and aesthetic content."[10]

In *Ecological Design* by Sim Van der Ryn and Stuart Cowan, design is defined as:

> [T]he intentional shaping of matter, energy, and process to meet a perceived need or desire. Design is a hinge that inevitably connects culture and nature through exchanges of materials, flows of energy, and choices of land use.

They believe that the environmental crisis and design crisis are equal, and the manner of designing, and constructing buildings, landscaping is also responsible of the environmental crisis.[11]

A clear and obvious response to the environmental crisis finds its expression in the introduction of ecological concerns into design concepts instead of what is called "dump design" which has the insufficient in considering not only the health of human communities but also ecosystems.[12]"Ecological design" or eco-design" has beenone of the approaches. As a deduction of the thoughts of Fuller (1975), Olkowski et al. (1979); Todd and Todd (1994); Scott (1999), stated in "Principles and Practice of Ecological Design":

> Eco-design provides a framework for uniting conventional perspectives on design and management with environmental ones, by incorporating the consideration of ecological concerns at relevant spatial and temporal scales. If the principles of eco-design are rigorously applied, important progress will be made towards ecologically sustainable economic development.[13]

Ecological design is defined by Sim Van der Ryn and Stuart Cowan as "any form of design that minimizes environmentally destructive impacts by integrating itself with living

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[8] Fan Shu-Yang, Bill Freedman, and Raymond Cote, "Principles and Practice of Ecological Design", *Environmental Reviews*, June 2004, Vol.12, p98, http://ehis.ebscohost.com/eds/pdfviewer/pdfviewer?sid=a23fa3f7-a21c-48b9-aadb-0925416cc3ce%40sessionmgr13&vid=2&hid=115 (accessed: July 07, 2012)

[9] James Wines, *Green Architecture*, (Köln:Taschen, 2008), p38

[10] ibid., p20

[11] Sim Van der Ryn and Stuart Cowan, *Ecological Design*, (Washington: Island Press, 1996), p24

[12] ibid, p26

[13] Shu-Yang, op.cit., p99

processes."[14] And also it is defined as "way of integrating human purpose with nature's own flows, cycles, and patterns."[15]

And in "Principles and Practice of Ecological Design", it is mentioned that:

> [E]co-design seeks to provide a framework for an environmentally appropriate system of design and management by incorporating both anthropogenic and ecological values, at relevant spatial and temporal scales.[16]

The start point of every building and construction as a change and interference is not the destruction of something but the creation of the better and new one. Although building process is not an ecological one, the ecological aspects should be taken into account by the architect, as Herzog believes.[17]

Several parts of a design with their different characteristics determine the coherence of the whole. Not in a specific architectural style and just in order to reach specific aims, "respecting species diversity", "minimizing resource depletion", "preserving nutrient and water cycle", "maintaining habitat quality" and "health of human and ecosystem" are at the point of attention.[18]

There are five principles for ecological design extracted from a detailed critical analysis on several examples specified in Sim Van der Ryn's and Stuart Cowan's book *Ecological Design*. The physical and cultural characteristics of a place which is not considered in most design processes form the first principle as "Solution Grow from Place". Most of the time, human, material and ecological character of a place are the context of design and its process.

"Ecological Accounting Informs Design", is the second principle, which plays an essential role in construction and architecture -as in LEED, the rating system of USGBC, which financial metrics having equal role as site, energy, water, material and indoor air quality (social and environmental factors). The measurements and models for the human built environment, technologies applied and also social institutions are systems integrated with the nature. "Design with Nature" is the third principle.

Cooperation is what newly considered by a group of designers in the process of design, and "Everyone Is a Designer" is the fourth principle which makes an entire community involved in design.

The fifth and final principle specified for the ecological design is "Making Nature Visible". It is recently observed more seriously by the designers and operators. Making the natural and living systems and processes visible and accessible in the present urbanized world is critical. These principles help to think about the integration between living and natural world, and humanly designed and built environment within a continuum of spatial scales from small houses to great manufactures and also city textures.

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[14] Van der Ryn, op.cit., p34
[15] ibid., p40
[16] Shu-Yang, op.cit., p102
[17] Thomas Herzog, "Reflections on Sustainable Architecture: Ecological Conditions and Intelligent Architecture", *Green Design From Theory to Practice*, Ken Yeang and Arthur Spectore (ed.), (London: Black Dog Publishing limited, 2011), p66
[18] Van der Ryn, lop.cit.

"[T]he search for a unified approach to the design of sustainable systems that integrates scales ranging from the molecular to global", is the expression representing "Ecological Design" by Sim Van der Ryn and Stuart Cowan.[19]

In architecture, as one of the essential representations of humans' relationship with the environment around, each civilization and also its architecture seem "to have risen and fallen based on its capacity to achieve a balance with nature", as James Wines believes.[20]

1.1.2 Sustainable design

"The word sustainability is derived from the Latin *sustinere* (tenere, to hold; sus, up).[21] "Able to be maintained at a certain rate or level" is the meaning stated in the Oxford Dictionaries.[22] Also its meaning in Merriam-Webster is as:

> sus·tain·able adjective (circa 1727) 1**:** capable of being sustained 2 ***a*:** of, relating to, or being a method of harvesting or using a resource so that the resource is not depleted or permanently damaged <sustainable techniques> <sustainable agriculture> ***b*:** of or relating to a lifestyle involving the use of sustainable methods <sustainable society> [23]

Additionally, other dictionaries provide meanings such as 'endure' and 'support' for the word 'sustain'. Sustainability which is synonymously used by sustainable development is from "sustained yield" - the older forestry term- which is the translation of "*nachhaltiger Ertrag*" - the German term- dating from 1713.[24]

World Commission on Environment and Development, established in 1983, has three objectives as follows:

> To re-examine the critical environment and development issues and to formulate realistic proposals for dealing with them; to propose new forms of international cooperation on these issues that will influence policies and events in the direction of needed changes; and to raise the levels of understanding and commitment to action of individuals, voluntary organizations, businesses, institutes, and governments.[25]

Sustainability was defined in the World Commission on Environment and Development report (known as Brundtland report) published by Oxford university Press in 1987, in a broad sense as dealing with all aspects of society, environmentally, economically and socially concerned, and more specifically as:

> Humanity has the ability to make development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs … Sustainable development is not a fixed state of harmony, but rather a

[19] ibid., p3-5
[20] Wines, op.cit., p38
[21] Wikipedia, the free encyclopedia, "Sustainability", http://en.wikipedia.org/wiki/Environmental_sustainability#cite_note-Ott-0 (accessed: January 02, 2011)
[22] Oxford Dictionaries, "Sustainability", http://oxforddictionaries.com/definition/sustainable (accessed: February 10, 2011)
[23] Merriam-Webster Dictionary, "Sustainable", http://www.merriam-webster.com/dictionary/sustainable (accessed: January 05, 2013)
[24] Wikipedia, the free encyclopedia, "Sustainable Development", http://en.wikipedia.org/wiki/Sustainable_development (accessed: January 02, 2011)
[25] United Nations, "Our Common Future, Report of the World Commission on Environment and Development", http://conspect.nl/pdf/Our_Common_Future-Brundtland_Report_1987.pdf (accessed: January 10, 2013)

> process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with future as well as present needs.[26]

The definition is focused on two concepts; the "needs" especially those are basic such as food and clothing and "making consistent" the resource needs of the organizations, technologically, socially and economically, and in local and global dimensions which has political concerns.[27]

Sustainable development is the intersection of the pillars, environmental, social and economical sustainability. The overlap of environmental protection, social equity and economic development as a development paradigm is accepted by governments and societies as guiding principles but it is difficult to describe the concept; the implementation is difficult; real progress is not pursuing, as unsustainability is continuing.[28] Also, it is mentioned in the Brundtland report that, sustainable development must rest on political will.[29]

Nerkis KURAL in her PhD thesis underlines what Egon Becker et al. state; "[T]he tendency of present environmental policies and recommendations to be formulated in non-social terms."[30]

Also, she believes that "[C]ontrary to a general conviction sustainability is not a static character of society but a dynamic process for societal change in which the natural environment is a central dimension."[31]

The essential problem has been "in designing the move from theory to practice. Here the tenacious grip of technological, political and other constraints becomes clear", as Matthews and Hammill (2009) note.[32]

Jason F. McLennan who is known as an international thought leader in the green architecture movement provided a definition for Sustainable Design in his book, *The Philosophy of Sustainable Design*:

> Sustainable Design is a design philosophy that seeks to maximize the quality of the built environment, while minimizing or eliminating negative impact to the natural environment. [33]

The philosophy of sustainable design as in the definition has introduced a new interpretation of the built environment and design approaches which the comfort of human being is at the center of concentration and it is devoted to the natural environment. It is an approach independent of kind and size of design. The goal is to enhance the quality of life influenced by the built

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[26] Terry Williamson, Antony Radford and Helen Bennetts, *Understanding Sustainable Architecture*, (London and New York: Spon Press, 2003; reprint: 2004), p4
[27] ibid., p4,5
[28]International Institute for Sustainable Development (IISD) , " Sustainable Development: From Brundtland to Rio 2012", Background Paper prepared for consideration by the High Level Panel on Global Sustainability at its first meeting, 19 September 2010, New York, p2, http://www.un.org/wcm/webdav/site/climatechange/shared/gsp/docs/GSP1-6_Background%20on%20Sustainable%20Devt.pdf (accessed: January 5, 2013)
[29] United Nations, loc.cit.
[30] Nerkis KURAL, "Parameters of Sustainability in Urban Residential Areas: A Critique of Temelli/ Ankara", (Ph.D. diss., Middle East Technical University, 2009, supervised by Prof. Dr. Ali Cengizkan), p7
[31] ibid.
[32] International Institute for Sustainable Development (IISD) , op.cit., p6
[33] Jason F. Mclennan, *The Philosophy of Sustainable Design*, The Future of Architecture, (Bainbridge, Ecotone Publishing, 2004), p4

environment and to create physical artifacts for the benefit of human kind and to have less or no impact, negative one in particular, on the natural environment.

Actually, sustainable design is a design approach respecting natural systems and resources, people and their life cycle, and looks for the best responses from the comfort, aesthetics, costs and traditional and vernacular architectural or design points of view.

Sustainable design responds to questions on the responsibility of the choices, effects of the choices on the environment, human health and design processes. Being "good for all species for all times" may be the aim of the solutions in sustainable design philosophy, as stated by Jason F. Mclennan.[34]

It is argued by Harry Gordon that:

> After decades of intense effort by designers, architects, individuals, and organizations, a tectonic shift in design thinking has occurred: sustainability is now becoming mainstream. Some might even say it has become a societal design norm.[35]

Joseph Cory[36] in his article "The Fifth Element in Sustainable Design" in the seventh Jerusalem Seminar analyzes sustainability by placing the concentration on the classical elements of the ancient theory, Earth, Water, Air, Fire and the non-material fifth element, and to find the representations of each element in sustainable design approach, from theory to practice.

Basing on the first element, the earth, the available climate data and soil survey of the site and building mass orientation and evaluating its relation with landscape are the early site activities. Low water consumption, capturing rainwater and grey and black water, green roofs, vertical gardens and shade usage are related with water as the second element.

He also declares the energy equivalent to fire, the third element, and sustainable fire equal to energy efficiency. Saving the energy, producing energy, using natural light, efficient artificial light and maintenance costs in long-term, improving the life quality and reducing energy consumption as the results are the aims. Overcoming the problems such as acoustic and air pollution, specifying the local climatic conditions as the direction and velocity of the wind in the site are in order to locate the mass of building in the best place and also utilizing the natural ventilation and energy efficiency as the final result. All of these are related with the fourth element, the air, in Cory's declaration.

Coming to the fifth element, the non-material one, the innovative, creative and educational contribution of the project, its adaptability with the users and the dynamic existence of it all form a living laboratory of ecological and social values and the fifth element of the sustainable architecture.

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[34] ibid., p5-7

[35] Simon Guy and Steven A. Moore, "The paradoxes of sustainable architecture", *Sustainable Architectures: Cultures and Natures in Europe and North America*, Simon Guy and Steven A. Moore(ed.) (London and New York: Spon Press, 2005), p1

[36] He is an innovative designer specializing in creative and practical architectural solutions to social and environmental challenges and sustainability. He is the graduate of Israel Institute of Technology and founder of GEOTECTURA office. He teaches and gives lecture on sustainable architecture worldwide.

The integration of all the criteria is important in the sustainable design process and the architect should meet the complex challenges of the process.[37]

It is stated in *Understanding Sustainable Architecture* that "Sustainable architecture, then, is a revised conceptualization of architecture in response to a myriad of contemporary concerns about the effects of human activity."[38]

1.1.3 Green concept

Green is an abstract concept that is not easy to define, and also it is difficult to express a building, "green".

> As sustainability enters the mainstream, becoming the accepted goal if not always the practice of governments and architects alike, it seems to be slipping through our fingers. No longer an alternative route out in the cold, green architecture is, as a result, ever more elusive and difficult to define.[39]
>
> Castle, 2001

It is argued by the architect Graham Farmer and the Professor of urban development Simon Guy that although there is clear consensus on essential environmental issues, there is not enough clarity in factors defining and representing a green building.[40]

Deyan Sudjic, the design and architecture critic, looks at the subject from another point of view and believes in the long distance between the designed green buildings and green philosophy and the desired one. It may be because of not any exact definition. As he says:

> Designing buildings that are truly green is still a far from exact science, and we judge by appearances. We assume that buildings are green if they look hand-made and are built of 'natural materials'.[41]

Most of the contemporary architectural works are not observed as the samples of the "true green" according to the exact definition of the environmental technologies, and no form of sheltering and construction now can be recognized as genuinely green, as James Wines believes.[42]

Definition of the green and also measurement of the greenness of a building is difficult and also challenging. The definition of a concept is assigning meaning to it by specifying the activities or operations necessary to measure it as expressed by Osman Attman from Sociologist Nachmias.[43] The same can be observed for the "green" concept.

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[37] Joseph Cory, "The Fifth Element in Sustainable Design", *Green Design From Theory to Practice*, Ken Yeang and Arthur Spectore (ed.), (London: Black Dog Publishing limited, 2011), p71-78
[38] Williamson, op.cit., p1
[39] Graham Farmer and Simon Guy, "Hybrid environments, The spaces of sustainable design", *Sustainable Architectures: Cultures and Natures in Europe and North America*, Simon Guy and Steven A. Moore(ed.) (London and New York: Spon Press, 2005), p15
[40] ibid.
[41] Guy, *Sustainable Architectures: Cultures and Natures in Europe and North America*, op.cit., p5
[42] Wines, *op.cit.*, p226
[43] Attmann, op.cit., p40

In order to define the green building, a series of principles, technologies and approaches are specified by different sources in the existing conditions and the related problems. But what is important is that there is not an exact set of them and every organization face with the situation differently.

1.2 Aim and scope of the study

Paying attention to the importance of the environmental concerns in the contemporary decades, facing with the related problems, and the necessity needed for further studies on the related issues, this thesis study will focus on green movement and the attempts done in so called green architecture.

Firstly, some of the concepts and terminology used in the movement such as ecological, sustainable and green will be clarified and the definitions by the designers and theoreticians will be represented.

In continuation with this, in the second chapter of the study, in order to clarify the essence of the green movement, the evolution of the movement through the decades, the organizations established in order to reach the environmental goals and the international events held will be reviewed.

In the third chapter, a series of award programs as evaluation systems held in relation with the green movement and its goals are going to be introduced. Among them, four programs rewarding green buildings have been selected in order to be analyzed in detail, and to identify their evaluation criteria which are presented as the principles of green architecture and a green building. The preference in award selection depends on their clarity in evaluation criteria and for being institutionalized.

The four green awards are Top Ten Green Projects Award by American Institute of Architects (AIA), Holcim Awards for Sustainable Construction by Holcim Foundation, Green Building Award by Royal Architectural Institute of Canada and SAB Canadian Green Building Award which are presented and analyzed in detail. The principles, approaches and elements forming and defining a green building in award programs will be compared with each other in order to achieve a set of green principles and parameters.

The fourth chapter of this thesis study is involved with the projects designed and built, winning the awards. One per award is selected in order to be analyzed as case studies. Winners of the same year (2011) which have other successions and awards other than the mentioned awards are at the point of attention.

Vancouver Convention Center West, winner of Top Ten Green Building award, the Secondary school with passive system in Burkina Faso, winner of the Holcim Foundation award, Creekside Community Recreation Centre, winner of SAB Canadian Green Building Award and also, Durham Consolidated Courthouse, winner of Green Building Award by Royal Architectural Institute of Canada are the four buildings selected. The case studies are going to be evaluated according to the achieved parameters and criteria. Finally, in the fifth chapter, the achievements from each chapter will be represented.

Because of the growing importance of the environmental issues, there are several written and online references on the subject. Many of them are going to be used in this study. But because of the focus of the research on the institutions and awards, the official websites of the needed ones are utilized, such as the official websites of the environmental organizations and award programs.

CHAPTER 2

CHRONOLOGY OF GREEN MOVEMENT EVENTS AND ORGANIZATIONS IN THE 20TH CENTURY

The human kind has always tried to gain knowledge about living in harmony with the nature and the environmental impacts. The attempts were to ensure the life quality of the present and future generations and suitable usage of natural resources and this approach has influenced so many disciplines specifically architecture, urbanism and land use.

After the industrial revolution, in the late nineteen century, mankind became more concerned with the increase in the world population, and the "birth control" expression entered the conversations for the first time in 1914 by Margaret Sanger, the American reformer.[44]

Environmental damages such as decrease in natural resources especially fossil fuel and water, increase in waste volume and decline in air, water and soil quality especially in the industrialized urban spaces were the consequences of the rapid population growth. In the early 20th century _in the 1920s and '30s_ the effects of environmental damage and climate change became apparent and the humankind began to protect his natural environment.

A high mountainous area in Hawaii was where a increase in amount of carbon dioxide (co2) measured around the 1950s and it became confirmed that it could cause a 4-Fahrenheit degree increase in global temperature depending on co2 levels in the following decades, 1960s and 70s. Developed climate models and researches represented the link between co2 and global warming. This relationship and the fact that carbon dioxide may enhance the green house effect and lead to global warming was firstly proposed by "Swante August Arrhenius"[45] the Swedish scientist in 1896.[46]

2.1 Earth Day

Earth day might be the beginning of the attempts to have a clear perception to the natural environment and it is a day which series of events are held around the world to increase the knowledge about the natural environment. John McConnell named the 21th of March -first of day of spring- "Earth Day", in a UNESCO Conference in San Francisco in 1969 for the first time. Meanwhile, Gaylord Nelson, U.S. Senator founded another earth day as April 22 in 1970 which was focused on, in the United States. International events were held from 1990 onward. The 22th of April was selected by the United Nations as "International Mother Earth Day"[47] It was the time of increment in the concern about over population, industrialized societies and global warming.

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[44] Barry James, "Overpopulation Has a Brief History", The New York Times Archive: September 8, 1994, http://www.nytimes.com/1994/09/08/news/08iht-birth.html (Accessed: March 09, 2012)

[45] "Svante August Arrhenius (19 February 1859 – 2 October 1927) was a Swedish scientist, originally a physicist, but often referred to as a chemist, and one of the founders of the science of physical chemistry." http://en.wikipedia.org/wiki/Svante_Arrhenius (Accessed: 09.03.2012)

[46] "A History of Climate Change", http://www.direct.gov.uk/en/Environmentandgreenerliving/Thewiderenvironment/Climatechange/DG_072901 (accessed: March 06, 2012)

[47] Wikipedia, "Earth Day", http://en.wikipedia.org/wiki/Earth_Day (accessed: February 08, 2012)

2.2 The Stockholm Declaration (1972)

In July 1972, the United Nations Conference on the Human Environment in Stockholm was the first large scale meeting on the human activities affecting the environment. Air pollution, decrease in natural sources, destroyed environment, overthrown species, and damaged social well-being as the existing problems and the preservation and enhancement of the human environment were at the point of attention in the process of meeting.[48] The conference encouraged the countries to improve the living standards of their population and specified twenty six principles that would ensure the sustainability of the development.[49]

2.3 HABITAT I - Vancouver Declaration on Human Settlements (1976)

The United Nations held the first habitat conference in 1976 in Vancouver on "the issue of physical and spatial organization of human life on this planet, and on the national and international actions needed to accommodate the growing number of population in urban and rural communities".

The conference established the "concept of human settlements to consist of several elements that had been previously considered separately from one another - housing, building, planning and the relationship of these and such other activities as environmental change and national and international development." Human settlements were defined by Vancouver Declaration.

> Human settlements means the totality of the human community - whether city, town or village - with all the social, material, organizational, spiritual and cultural elements that sustain it. The fabric of human settlements consists of physical elements and services to which these elements provide the material support.[50]

The physical components specified as "shelter", "infrastructure" and "services". Shelter was defined as "the superstructures of different shapes, size, type and materials erected by mankind for security, privacy and protection from the elements and for his singularity within a community"; Infrastructure as "the complex networks designed to deliver to or remove from the shelter people, goods, energy or information"; and Services cover "those required by a community for the fulfillment of its functions as a social body, such as education, health, culture, welfare, recreation and nutrition".[51]

2.4 First World Climate Conference (1979)

The World Meteorological Organization (WMO) held the first World Climate Conference about global climate issues in 12-23 February 1979, in Geneva. Switzerland and resulted in the establishment of the WMO World Climate Programme "including the WMO co-sponsored

[48] United Nations Environment Programme Official Website, "Declaration of the United Nations Conference on the Human Environment", http://www.unep.org/Documents.Multilingual/Default.asp?documentid=97&articleid=1503 (accessed: February 08, 2012)
[49] Chemical Industry Education Center Official Website, "A brief history of sustainable development", http://www.sustain-ed.org/pages/WhatSD/hist_text.html (accessed: September 30, .2011)
[50] The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) website, "What is Human Settlements", http://www.unescap.org/huset/whatis.htm (accessed: March 07, 2012)
[51] ibid.

World Climate Research Programme and the Intergovernmental Panel on Climate Change (IPCC)".[52]

2.4.1 Intergovernmental Panel on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) was established as the leading international scientific body for the assessment of climate change by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) in order to gain best and clear scientific view to the present condition in climate, its changing process and the potential environmental and socio-economic impacts. It reviews and assesses the relevant information worldwide. The result presents rigorous and balanced scientific information for the decision makers. Its work is policy-relevant and policy-neutral, not policy-prescriptive.[53]

Figure 1: The World Meteorological Organization Headquarters in Geneva. IPCC Secretariat is hosted by WMO (www.ipcc.ch)

2.5Brundtland Report (1987)

United Nations set up the World Commission on Environment and Development, and the environmental degradation was "understood to be a matter of survival for developing nations" in 1983.[54] March 20, 1987 was the time of the publication of the Brundtland report "Our Common Future" by the World Commission on Environment and Development, and the time when the concept of 'sustainable development' put forward.

It was defined as "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their needs." in World Commission on Environment and Development .[55]

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[52] World Meteorological Organization website, "World Meteorological Organization Message at the Green Cross International Event", http://www.wmo.int/pages/mediacentre/statann/documents/GreenCrossV.3.pdf (accessed: March 09, 2012)

[53] Intergovernmental Panel on Climate Change website, "Organization", http://www.ipcc.ch/organization/organization.shtml#.T2MlNnkzKSq (accessed: March 09, 2012)

[54] United Nations official website, "UN Conference on Environment and Development (1992)", http://www.un.org/geninfo/bp/envirp2.html (accessed: September 30, 2011)

[55] Corinne van Beilen and others, *Sustainable Development, The Role of Lifelong Learning*, Osborne, Michael, Kate Sankey and Bruce Wilson (edit.), *Social Capital, Lifelong Learning and the Management of Place, an International Perspective,* New York and London: Routledge, 2007, p216

2.6 Second World Climate Conference (1989)

Following the formation of the American Institute of Architects "Committee on the Environment" in 1989, the 20th anniversary of earth day took place in the United States in 1990.56 WMO's second World Climate Conference was also held on 29 October to 7 November 1990, again in Geneva, in partnership with Global Climate Observing System (GCOS). This conference resulted in "United Nations Framework Convention on Climate Change", Earth Summit in 1992.

2.7 BREEAM by BRE (1990)

The Building Research Environment (BRE) is a government establishment in United Kingdom founded in 1920, for the "research, consultancy and testing" the construction sector. Preparing the UK Building Regulations and also assessment codes is among its activities. Environmental rating systems such as BREEAM and EcoHomes are among them.[57]

BREEAM is an internationally recognized environmental assessment method which provides the standards for sustainable building design and environmental performance. Many aspects such as energy, pollution, water, materials, waste, and ecology are among the considered ones. This rating system was established in 1990 to measure the sustainability of non-domestic buildings in the United Kingdom and was being updated periodically according to UK Building Regulation as in 2008.[58]

2.8 Rio Earth Summit (1992)

The United Nation Conference on the Environment and Development known as Earth Summit was held in 1992, 3-14 June in Rio de Janeiro, Brazil.[59] "Agenda 21, the Rio Declaration on Environment and Development, the Statement of Forest Principles, the United Nations Framework Convention on Climate Change and the United Nations Convention on Biological Diversity" were all the resulting documents of the conference.

In the Earth Summit, the United Nations sought "to help Governments rethink economic development and find ways to halt the destruction of irreplaceable natural resources and pollution of the planet" 20 years after the first global environment conference.[60] The U.S. Green Building Council was founded in 1993 after the summit.

2.8.1 Agenda 21

It was the formulation of a sustainable development plan for the 21th century. Calls for reduction of air pollution and the emissions and the use of precious natural resources were what came in Agenda 21. Everyone should tackle non-sustainable practices and in this situation, local actions can lead to the solution of global problems. The Hanover Expo in 2000 in Germany with theme of "man, nature and technology", and Comité 21 of France are the European authorities' own Agenda 21.[61]

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[56] Jerry Yudelson, *The Green Building Revolution*, Washington: Island Press, 2008, p2
[57] Wikipedia, "Building Research Environment)", http://en.wikipedia.org/wiki/Building_Research_Establishment (accessed: July05, 2012)
[58] BREEAM Official Website, "What is BREEAM?", http://www.breeam.org/about.jsp?id=66 (accessed: July 07, 2012)
[59] Jerry Yudelson, *Greening Existing Buildings, A GreenSource Book*, (New York: Mc Graw Hill, 2010), p2
[60] United Nations official website, loc.cit.
[61] Dominique Gauzin Müller, *Sustainable Architecture and Urbanism: Concepts, Technologies, Examples*, Basel: Birkhäuser2002, p14

2.9 HABITAT II - Second United Nations Conference on Human Settlements (1996)

The second United Nations Conference on Human Settlements (Habitat II) was held in Istanbul, 3-14 June 1996. Human beings as the center of the sustainable development need a healthy life in harmony with the nature. "Adequate shelter for all" and "Sustainable human settlements development in an urbanizing world" were the main themes of the conference owning the same importance.[62]

2.10 Kyoto Summit (1997)

The Kyoto meeting was held in Japan in 1997 and it took a look at the problem of global warming again and the reduction of the emissions of carbon dioxide according to the previous years.

2.10.1 Kyoto Climate Change Protocol

The Kyoto protocol specified more strong measures about greenhouse gas emissions, after the Rio's emphasize on cultural and social aspects. Participating nations in the protocol must have the average greenhouse gas emissions in the level of the year 1990, in the 2008-2012period. 2000 was when the nations met in The Hague to set reductions in co2 and five other greenhouse gases for 38 industrialized countries but the conference ended in failure because of disagreements.[63]

It was the "first international treaty to set legally binding emissions cuts" for industrialized nations. 178 countries signed it and it came into force in 2005.[64]

2.11 LEED by USGBC (1998)

The private non-profit organization of U.S. Green Building Council (USGBC) was co-founded by Mike Italiano, David Gottfried and Rich Fedrizzi in 1993 in the influence of the formation of the American Institute of Architects in 1989 and 1992 UN Conference (Rio Earth Summit) and it is focused on how building are sustainably designed, built and operated. Its LEED green building rating system and Greenbuild (green building conference and expo) promote the green building industry.[65]

The Leadership in Energy and Environmental Design (LEED) is the rating system established by USGBC in 1998 and "provides building owners and operators with a framework for identifying and implementing practical and measurable green building design, construction, operations and maintenance solutions." Aiming at environmental and human health, energy efficiency, suitable materials and water and indoor air quality it is processed openly and consciously by the LEED committees.[66]

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[62] United Nations official website, "Outcomes on Human Settlements", http://www.un.org/en/development/devagenda/habitat.shtml (accessed: February 06, 2012)
[63] Müller, loc.cit.
[64] "A History of Climate Change", http://www.direct.gov.uk/en/Environmentandgreenerliving/Thewiderenvironment/Climatechange/DG_072901
[64] Wikipedia, "Earth day", http://en.wikipedia.org/wiki/Earth_day (accessed: February 02, 2012)
[65] Wikipedia, "U.S. Green Building Council", http://en.wikipedia.org/wiki/U.S._Green_Building_Council, (accessed: July 06, 2012)
[66] U.S. Green Building Council, "What LEED is", http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1988 (accessed: July 06, 2012)

2.12 Green Building Challenge (GBC)

Following the interest of the 1990s in building environmental assessment such as BREEAM (BRE- UK), LEED (USGBC) and the ones which were more close to Life Cycle Assessment (LSA) as ECO QUANTUM (Netherlands), ECO-PRO (Germany) and EQUER (France), the Green Building Challenge (GBC) initiated as an international competition for green buildings in 1995 and the winners were acknowledged in the conference.

A presentation was made in March 1996. Changing the concept of GBC from a competition of buildings to an assessment framework to define the characteristics of a green building was previewed. Finally, the concept of an international conference was preferred by the name "Green Building Challenge" did not change. The project GBC was consisted of two stages (two 2-year processes).

The three general goals of the GBC are:

- "To advance the state-of-the-art in building environmental performance assessment methodologies.
- To maintain a watching brief on sustainability issues to ascertain their relevance to "green" building in general, and to the content and structuring of building environmental assessment methods in particular.
- Sponsor conferences that promote knowledge exchange between the building environmental research community and building practitioners, including a showcase for the performance assessments of environmentally progressive buildings."[67]

The First Stage (1996-98): The first semi-official meeting was held in Warsaw in autumn in 1996. Representatives of the participants were called "International Framework Committee" (IFC) and "responsible for guiding the redesign of the assessment framework and selection of the case-study projects" and would meet twice a year. GBC did not have any international sponsorship.[68]

In mid-1997, 14 countries and 15 teams became involved in the process and responsible of representing at least two projects. The first major international conference was in Vancouver in October 1998 which was called as GBC'98.[69]

The Second Stage (1998-2000): In this period, some new countries joined the process and increased the international importance of the challenge. They also decided to increase the costs in comparison with the previous stage.

Some specific objectives of GBC 2000 process are:

- "To develop an internationally accepted generic framework that can be used to compare existing building environmental assessment methods and used by others to produce regionally based industry systems.

[67] International Initiative for a Sustainable Built Environment Official Website, "Green Building Challenge 2000", http://iisbe.org/gbc2k/gbc-start.htm (accessed: July 07, 2012)
[68] Nils K. Larsson and Raymond J. Cole, "Green Building Challenge: the development of an idea", *Building Research and Information*, Volume29, issue5, p337-8, September 2001, http://www.tandfonline.com/doi/pdf/10.1080/09613210110063818 (accessed: February 02, 2012)
[69] ibid., p339

- To expand the scope of the GBC Assessment Framework from green building to include environmental sustainability issues and to facilitate international comparisons of the environmental performance of buildings."

The second conference was presented in Maastricht, the Netherlands, in October 2000 called as GBC/SB2000.[70]

The continuation of the second stage was GBC 2002 which was a period to review, modify and test of the GBC assessment Framework and Green Building Tool (GBTool) – the operational software. Gaining information in detail about some internationally best sustainable buildings was among the accomplishments of the period. The result of this process was represented in Sustainable Building 2002 Conference (SB 2002) in Oslo, Norway in 23-25 September, 2002.[71]

In 2004, a series of regional conferences supported by CIB[72], iiSBE and UNEP and the essential role of the regional organizers was held, each following the same generic structure and so, the results provide comparative analysis. In continue, the Sustainable Building 05 Conference (SB'05) was held in 27-29 September in Tokyo, Japan which the latest information and experience on sustainable buildings were exchanged.

2.13 Rio+10

"Rio+10" meeting was held in Johannesburg in 2002, ten years after the Rio Earth Summit and countries met to review progress towards sustainable development. The focus was on poverty and the access of people to safe drinking water and sanitation. A set of objectives defined in the meeting are as follows:

- "To reduce the number of people that are not connected to clean drinking water supplies from over 1 billion to 500 million by the year 2015.
- To halve the number of people without proper sanitation to 1.2 billion.
- To increase the use of sustainable energy sources and restore depleted fish stocks."[73]

2.14 Green Star by GBCA (2004)

Green Building council of Australia (GBCA) is a national and not-profit organization established in 2002 and it is supported by both industry and governments. Its commitment is to encourage on green building practices and the development of a sustainable property industry for the country as a result.

Green star environmental rating system is a national environmental rating system which the design and construction of the buildings and communities are evaluated and tries to transform the environment of Australia by 4 million square meters of Green Star certified space. It was firstly launched by GBCA for buildings in 2004.[74]

[70] International Initiative for a Sustainable Built Environment Official Website, loc.cit.
[71] ibid.
[72] CIB is the acronym of the abbreviated French (former) name: "Conseil International du Bâtiment", in English, International Council for Building which the full name changed into INTERNATIONAL COUNCIL FOR RESEARCH AND INNOVATION IN BUILDING AND CONSTRUCTION.
[73] Chemical Industry Education Center Official Website, loc.cit
[74] Green Building Council Australia Official Website, "Green Star overview", http://www.gbca.org.au/green-star/green-star-overview/ (accessed: July 07, 2012)

2.15 Third World Climate Conference

"Climate Prediction and Information for Decision Making" was the theme of the third session of the WCCs series which took place in 2009. It had a declaration strengthening the "production, availability, delivery and application of science-based climate predictions and services".[75]

"The green building revolution is part of a paradigm shift toward sustainability."[76]

[75] World Meteorological Organization website, "World Meteorological Organization Message at the Green Cross International Event", http://www.wmo.int/pages/mediacentre/statann/documents/GreenCrossV.3.pdf (accessed: March 09, 2012)

[76] Jerry Yudelson, *The Green Building Revolution*, (Washington: Island Press, 2008), p1

CHAPTER3

GREEN AWARDS AND THEIR ROLE IN THE PROMOTION OF GREEN PRINCIPLES

As part of the activities in green movement and the promotion of awareness on environmental issues, awards and certification programs have been organized by different groups and institutions with the objective to promote green building practices. These awards have provided criteria in order to specify how much they succeed presenting solutions in reaching their aims.

Certification and award programs have been based on evaluation systems providing specifications to achieve the built environment best fitting to the green goals. The attempts to promote the green principles intensified especially in the last decade of the twentieth century.

By creating a competitive circumstance and promoting specifications and characteristics supporting the environmentally friendly goals, and in order to attain a green and sustainable environment, awards convey important roles in the green movement.

Governments, associations, institutions and organizations are the rewarding agents , and their targets can be the designed products, people (designers, builders and executors), groups and organizations, and finally, the built environment which is interrelated with the natural environment. Green building and sustainable building awards are those evaluating the building or environment, designed and built by architects, landscape architects and urban designers and in the recent years. One can observe that the number of those awards and their attempts to define accurate principles have increased in the recent years.

There are several awards rewarding organizations and individuals, focusing on the environmental innovation, which are organized by individual enterprises, non-governmental or governmental organizations. Among those, the Global Award for Sustainable Architecture, in Europe, selecting five contemporary sustainable architects each year by worldwide critiques and specialists of the European Scientific Board of Architecture, New South Wales (NSW) government's Green Globe Awards in Australia ,are well known awards. Royal Institute of British Architects is another institution which established a rewarding system (RIBA Sustainability Award) which seeks for the projects presenting principles of sustainable architecture refined in appearance, style and behavior and also for a long time. It's emphasize is on energy-efficient buildings and their aesthetical aspects.[77]

The Green Building Award which is one of the fourteen categories of national World Environment Day Awards held by United Nations Association of Australia is an international attempt to promote the awareness on environmental challenges and issues, and an encouragement towards environmental excellence and sustainability in the projects.[78]

European Green Capital Award is another award which is particularly concerned with the urban environment. The idea originated in a meeting in Tallinn, Estonia, in May 2006, with

[77] Royal Institute of British Architects official website, "RIBA Sustainability Award", http://www.architecture.com/Awards/RIBASpecialAwards/RIBASustainabilityAward/RIBASustainabilityAward.aspx (accessed: March 30, 2012)

[78] United Nations Association of Australia, Victorian Division official website, "Award Programs", http://www.unaavictoria.org.au/awards-programs/world-environment-day-awards/ (accessed: March 30, 2012)

the belief that "a green and sustainable Europe is essential for improving public health and the quality of [European] citizens". To improve not only the living environment in cities but also the whole environment as a result -in a continent which 3 out of 4 of its population live in the urban environment-and to make greener the environment and improve life quality are the main goals of the award.[79]

Among the award programs evaluating the designed and built environment and aiming at a sustainable and green future, four of them are selected in this study, for being institutionalized and providing clear specifications. These awards are presented and analyzed in detailTop Ten Green Projects Award by American Institute of Architects (AIA), Holcim Awards for Sustainable Construction by Holcim Foundation, Green Building Award by Royal Architectural Institute of Canada and SAB Canadian Green Building Award are the ones this thesis study focuses on.

The origin of each award, the length and dimensions of it and the criteria and specs of the award in purpose are studied to set out the green building principles based on the awards' criteria and evaluation procedure. The best award program and also the least and the most recurrent issues in the evaluation criteria will be identified following the comparison of the principles in four selected award programs.

3.1 Holcim Awards for Sustainable Construction

3.1.1 Holcim Foundation

The Holcim Foundation was founded in Switzerland in 1912, called after the name of the village, Holderbank. The company had a great expansion in Europe, through Africa, America, Asia Pacific and the Middle East, in cement and aggregates industries and also in ready-mixed cement and asphalt and their services. In 1999, the company joined the World Business Council for Sustainable Development (WBCSD).

In 2001, it continued its activities with its present name Holcim Ltd. As a local and regional business, it focused on utilizing the local resources and it was based on local issues, economically, socially and environmentally. The "best sustainability performance in building materials industry" was its priority for several years.

Holcim Foundation for Sustainable Construction was launched in 2003, supported by Holcim Ltd. but independent of its commercial views. Its aim was reinforcing the public awareness on architecture and construction towards a sustainable future and representing different approaches in construction industry to reach the aim.[80]

3.1.2 Holcim Awards

An international competition is held by the Holcim foundation named as Holcim Award looking for future-oriented concepts, innovationsas well as conventional notions, balanced environmental, social and economic performance and architectural excellence. The award has been held in three-year cycles, regionally and globally.

The award program is organized in two categories. The main one is open to architects, engineers and construction firms, and the second one titled "Next Generation" is directed to

[79] European Commission official website, "European Green Capital", http://ec.europa.eu/environment/europeangreencapital/about-the-award/background/index.html (accessed: March 30, 2012)

[80] Holcim Foundation for Sustainable Construction official website, "Holcim Foundation Origins", http://www.holcimfoundation.org/T700/HolcimFoundationbrOrigins.htm (accessed: November 28, 2011)

last year bachelor students or above (masters and PhD). The main category is held in five regions (Europe, North America, Latin America, Africa and Middle East, and Asia Pacific) and three projects receive Gold, Silver and Bronze awards in each region. The final competition is held between these 15 projects for achieving Global Holcim Awards. Besides, these projects along with acknowledgement and "Next Generation" winners compete for Global Holcim innovation prizes.[81]

3.1.3 Award's criteria

Evaluation in the award program is done by independent juries from the partner universities of the foundation and their evaluation criteria are specified as "target issues" for sustainable construction which are defined in order to quantify the contribution of the building to sustainable development. The five "target issues" of the award which are based on the "triple bottom line"[82] concept -the need for "balanced achievement of economic development, environmental performance and social advancement" for sustainability- are Progress, People, Planet, Prosperity and Proficiency.

Each of the targets is defined as follows:

- "Progress" as "innovation and transferability"
- "People" as "ethical standards and social equity"
- "Planet" as "environmental quality and resource efficiency"
- "Prosperity" as "economic performance and compatibility"
- "Proficiency" as "contextual and aesthetic impact"[83]

"Progress" as "Innovation and Transferability"

The innovative aspects must be present in the project in order to be a sustainable construction. In other words, having a productive insight, a trend popularizing approach and being irrespective of scale, the project must be transferable to other kinds of applications. The innovative aspects should have the potential to be copied to be globally beneficial. Also, the application of the project must be changed simply and affordably. A detailed expression of the specification in the first target issue is as follows:

- "Innovative concepts regarding design, integration of materials and products, structure, enclosure and building services"
- "Outstanding approaches regarding construction technology and processes, operation and maintenance"
- "Contributions to the disciplines of architecture, urban and landscape design, civil, urban and environmental engineering and other related fields pertaining to construction"
- "Long term monitoring to evaluate the fulfillment of the initial expectations and goals"
- "Dissemination of knowledge (project documentation and communication, education and training)"[84]

[81] Holcim Foundation for Sustainable Construction official website, "Holcim Awards Introduction", http://www.holcimfoundation.org/T1115/Holcim_Awards_Background.htm (accessed: November 28, 2011)
[82] Also known as people, planet, profit or "the three pillars"
[83] Holcim Foundation for Sustainable Construction official website, "Target Issues for Sustainable Construction", http://www.holcimfoundation.org/T439/target.htm (accessed: November 28, 2011)
[84] Holcim Foundation for Sustainable Construction official website, "Innovation and transferability-progress", http://www.holcimfoundation.org/T973/Progress.htm (accessed: November 28, 2011)

"People" as "Ethical Standards and Social Equity"

According to this target, the highest degree of ethical and social equity must be provided in the process of construction, design, planning and building, and in its long-term impact on the social fabric. In other words, it must be socially and ethically responsive. Advancement in people's awareness on values and inspiration of the spirit of the human kind, the society and the neighborhood communities are required in a sustainable project in order to respond to people emotionally and psychologically. All the people involved in the project during design, construction, use and recycling should be treated as principal actors.

The detailed specifications in the second target issue are expressed as follows:

- "Adherence to ethical standards in all phases of the project's life cycle"
- "Contributions to the formation of socially viable environments and the values of communities"
- "Participation of stakeholders (the client, users, neighborhood, local authorities, non-governmental organizations and others)"
- "Quality of working conditions in the suppliers' workshop, on site and during operation (compensation, safety, basic needs, gender issues)"
- "Political transparency and correctness"[85]

"Planet" as "Environmental Quality and Resource Efficiency"

In the life cycles of the project, in operation and maintenance, the natural resources must be utilized and managed reasonably, and long-term environmental concerns on materials and energy should be integrated in the built structure. This maintains the planet and it is an indefinite support for the next generations as a sustainable construction, fronting with the overuse of resources.

The building should conserve finite sources of energy and materials, focusing on their renewability, durability and recyclability. This can be possible through energy-efficient design and utilizing environmentally neutral energy sources (sun, wind and geothermal) and mechanisms (simple evaporation cooling, shading).

In larger scales such as urban fabric and regions, energy conservation by efficient design, consumption and waste reduction by sensible design, pollution reduction by efficient transportation networks are needed independent of the scale of the sustainable project. The final aim is to design with nature and to support the ecosystems.

The details leading to the third target issue, environmental quality and resource efficiency are stated as follows:

- "Low environmental impacts over the project's life cycle"
- "Energy and material efficiency in construction, operation and maintenance"
- "High ratio of renewable energy to fossil energy in construction, operation and maintenance"
- "Land use efficiency"
- "Robust products and technologies"[86]

[85] Holcim Foundation for Sustainable Construction official website, "Ethical standards and social equity", http://www.holcimfoundation.org/T976/People.htm (accessed: November 28, 2011)

[86] Holcim Foundation for Sustainable Construction official website, "Environmental quality and resource efficiency-Planet", http://www.holcimfoundation.org/T979/Planet.htm (accessed: November 28, 2011)

"Prosperity" as "Economic Performance and Compatibility"

In the fourth target issue, the project should be economically suitable and innovative according to the financial resources. The economy of the project must have enough compatibility with demands, and restrictions in the construction life cycle. Users of the project, its owners and the communities in general, all should be provided by long-term economic benefits in a sustainable design and in all the process of construction, maintenance, operation, reuse and recycling of the sustainable construction. Durability, adaptability, lifecycle cost planning, free low-tech natural resources and innovative arrangement of financial resources all make a project suitable and also preferred for a sustainable process. The following are the items specified in the fourth target issue:

- "Innovative models for financing"
- "Financial resources over the project's life cycle and their regional impact"
- "Flexibility with regard to future changes (user, ownership, laws and regulations)"
- "Robustness to economic conditions (interest rates, taxes, inflation)"
- "Economy of resources deployed in construction."[87]

"Proficiency" as "Contextual and Aesthetic Impact"

In the last target issue of the program, in a sustainable construction, the architectural quality must be in the maximum levels addressing physical and cultural factors. "Fitness of form" and "visual expression" are two essential and important qualities in all good architectural designs. It is central in sustainable construction and it is applied in all scales such as urban planning and land use planning next to the architectural design. Preservation of natural areas and ingrained and inherent qualities of landscape are essential in land use planning scale. The creation of spaces and places with cultural significance and social value is along with the efficient and functional infrastructure of the urban planning. Also, a lasting and strong aesthetic impact on the surrounding environment must be in the sustainable construction using its form and space design. The items in this target issue are as follows:

- "Improvement of existing contextual conditions responding to the natural and human-made contexts"
- "Interdependencies of landscape, infrastructure, urban fabric and architecture"
- "Cautious restoration and alteration of the built environment"
- "Programming strategies (use, flexibility, multiplicity of functions, change)."
- "Architectural quality and its aesthetic impact (space, form, light, ambiance)."[88]

3.1.4 The reasons of the selection of the award program

Holcim Award for Sustainable Construction is selected for a comparison with other selected awards.The awarder is not an official organization of the architecture discipline, but it is a foundation that promotes the idea of a sustainable future, through construction practices. In order to reach the aim and select the owners of the award, the jury members are selected from the partner universities of the foundation. Meanwhile, the important part of the award program is to specify target issues and criteria so that the jury could be able to evaluate the project and select the winners. The strong point of the award is the elaborated target issues orienting the evaluation in the best direction.

[87] Holcim Foundation for Sustainable Construction official website, "Economic performance and compatibility – prosperity", http://www.holcimfoundation.org/T982/Prosperity.htm (accessed: November 28, 2011)

[88] Holcim Foundation for Sustainable Construction official website, "Contextual and aesthetic impact – proficiency", http://www.holcimfoundation.org/T985/Proficiency.htm (accessed: November 28, 2011)

3.2 Top Ten Green Projects by AIA (USA)

3.2.1 American Institute of Architects (AIA)

The meeting of 13 architects in Richard Upjohn's office in 1857 is the commencement point of the attempts of a leading strategic and professional membership association for licensed architects in the United States of America. The group in the meeting, Upjohn, Cleaveland, Dudley, Eidlitz, Gardiner, Morris and others started an attempt to create an architecture organization to "promote the scientific and practical perfection of its members" and "elevate the standing of the profession". This organization is the American Institute of Architects, a nationally elected body based in Washington D.C. and serves the architecture profession and the society related.

After the establishment of this organization, everybody could not call himself or herself architect and do architectural practices.. To have a profound change in the profession of architecture in the Unites States was one of the early aims of the founding members. The name of the organization changed from its initial one, the New York society of Architects, to its present name, in 1857. A draft constitution and bylaws is also the product of this meeting.

"Continuing education experiences", providing contract documents for industrial standards and economical factors analysis (affective on architecture), annual National Convention and Design Exposition, being "advocate of the architecture profession", "enhancing public belief in the value of design" and also award programs all represent the activities of the American Institute of Architects along its more than a century life.[89]

Susan Maxman, the AIA's first woman president presided the AIA National Convention in Chicago in 1993, as the first one to focus on sustainable design. She told: "We said we wanted the convention to focus on sustainability—architecture at the crossroads—and several people suggested that no one would come," the convention was a great success supported by 3000 AIA members.[90]

3.2.2 Committee of the Environment (COTE)

To face with the environmental problems, AIA members have established a committee named COTE, Committee of the Environment, in 1990 (after the Energy Committee founded in 1973) which is a part of the institute and develops and supports the design practices with the integration of the built and natural systems and also, controls the design quality and environmental performance of the built environment. It is one of the committees of the AIA's architects responsible for sustainable design, building science and performance. It advises the institute "on environmental policy matters affecting the practice of architecture" and supports other entities and units in developing environmental design approaches and standards and also, regenerative and innovative systems and materials.[91]

[89] American Institute of Architects Official Website, www.aia.org (accessed: April28, .2012)
[90] American Institute of Architects Official Website, "AIA/COTE: A History Within a Movement", http://www.aia.org/practicing/groups/kc/AIAS077347 (accessed: April 28, 2012)
[91] American Institute of Architects Official Website, "AIA Committee on the Environment", http://www.aia.org/practicing/groups/kc/AIAS074686?dvid=&recspec=AIAS074686 (accessed: April 28, 2012)

Randolph Croxton[92] said:

> We saw early on that one of the most valuable roles COTE could play would be in the development and dissemination of reliable and scientifically sound knowledge and insights needed within the profession to pursue this deeper consideration of architecture and design.

One of the important aspects of COTE is its multidisciplinary structure and its key concepts are social, environmental and economic sustainability.

COTE has an important role in environmental activities and it has been apparent with respect to USGBC (United States Green Building Council). Most of its members have been active in the development of LEED™ program of USGBC and also in collaborations as EPA (US Environmental Protection Agency), the Sustainable Buildings Industry Council (SBIC), the American Society of Landscape Architects (ASLA), Architects, Designers and Planners for Social Responsibility (ADPSR) and others.[93]

Some of the goals of the Committee of the Environment are:

- "To advance the importance of sustainable design"
- "To educate architects about the environmental and energy-related impacts of design decisions"
- "To define and promote the cutting edge of sustainable design for our profession"
- "To foster leadership among architects in all facets of environmental decision making"
- "To recognize environmental leadership of architects in practice, education, industry, and government"
- "To influence the direction of architectural education to place more emphasis on ecological literacy, sustainable design and building science"
- "To green AIA convention venues and meetings"
- "To communicate the AIA's environmental and energy-related concerns to the public and private sectors and influence the decisions of the public, professionals, clients, and public officials on the impact of their environmental and energy-related decisions"
- "To educate architects on regulatory, performance, technical and building science issues and how those issues influence architecture"
- "To investigate and disseminate information regarding building performance best practices, criteria, measurement methods, planning tools, occupant-comfort, heat/air/moisture interfaces between the interior and exterior of buildings"
- "To promote a more integrated practice in order to achieve environmentally and economically efficient buildings" (such as BIM)

3.2.3 Award's criteria

Ten measures of sustainable design are specified by COTE as the criteria for the evaluation of the projects in the award program "Top Ten Green Projects Awards" organized by the Committee. Introduction and awarding ten successful green projects and representing their technologies have been done since 1997 until now.

[92] "Randolph R. Croxton is internationally recognized as a pioneer and innovator in the achievement of environmental and sustainable architectural design." http://www.croxtoncollaborative.com/people-rrc.htm (accessed: April 29, 2012)

[93] American Institute of Architects Official Website, "AIA/COTE: A History Within a Movement", http://www.aia.org/practicing/groups/kc/AIAS077347 (accessed: April 28, 2012)

The ten evaluating measures for “Top Ten Green Projects Award” are as follows:

Measure 1: Design and Innovation

Sustainable design concepts and intentions should be represented in the projects and also innovative programs, approaches and technologies should be utilized. Sustainable design is inherent and natural aspect of an excellent design.

Measure 2: Regional/Community Design

In a specific region or community, the role and importance of sustainable design in conservation of cultural and natural characteristics of the site is represented.

Measure 3: Land Use and Site Ecology

All ecosystems, wildlife habitat and watersheds accompanying human development are protected in sustainable design. Sustainable design also benefits them.

Measure 4: Bioclimatic Design

Resource conservation and comfort maximization according to the site characteristics and conditions and climate is the bioclimatic aspect of sustainable design.

Measure 5: Light and Air

Usage of daylight, defining views and paying attention to the air quality in the interior spaces are the results of sustainable design’s comfortable interior environment.

Measure 6: Water Cycle

Water conservation and protection and improvement of water quality is the result of a sustainable design.

Measure 7: Energy Flows and Energy Future

Energy and resource conservation and reduction of the carbon footprint while improving construction and performance quality is among the essential duties of sustainable design and it foresees the needs and sources for future.

Measure 8: Materials and Construction

The importance of well-informed material and product selection in the reduction of product-cycle environmental impacts, performance improvement and providing healthy and comfortable environments for occupants is included in sustainable design.

Measure 9: Long Life, Loose Fit

Improving and increasing the ecological, social and economic values is what sustainable design tries to reach.

Measure 10: Collective Wisdom and Feedback Loops

Documented performance and shared knowledge make sustainable design strategies and practices developed.[94]

3.2.4 The reasons of the selection of the award program

Top Ten Green Building, is an award program organized by a national professional institution. The American Institute of Architects, established a committee which was actually focused on environmental issues in the architecture discipline in 1990. Top Ten Green Buildings are selected and rewarded by a committee which is concerned with the environmental problems and negative impacts of the man-made environment on the natural one. And therefore the principles for a building being an environmentally friendly and a green one are based on a number of goals and ten measures which are wisely specified to face with the environmental problems.

3.3 SAB Canadian Green Building Award

3.3.1 Award Program

Canadian Green Building Award organized by Sustainable Architecture and Building Magazine (SABMag) and SABHomes magazine teamed with Canada Green Building Council (CaGBC) shapes the future of the green construction in Canada. It is held annually nationwide, seeking for sustainable design, architectural excellence and technical innovation criteria, with the objective to promote the sustainable residential and non-residential construction of all types including interior design, new construction and renovation projects in Canada. It has been awarded since 2008 and the jury members are selected each year among architects and specialists of green design in order to evaluate the submitted projects and specify the Canadian Green Building.[95]

3.3.2 Award's criteria

All the projects nominated for the award and seeking for sustainable design should present sustainable design narrative. The items analyzed for the projects are as follows:

- Strategic Decisions
- Community
- Site Ecology
- Light and Air
- Water Conservation
- Energy Present and Future
- Materials and Resources
- Life Cycle Consideration
- Education and Information Sharing[96]

[94] American Institute of Architects official website, "AIA Committee on the Environment", http://www.aia.org/practicing/groups/kc/AIAS074684 (accessed: May 02, 2012)
[95] SAB Magazine official website, http://sabmagazine.com/sab-awards.html and http://sabmagazine.com/winners-2011.html (accessed: March 30, 2012)
[96] SAB Magazine official website, "Winners 2012", http://www.sabmagazine.com/winners2012.html (accessed: March 30, 2012)

3.3.3 The reasons of the selection of the award program

The essential reason resulting in the preference of the SAB Canadian Green Building for comparison in this thesis study is the organizers of the award program, i.e. the "Sustainable Architecture and Building Magazine" (SABMag) and Canada Green Building Council both of which are involved directly in the discussions of the recent years, green design. Also, the items the projects are evaluated according to are specified as "sustainable design", "architecture excellence" and "technical innovation" firmly.

But the criteria looked for in a sustainable design are not explicitly defined in the award program although nine items are fixed in the presented documentations by the designers of the projects, and according to me, the separation of the "architecture excellence" and "technical innovation" from the sustainable design's criteria may be questionable.

3.4 Green Building Award by Royal Architectural Institute of Canada (RAIC)

3.4.1 RIAC Foundation

Established in 1964, the foundation focused on strengthening architecture profession, and it is governed by a Board of Trustees. It is a commitment to develop programs in order to provide a vivacious place for architecture in Canada, to achieve architectural excellences by architects, to observe the diversity and richness of architecture in Canada and also to provide programs supporting architectural profession throughout the country. As a leading organization in Canada's architecture, it recognizes with gratitude the contribution of architecture in physical and cultural well-being of Canadians.

It focuses on values such as "integrity", the highest professional and ethical standards, "environmental responsibility", promoting sustainable design and operation, "inclusiveness", creation and maintenance of all people involved in architecture in society and "effectiveness", establishing clear and measurable objectives.[97]

3.4.2 Green Building Award

Green Building is among the Awards of Excellence awarded by Royal Architectural Institute of Canada, and in partnership with Canada Green Building Council. Only the members of the Canada Green Building Council (CaGBC) and members of Architecture Canada are eligible to attend and the project should be a LEED Gold or Platinum certified one, proving the commitment of it in sustainability factors, energy efficiency and environmental responsibility.[98]

In this award program, the environmentally responsive buildings (built works) with high architectural performance and outstanding achievements are promoted besides being livable and workable as a healthy place. Building designs and constructions with significant reduction and elimination of the negative impacts on the environment and also social fabric are recognized in it.

[97] Royal Architectural Institute of Canada official website, "Vision, Mission and Values", http://www.raic.org/raic/about_us/mission_e.htm (accessed: November 2012)
[98] Royal Architectural Institute of Canada official website, "2013 Awards of Excellence", http://www.raic.org/honours_and_awards/awards_raic_awards/2013call/raic-green_e.htm (accessed: November 28, 2012)

Five essential areas are defined in the program in order to evaluate the nominated buildings.

- "Sustainable site planning;
- Safeguarding water and water efficiency;
- Energy efficiency and renewable energy;
- Conservation of materials and resources;
- Indoor environmental quality."[99]

3.4.3 Reasons of the selection of the award program

Environmentally responsible projects which are previously evaluated by Canada Green Building Council (CaGBC) and certified LEED Gold and Platinum according to certain criteria specifying the degree of their succession following the sustainability factors are the target projects. Also, a professional architectural institute (RAIC) is responsible for the judgment.

Mainly focused on energy efficiency as the project is assessed by CaGBC firstly, the award program strictly defines five principles for the winning project in order to present it as the green one.

3.5 Comparative evaluation of the awards and their principles

All four award programs have their own evaluation framework in order to specify the winner project. In fact, the founders of the award or the jury members are defining a green building with specific criteria at first. Then, they put the nominated building in this context and judge whether it is attuned to the definition or not. It means that the important part of the process is to narrow down a correct and comprehensive framework so that the evaluation could be done the best.

Among the chosen award programs, Holcim award defines and fixes the most comprehensive and clear conceptual framework for its evaluation putting the base on progress, people, planet, prosperity and proficiency. Coming to the other ones, they do not encompass the all five bases of Holcim Award, as Top Ten Green Buildings does not focus on proficiency, and prosperity and proficiency are not included in the framework of Green Building Award by RAIC. SAB Canadian Green Building also follows all five bases but just in a few factors.

[99] Royal Architectural Institute of Canada official website, "Awards of Excellence", http://www.raic.org/honours_and_awards/awards_raic_awards/2013call/index_e.htm (accessed: November 28, 2012)

Table 1: Comparison of the four awards in the Holcim conceptual framework (by the author)

Target issues \ Awards	Holcim Award	Top Ten Green Building	SAB Canadian Green Building	Green Building Award by RAIC
Progress Innovation and Transferability	*	*	*	*
People Ethical Standards and Social Equity	*	*	*	*
Planet Environmental Quality and Resource Efficiency	*	*	*	*
Prosperity Economic Performance and Compatibility	*	*	*	-
Proficiency Contextual and Aesthetic Impact	*	-	*	-

Table 2: Comparison of the criteria specified in four award program (by the author)

	Criteria	Holcim Award	Top Ten Green Building	SAB Canadian Green Building	Green Building Award by RAIC
Progress	Innovative concepts	*	*	-	-
	Outstanding approaches	*	*	-	*
	Contribution to construction disciplines (architecture, landscape architecture, engineering, …)	*	-	-	*
Innovation and Transferability	Fulfillment of the initial expectations and goals	*	-	-	-
	Public exposure (documentation, communication, education)	*	*	-	-
	Life cycle consideration	-	-	*	-
-People	Supporting the ethical standards	*	*	*	*
	The role in social formation and community values	*	*	*	*
Ethical Standards and Social Equity	Quality of user's indoor conditions (comfort)	*	*	-	*
	Political transparency	*	-	-	-
Planet	Low environmental impact and conservation of natural characteristics	*	*	*	*
	Energy efficiency (resource efficiency in construction, operation and maintenance)	*	*	*	*
Environmental Quality and Resource Efficiency	Material efficiency (resource efficiency in construction, operation and maintenance)	*	*	*	*
	Land use efficiency	*	*	*	*
	Use of renewable energy	*	*	*	*
	Interior space quality (light and air)	-	*	*	*
	Reduction of carbon footprint	-	*	-	-
Prosperity	Financial resources (sufficiency and flexibility)	*	-	-	-
Economic Performance and Compatibility	Economic steadiness	*	*	*	-
	Performance flexibility	*	-	-	-
Proficiency	Architectural quality and aesthetic impact (space, form, light and ambiance)	*	-	-	-
	Careful restoration and modification	*	-	-	-
Contextual and Aesthetic Impact	Programming strategies (use, multiplicity of functions, flexibility and change)	*	-	*	-
	Reciprocal relation between architecture, landscape, urban fabric and infrastructure)	*	-	-	-

Defining a green building which is facing with the present problems worldwide is a critical and also very difficult issue. According to the definition, the specs and criteria are specified so that solutions can be generated for the existing problems and new problems do not exist. The selected award programs in this study have also prepared their own framework and the criteria and specifications. In a comprehensive comparison of all four awards, the principles which are the most and the least focused on to define the green building are obtained.

Having a look at the comparison table, it is observed that the principles relating to environmental quality and resource efficiency (planet) and ethical standards and social equity (people) are covered in all four samples, and among them, there are many principles that are the most recurrent ones.

Low environmental impact and conservation of natural characteristics, energy and material efficiency (resource efficiency in construction, operation and maintenance), land use efficiency, use of renewable energy, in category related to planet, and supporting the ethical standards and the role in social formation and community values, in people category, are all common in four award's principles, and they can constitute a general frame for a green building.

There are a few other factors which are mentioned in three of the programs as outstanding approaches, public exposure (documentation, communication, education), quality of user's conditions (comfort), interior space quality (light and air) and economic steadiness. In the next step, innovative concepts and programming strategies (use, multiplicity of functions, flexibility and change) are just mentioned in two of the award programs.

Finally, the least recurrent principles in the comparison -which seem less important among the others- are fulfillment of the initial expectations and goals, life cycle consideration, political transparency, reduction of carbon footprint, financial resources (sufficiency and flexibility), performance flexibility, architectural quality and aesthetic impact (space, form, light and ambiance), careful restoration and modification and also reciprocal relation between architecture, landscape, urban fabric and infrastructure.

3.5.1 Defining the principles of a green building

According to the information and comparison of the mentioned factors, the set of principles defining a green building is extracted as follows:

- Low environmental impact and conservation of natural characteristics
- Energy efficiency (resource efficiency in construction, operation and maintenance)
- Material efficiency (resource efficiency in construction, operation and maintenance)
- Land use efficiency
- Use of renewable energy
- Supporting the ethical standards
- The role in social formation and community values

The above common principles in awards studied above can represent a green building facing with the present problems according to the programs' framework. But whether the stated seven principles are sufficient for naming a building "green" or not is another question to be discussed.

There are many of principles in the award programs which may not be present in all of them, but I think that they could or should be among the principles defining the green building. As a response to the present conditions in the world, in the items mentioned in three of the awards, outstanding approaches, quality of user's conditions (comfort), interior space quality (light and air) and economic steadiness should be among the principles defining green building. Reduction of carbon footprint, and architectural quality and aesthetic impact (space, form, light

and ambiance) are the factors that are stated only in one evaluation program, but it seems coherent and reasonable to have those in the set of principles of green building I believe.

As a result of the evaluation of the criteria specified by the selected green design awards in this study, it is intended to draw a framework of principles for defining a green building definitely and clearly.. For this aim, a set of principles is proposed based on the selected green awards..

As the result of analysis and evaluation in this study, the principles defining "green building" are listed as follows:

- Low environmental impact and conservation of natural characteristics
- Energy efficiency
- Material efficiency
- Land use efficiency
- Use of renewable energy
- Supporting the ethical standards
- The role in social formation and community values
- Outstanding approaches
- Quality of user's conditions (comfort),
- Interior space quality (light and air)
- Economic steadiness
- Reduction of carbon footprint
- Architectural quality and aesthetic impact (space, form, light and ambiance)

The all above principles are directed to design and construct buildings for the living of the mankind in a healthier and more efficient environment, covering the construction, operation and maintenance and destruction stages on the basis of the award programs.

CHAPTER4

CASE STUDIES

Every award program is specifying its own criteria to reach the project best representing the principles of a green one. The basic set of principles defining the green buildings is extracted comparing the principles mentioned in all four analyzed award programs as

- Low environmental impact and conservation of natural characteristics
- Energy efficiency
- Material efficiency
- Land use efficiency
- Use of renewable energy
- Supporting the ethical standards
- The role in social formation and community values

Besides, there are secondary principles which are focused just in a few of them but they may be important factors in designing green, as outstanding approaches, quality of user's conditions (comfort), interior space quality (light and air), economic steadiness, reduction of carbon footprint, architectural quality and aesthetic impact (space, form, light and ambiance).

In the present survey, the projects of the year 2011 are at the center of concentration as the case studies. Four projects, one per each analyzed award, are selected in order to be introduced and analyzed. Every green masterpiece is selected and preferred not only because of being awarded but also because of owning other especial features, strength points or other successions for their design construction.

The preferred building and the selection reasons will be explained. The features of the building recalling a green one will be analyzed. The search for green principles extracted from the award programs in the selected building will be done. Also, some questions will be answered such as, whether it deserves the award it has gained, besides, whether it can be among the awarded projects of other three award programs according to their evaluation criteria.

Vancouver Convention Center West, winner of Top Ten Green Building award, the Secondary school with passive system in Burkina Faso, winner of the Holcim Foundation award, Creekside Community Recreation Centre, winner of SAB Canadian Green Building Award and also, Durham Consolidated Courthouse, winner of Green Building Award by Royal Architectural Institute of Canada are the four buildings selected as the case studies.

4.1 Case 1: Vancouver Convention Center West

4.1.1 Introducing the building

Vancouver Convention Center West is preferred for this study since it became the first Convention Center to achieve LEED® Canada Platinum certification in 2010. Also, it was located among the ten projects of best green design (Top Ten Green Buildings) protecting and enhancing environment announced by COTE (AIA's committee) in 12-14 May 2011, national convention and design exposition in New Orleans. Besides, this convention center extends on land and over water.

In the northern waterfront edge of downtown, the intersection point of the urban fabric and the labor with its amazing natural features of Vancouver, in North America, Canada is the location of Vancouver Convention Center. 1986 was the start point of the activities of the Convention Center. In April 2009, the new building, the West building combined to it which was a project of BC Pavilion Corporation (PavCo), a Crown Corporation of the Province of British Columbia and designed and built by LMN Architects in collaboration with Musson Cattel Mackey Partnership (MCM) and DA Architects and Planners.[100]

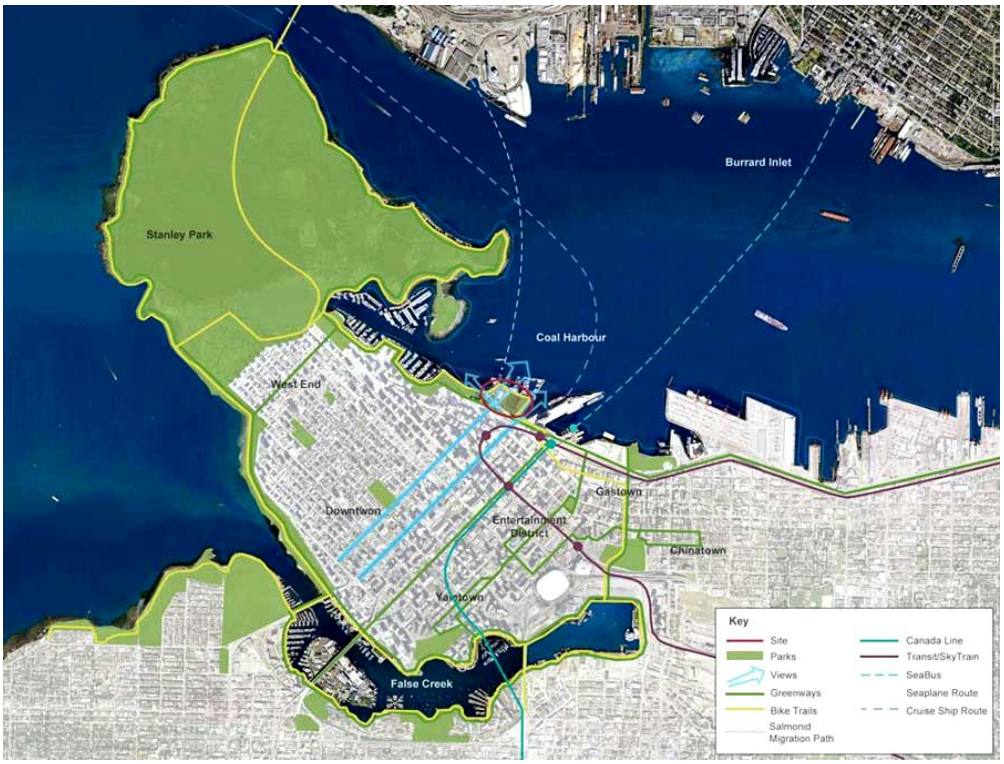

Figure 2: Location of the Vancouver Convention Center in city scale, Canada (www.e-architect.co.uk)

[100] Architecture News: Buildings from around the Globe, "Vancouver Convention Centre West, Canada: Architecture", http://www.e-architect.co.uk/canada/vancouver_convention_centre_west.htm (accessed: December 10, 2012)

Figure 3: Location and view of the Vancouver Convention Center next to the harbor (www.e-architect.co.uk)

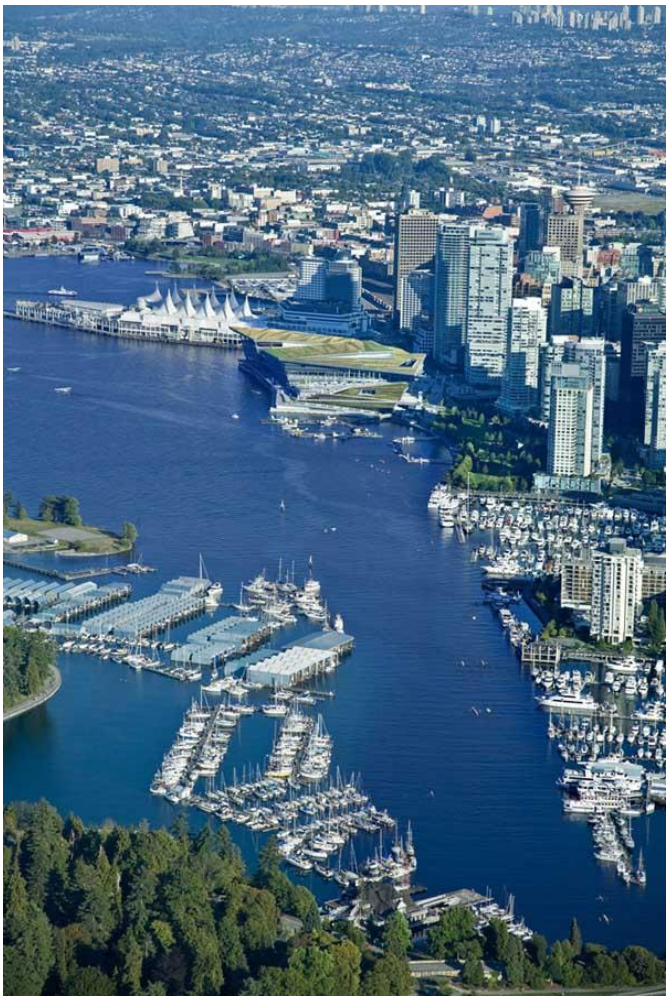

Figure 4: View of the Convention Center and its location in the city texture (www.e-architect.co.uk)

4.1.2 Representing the architecture and function of the building

Mark Reddington, FAIA, LMN partner believes that "the design goes far beyond the big box functionality and experience of a traditional convention centre."[101] Two buildings with more than 466,500 square feet of highly flexible function space form the facility. A series of modules in both the East and the West Buildings offer the highest degree of flexibility, in result, and they can be combined or divided to suit the needs of any event.

Table 3: Function and Meeting Space Overview (www.vancouverconventioncentre.com)

Function Space	West Building	East Building	Combined Facility
Exhibit Space	220,500 ft² 20,485 m²	91,000 ft² 8,500 m²	311,500 ft² 28,940 m²
Meeting Space	60,000 ft² 5,600 m²	25,000 ft² 2,300 m²	85,000 ft² 7,900 m²
# of Meeting Rooms	52	20	72
Signature Ballroom Space	53,000 ft² 4,920 m²	17,000 ft² 1,600 m²	70,000 ft² 6,500 m²
Total	333,500 ft² 30,980 m²	133,000 ft² 12,400 m²	466,500 ft² 43,340 m²

Figure 5: View of Vancouver Convention Center West over the water (www.e-architect.co.uk)

[101] Architecture News: Buildings from around the Globe, "Vancouver Convention Centre West, Canada: Architecture", http://www.e-architect.co.uk/canada/vancouver_convention_centre_west.htm (accessed: December 10, 2012)

Figure 6: Building's plans and sections (www.archdaily.net)

4.1.3 Defined green principles in the project

Mark Reddington believes that

> it offers a new vision of sustainability and a rich public experience by weaving together the natural ecology, local culture, urban context, and building program in a unified whole that functions literally as a living part of both the city and the harbor.[102]

Top Ten Green Award is monitoring the features of this convention center supporting ten measures of the program and calls it as a green one. Also, the designers of the project express clearly six principles as "ecology-based land use", "water balance", "healthy human ecology", "inspiration", "durability and adaptability" and also "vibrant communities" which make the Vancouver Convention Center green.[103]

In this study, the search for and analyze of features of the project supporting the green principles extracted from the comparison of the awards is foreseen.

Low environmental impact and conservation of natural characteristics

The convention center has been designed and built as the extension of the urban texture over the water, but despite of entering the water ecosystem, it does not damage it. On the contrary, the designed reef in the shoreline, keep the nature and ecology of it supporting marine species.

[102] Architecture News: Buildings from around the Globe, "Vancouver Convention Centre West, Canada: Architecture", http://www.e-architect.co.uk/canada/vancouver_convention_centre_west.htm (accessed: December 10, 2012)
[103] LMN Architects Official Website, "What makes it green?" http://lmnarchitects.com/exploration/whatmakesitgreen-vccw (accessed: December 10, 2012)

Energy efficiency

The constant temperature of seawater is used in the building for the heat-pump system, and its temperature is maintained according to the seasonal conditions.

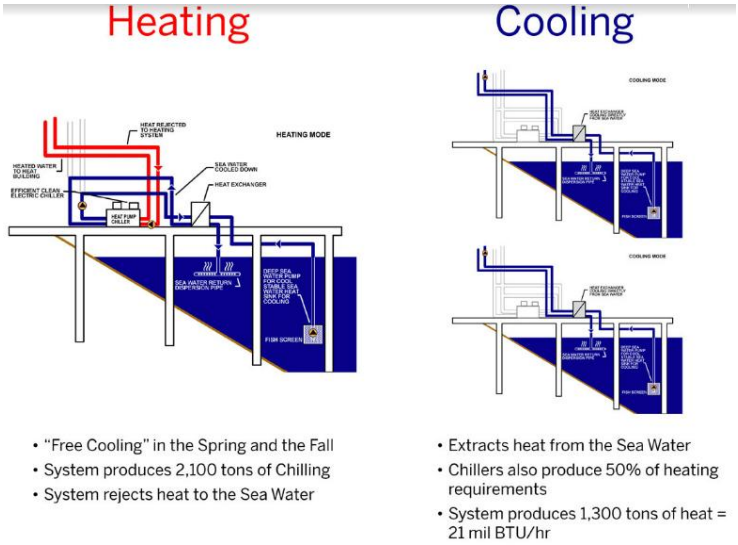

Figure 7: Heating and cooling system of the convention center (www.lmnarchitects.com)

Material efficiency

The natural materials of the region of British Columbia are used expressively in the interior spaces, about 20%. Also, use of recyclable and renewable materials is maximized to almost 16%.

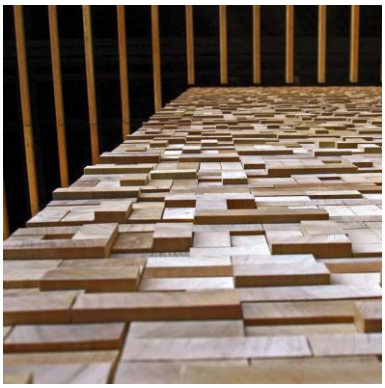

Figure 8: Materials used in the interior spaces (www.e-architect.co.uk)

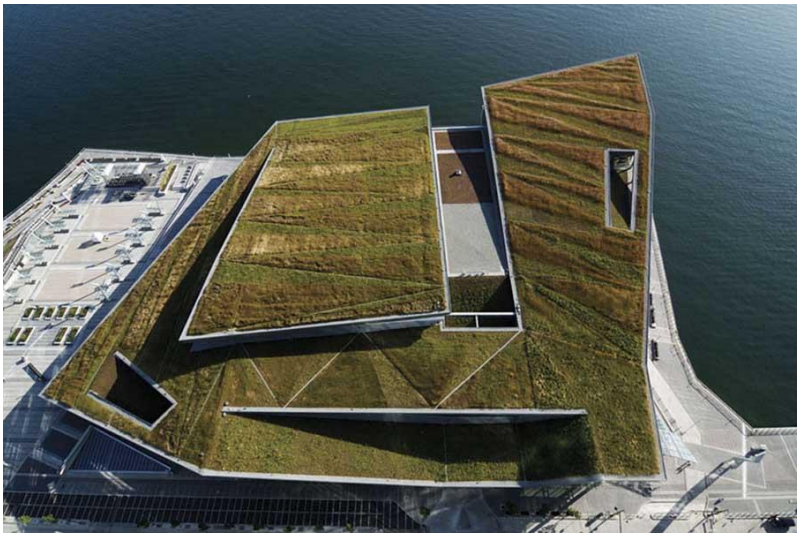

Figure 9: Six-acre green roof of the convention center (www.e-architect.co.uk)

Land use efficiency

The six-acre green roof of the center, the largest in Canada and its sloping form which follows the topography of the region and is linked with the surrounding mountainous area presents its deep approach to ecology.

The natural habitat in the green roof with more than 400000 kinds of local plants is continuous between the Convention Center, nearby Stanley Park and North Shore Mountains and preserves site ecology.

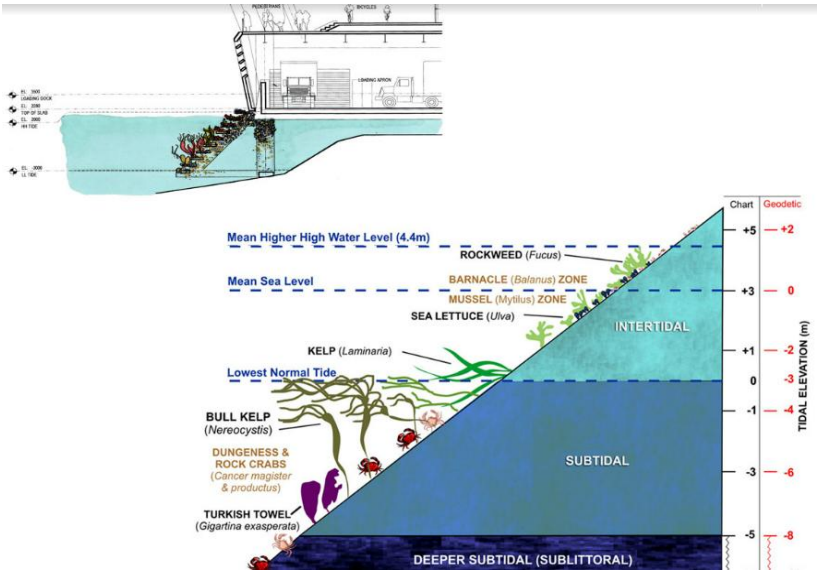

Figure 10: The marine habitat on the seashore (www.lmnarchitects.com)

Use of renewable energy

On the living roof of the center, an irrigation system installed which is ultra-efficient and ensures that use of recycled water in times of need the most effectively.

Supporting the ethical standards

The situation of the building in water front and the existent atmosphere as in view axes all create ethical motive for the users of the building, as an individual one or in public.

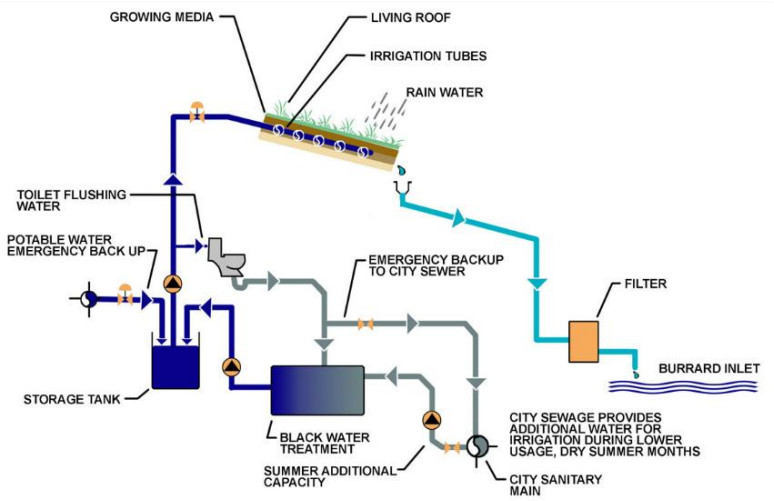

Figure 11: Water circulation (www.lmnarchitects.com)

The role in social formation and community values

The convention center is the mixture of an ecosystem, a building, a park and an urban place. It owns public and private places and it is the first public space over water in Vancouver. In and around its site, urban pedestrian activities extend and view corridors are supported and preserved with the help of ultra-clear glass skin of the building.[104]

Analyze of seven principles above and the response of the building represents the Vancouver Convention Center as a green one according to this thesis study, but it is questionable that whether the secondary principles which were defined as the possible principles of a green building in the previous chapter are included in the features of the project or not.

Among those principles, interior space quality is focused in the building. The ultra-clear structural glass skin of the convention center results in extensive daylight usage in the interior spaces which is about 23% of the spaces. Besides, in order to control the air quality, temperature and lighting controllers and also, humidity, CO2 and VOC sensors are installed in the interior spaces. Superior air conditioning is observed using suitable flooring and also operable windows and doors in the façade. Other than interior space quality, aesthetical considerations are perceived by the evaluating committee of AIA award.[105]

[104]LMN Architects and Top Ten Green Award Official websites, http://lmnarchitects.com and http://www2.aiatopten.org/hpb/overview.cfm?ProjectID=1970
[105]Top Ten Green Award Official Website, http://www2.aiatopten.org/hpb/overview.cfm?ProjectID=1970

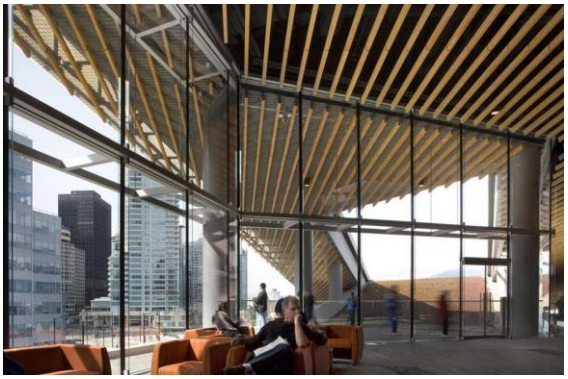

Figure 12: Natural lightening in the interior space (www.e-architect.co.uk)

4.2 Case 2: Secondary school with passive system, Ganda, Burkino Faso

4.2.1 Introducing the building

The secondary school in Gando is selected for this thesis since it is the winner of the 2011 Holcim regional (Africa Middle East) award. Also, it obtained Global Gold Holcim Award in 2012. Another preference reason is its sustainable design in a poor place, which it may be difficult to design or build what architect wants. And also, as the architect of the project claims, it is dealing with two cultures, German culture, the place of designers and financial support of the building, and Burkino Faso culture, which is one of the world's poorest countries.

The Secondary school with passive ventilation system is part of the ongoing project promoting the educational conditions as the beginning of development in village of Gonda which is designed by native architect Diébédo Francis Kéré **(**Germany based Kéré Architecture) who was the only person going to school . Gando, in the southern plains of Burkino Faso is a rural area which does not have any secondary education facilities. The goal of the school was to provide access to secondary education and jobs following the footsteps of Kéré. Complex was constructed in May, 2011.

Figure 13: Secondary school designed by Diébédo Francis Kéré (www.klewel.com)

Figure 14: Site plan of the school (www.aeccafe.com)

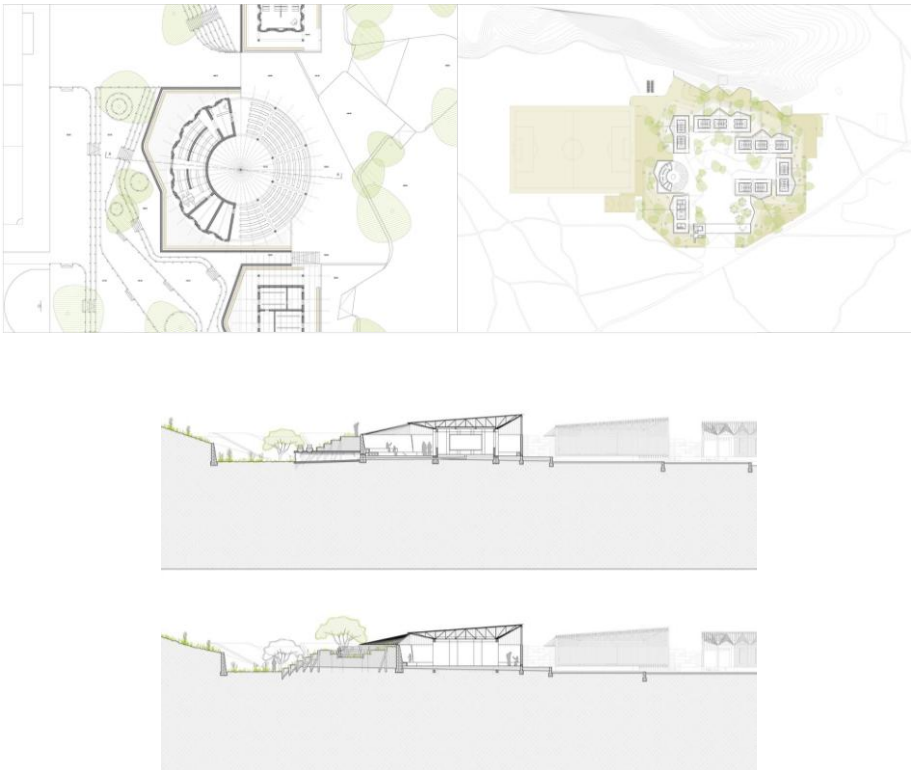

Figure 15: Plan and section of school and its library (www.aeccafe.com)

4.2.2 Representing the architecture and function of the building

The design of the school was the development of the previous projects as primary school and teachers' accommodation and it has simple and low-technological techniques and the structure of the complex is developed in the rural context of the traditional compounds. It is a response to the local culture and challenging weather conditions. The school complex is composed of seven buildings around a courtyard which are built with simple but innovative techniques.

Figure 16: Entrance of the project (www.aeccafe.com)

Figure 17: Section of the school complex (www.architectureindevelopment.org)

Figure 18: Bird view of the school complex (www.architectureindevelopment.org)

4.2.3 Defined green principles in the project

Diébédo Francis Kéré, the architect of the project says that:

> Using the knowledge gained in Germany, my intention was to achieve sustainability by emphasizing the use of local materials, the adaptation of new technology in a simple way, and through inherent potential of the local community.[106]

The secondary school with passive ventilation system is the project focused on goals which may create sustainable environment for a community that have a difficult living conditions. In this part of study, the school building is evaluated according to the extracted green principles in previous chapter.

Figure 19: Courtyard of the school complex (www.aeccafe.com)

Low environmental impact and conservation of natural characteristics

In order to preserve the natural environment and prevent erosion and desertification, reforestation is an important step in the construction process. The selected kind of tree for this purpose is mango tree that does not soak up much water and provide more shade.

Energy efficiency

The challenging weather of the area and shade temperature of almost 40 degrees forces the designers to have a solution and keep the building cool. Providing shade by planting trees in the courtyard and utilization of natural ventilation help the users of the building solve their temperature problem without energy use.

Also, during construction and operation, energy consumption is reduced to the possible minimum amount using only the sun and wind.

Also, the round structures of the compounds are enclosed in the countryside. It is sheltered towards the wind from the East which is dusty and hot but the structure is opened to the fresh

[106] Diébédo Francis Kéré, "School in Gando, Burkino Faso", *Journal of Architectural Design*, Volume 82, Issue6, November/December 2012, (Online published: 5 Nov 2012), http://onlinelibrary.wiley.com/doi/10.1002/ad.1496/pdf (accessed: January 5, 2013), p67

wind coming from the West. Using wind energy for natural ventilation is a traditional knowledge and plays an important role in the project.

Material efficiency

In the construction of the building, local materials are mostly used which can be accessed easily and cheaply, like mud bricks used in walls, clay utilized in roof and granite stones for the base.

Also, there is an attention for the usage of water which extinct in the region. Usage of traditional clay pots with drippers near the trees in the school courtyard and also in the environment around results in reaching the water directly and gradually to the roots of the trees and minimizing the water loss.

The scarce rainwater is collected and is integrated into the planting concept and is being irrigated in newly-planted trees.

Figure 20: Traditional clay used in construction (www.klewel.com)

Land use efficiency

The direction of the beneficial and useless winds in the site of the project has essential role in the construction of building.

Use of renewable energy

Renewable energies are not preferred in the design and construction of the school.

Supporting the ethical standards

In a poor region with no educational opportunities, the construction of this school and previous similar projects is a great step in the development of the unwise natives and it became place of meeting, learning and teaching.

The role in social formation and community values

In the construction of the school complex, native men and women are involved, and they do it importing their local culture in the process of construction. The young people became trained about construction techniques and it became a perfect model of community work.

Figure 21: Participation of the people in the construction (www.aeccafe.com)

Among the seven principles above to be a green one, this secondary school just does not use renewable energies, but its essential feature is among the secondary green principles extracted in this study which is interior space quality. Also, innovative approaches are observed in building design and construction.

In a region with high daytime temperatures, keeping the building is an important factor. A clay roof and the overlapping corrugated iron roof below it prevent the rain sideswiping the walls. Overlapping is making the air circulation below it, and hole of the clay roof permit the hot weather to exit. Wind blowing in the perforated pipes beneath the earth, moisture and cooled by tree roots is brought to the classrooms through the holes in the floor, and results in reducing temperature about 5 degrees.[107]

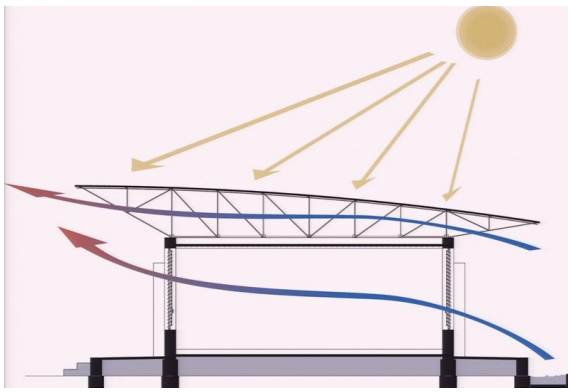

Figure 22: Air pattern in building (www.klewel.com)

[107] From sources as http://www.holcimfoundation.org, http://architectureindevelopment.org, and http://www.kerearchitecture.com

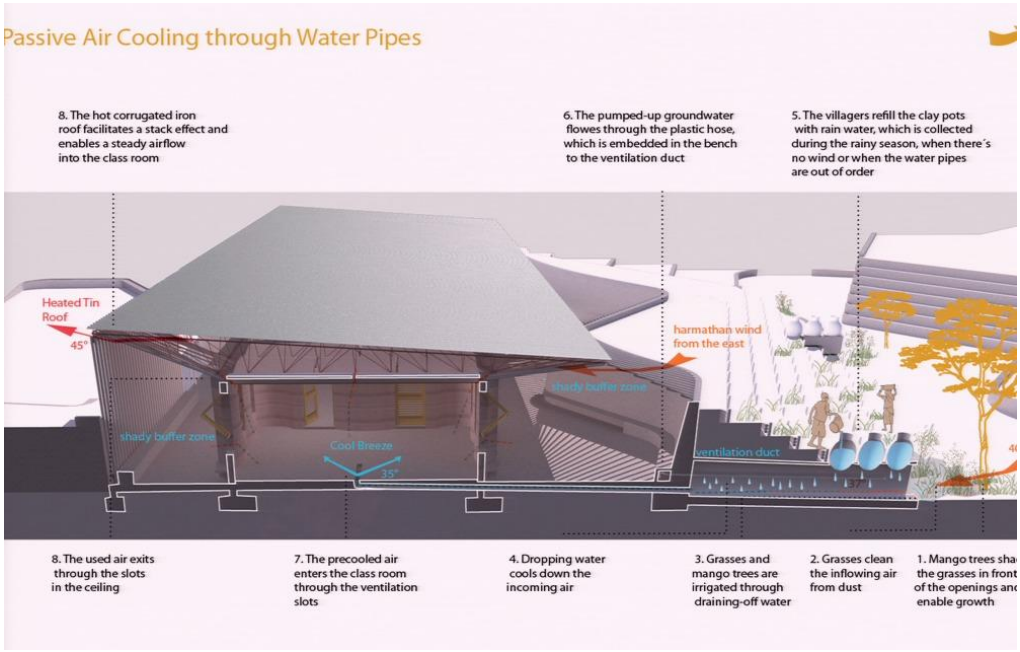

Figure 23: Passive air cooling through water pipes (www.klewel.com)

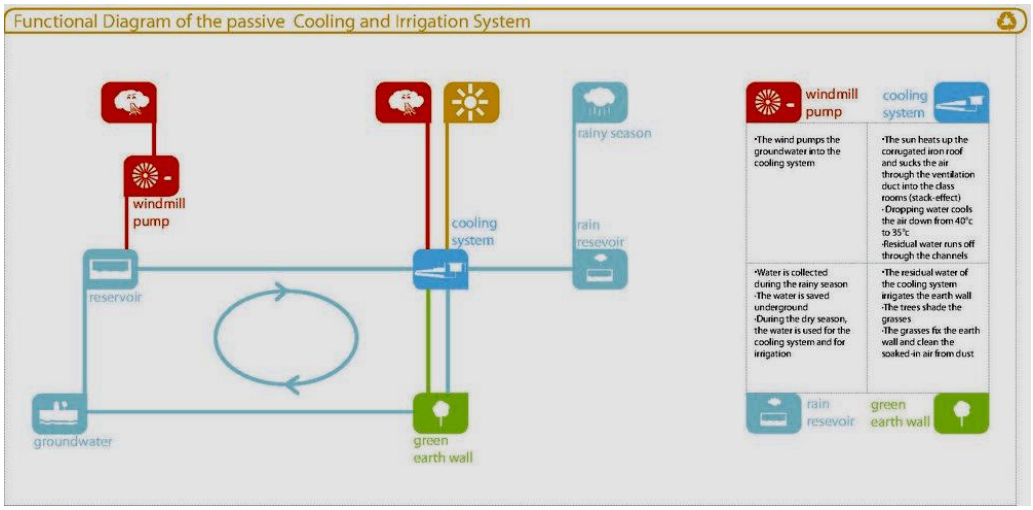

Figure 24: Functional diagram of the passive cooling and irrigation system (www.aeccafe.com)

4.3 Case 3: Creekside Community Centre, Vancouver, British Columbia

4.3.1 Introducing the building

Creekside Community Centre is selected for this thesis study since it is winner of the 2011 SAB Canadian Green Building Award. Also, it is the first community centre in Canada achieving LEED Platinum, and it is an attempt to preserve the waterfront for public access and use.

It is a project that is designed by Nick Milkovich Architects Inc. and Walter Francl Architecture for Vancouver Board of Parks and Recreation. It is located on the southeast shore of False Creek, the former industrial land, as a public building and part of the redevelopment process.[108] It was constructed in 2009 and was part of the Athlete's Village development designed for the 2010 Winter Olympic Games.

Figure 25: Creekside Community Centre in waterfront of Vancouver (www.sabmagazine.com)

4.3.2 Representing the architecture and function of the building

In a site with approximately 105m long and 34m deep, it has a long façade facing to environments. Southern facade is facing the urban street and northern one which is curved is facing the waterfront.

With its 44,000 square foot area, the core elements of community centre include: a gymnasium, activity and meeting rooms, and a fitness room. Associated services and administrative spaces are attached. The activities of a boating centre to serve the local paddling and rowing community with a 4,500 square foot area, neighborhood child-care facility with an 8,000 square foot area, and restaurant/dining terrace with a 6,000 square foot area, and parking

[108] SAB Magazine Official Website, "2011 SAB Canadian Green Building Awards projects shape future of green building", http://sabmagazine.com/winners-2011.html, (accessed: January 10, 2013)

located below grade are included in the project. Vegetating 50% of the site area is one of the essential goals of the project.[109]

The discrete program elements of this facility could be operated autonomously when it is necessary but also, it could operate within a single building around shared circulation and public spaces.[110]

Figure 26: Plans of the community centre (sabmagazine.com)

4.3.3 Defined green principles in the project

As a project getting LEED certification and gaining green award, it is obvious that several green principles are observed in its design and construction. The set of principles defining green building according to the previous chapter and the awards' comparison process are sought in this part of study.

Low environmental impact and conservation of natural characteristics

An important goal in the building is vegetating 50% of the site using extensive green walls, green roofs and also grade planting in order to create an environment for wildlife habitat, to reduce the heat island and to slow the storm water discharge.

[109] SAB Magazine Official Website, "2011 SAB Award winner - Creekside Community Centre", http://www.sabmagazine.com/blog/2011/08/10/2011-sab-award-winner-creekside-community-centre/ (accessed: January 10, 2013)

[110] Milkovich architects Official Website, "Creekside Community Centre", http://www.milkovicharchitects.com/projects/cultural-creekside-community-centre.php (accessed: January 15, 2013)

Figure 27: Green roof of the community centre and the solar collectors next to it (www.milkovicharchitects.com)

Energy efficiency

A low-intensity radiant slab and ceiling system is heating the community building. The district heating system in the building's neighborhood accompanying with vacuum-tube solar thermal collectors increase the water temperature until about 40 degree.

Material efficiency

The storm water is collected in the basement and it is used for irrigating the vegetation and also for toilet flushing, then, potable water is not used for irrigation. It may be used rarely when the gathered water is insufficient.

Also, durable materials such as concrete and zinc are selected for the construction of the building's skin. In its interior space, rapidly renewable materials such as bamboo plywood are used.

Land use efficiency

Locating in the waterfront and having access to water may be the dependance of the building to the site.

Use of renewable energy

Renewable energy is preferred in this community centre and it is used in vacuum-tube solar thermal collectors.

Figure 28: Solar collectors on the roof the centre (www.michael-elkan.photoshelter.com)

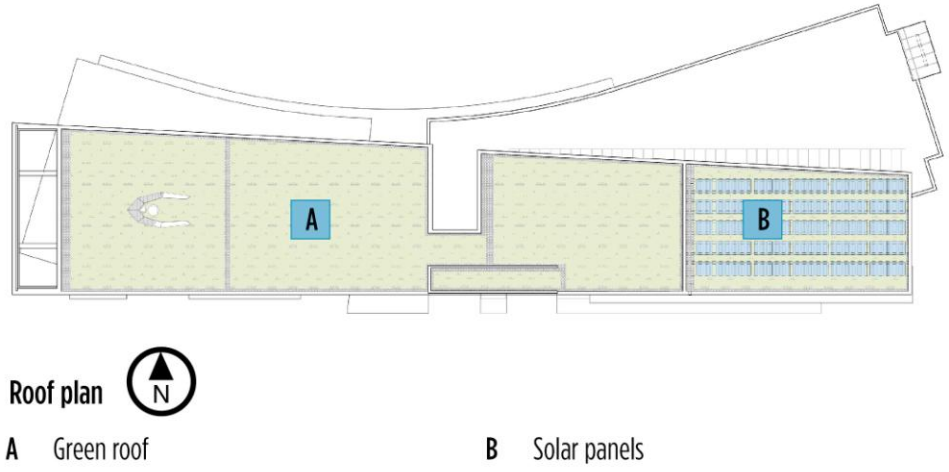

Figure 29: Green roof and solar panels of the community centre (www.sabmagazine.com)

Supporting the ethical standards

The Creekside Community Centre, as a public place with the recreational goals can have a great role in people's morality.

The role in social formation and community values

The design of the Creekside Community Centre is a positive response to the physical context of the city, and results specifically in the reaffirmation of public ownership of Vancouver's urban waterfront.

The all seven defined green principles in this study are observed in the design of Creekside Community recreational centre and it can be called as a green project accordingly. Moreover, innovative approaches stated in secondary principles are considered in its innovative mechanical systems. Also, the interior space quality is at the point of attention. Natural light is brought to the most of interior spaces by accurate selection of the size and position of the

windows. Natural and mechanical outdoor air displacement ventilation provides air ventilation in the project. The direction of the air circulation is from the cooler place, north side of the building. Passive cooling strategies are preferred for the community centre.[111]

Figure 30: Openings in the facade of the centre (milkovicharchitects.com)

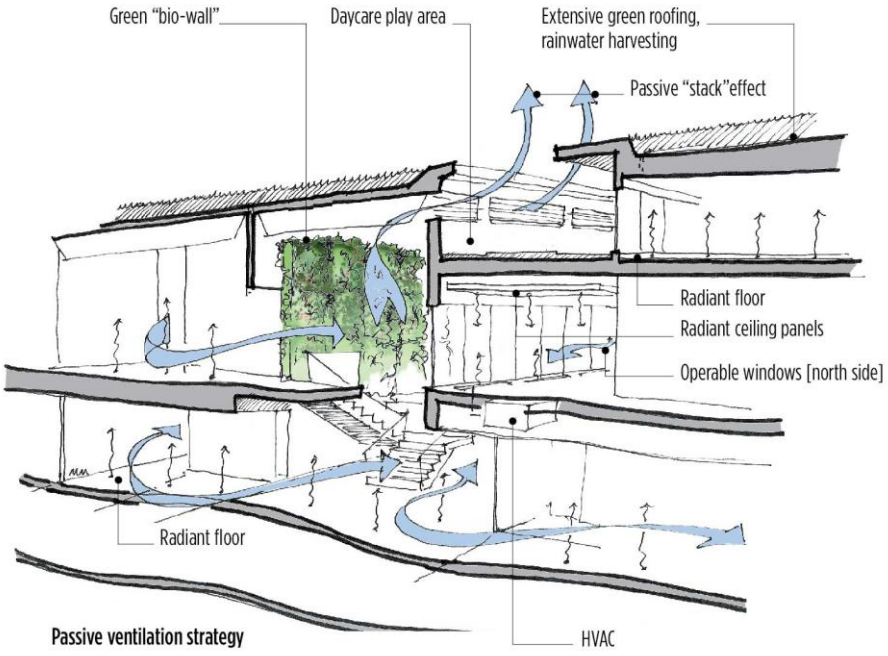

Figure 31: Passive ventilation strategy (www.sabmagazine.com)

[111] From sources as http://www.sabmagazine.com and http://www.integralgroup.com

4.4 Case 4: Durham Consolidated Courthouse

4.4.1 Introducing the building

Durham Consolidated Courthouse is preferred for this study since besides gaining award of excellence, green building by Royal Architectural Institute of Canada in 2011, it gained several awards such as 2011 Brownie Award in Financing, Risk Management & Partnerships Category by Canadian Urban Institute, 2011 Innovation & Excellence in Infrastructure Development - Silver Award by Canadian Council for Public-Private Partnerships, Award of Merit - Project Financing by Canadian Council for Public-Private Partnerships and finally, Justice Facility Review 2008 by American Institute of Architecture. Also, it is Ontario's first governmental building which received the Canada Green Building Council's (CaGBC's) LEED Silver certification for its energy-efficient design. Furthermore, the project is the first LEED NC Gold completed provincial government building.

Figure 32: Durham Consolidated Courthouse in Ontario (www.archdaily.com)

The Durham Consolidated Courthouse was designed by WZMH Architects in downtown Oshawa, Ontario in Canada, and completed in January 2010. Its client was Access Justice Durham and it cost 190000000 dollars.[112] It is bounded by Carriage Works Drive on the west, Bond Street on the south and Division Street on the east.

4.4.2 Representing the architecture and function of the building

Jury of the green award comments that;

> This building revitalizes the downtown core and provides a contextual response to a complex architectural challenge. The project provides landscaped open areas and a gateway to the downtown.

[112] PCL Construction Leaders Official Website, "Durham Consolidated Courthouse", http://www.pcl.com/Projects-that-Inspire/Pages/Durham-Consolidated-Courthouse.aspx#, (accessed: January 15, 2013)

The modern building is a large mass in the urban context. It is a six-storey construction with the area of about 40000 m2. There are two and three storey structures to the south and east. An outdoor public space with large dimensions as Courthouse Square is the entrance of the building and a forecourt. Also, there are 33 courtrooms in the structure in order to support the prisoner-holding facilities. Most of the high-volume functions are located at the grade level or very close to it in order to have efficiency in planning. The new "back to back" typology for a typical courtroom arrangement in the floor of the project results in short walking distances for staff and judges.[113]

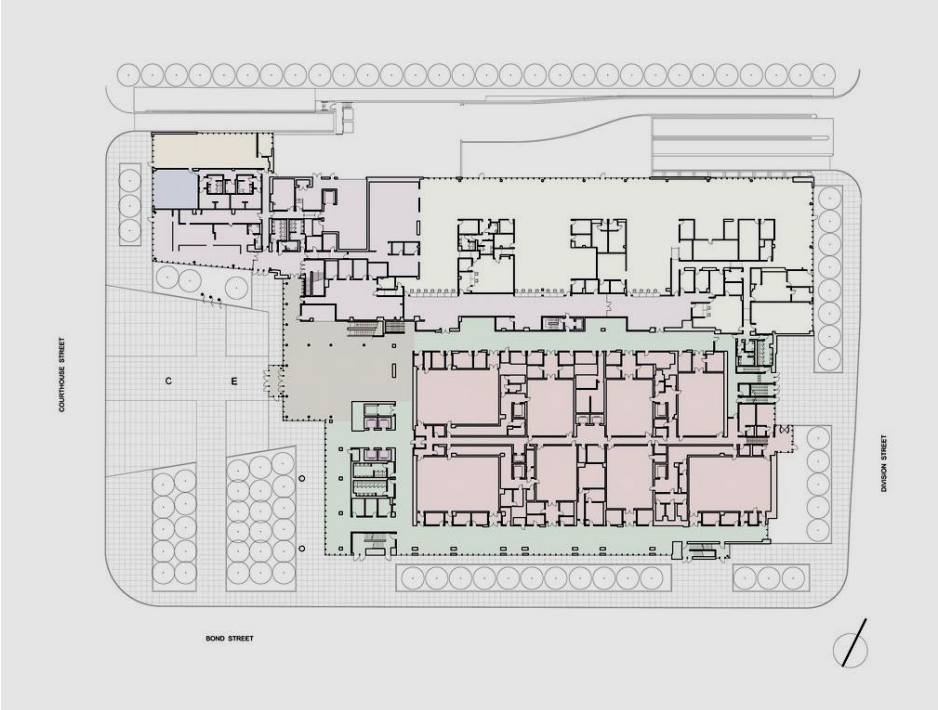

Figure 33: Plan of the Durham Consolidated Courthouse (www.arthitectural.com)

Figure 34: South and west elevation of the Courthouse (www.arthitectural.com)

[113] Royal Architectural Institute of Canada official website, "2011 Awards of Excellence", http://www.raic.org/honours_and_awards/awards_raic_awards/2011recipients/durham_e.htm, (accessed: January 15, 2013)

Figure 35: Views of the courthouse (www.canadianarchitect.com)

4.4.3 Defined green principles in the project

As a project getting LEED-NC Gold certification and gaining green award, it is obvious that several green principles are observed in its design and construction. The set of principles defining green building according to the previous chapter and the awards' comparison process are sought in this part of the thesis study.

Jury of the RAIC green building award comments that;

> In energy terms, the closest any project got to having a sustainability driver was with the Durham County Courthouse, where due to the P3 procurement method the constructors must efficiently operate the building for 30 years as part of the lowest cost bid. The Durham Consolidated Courthouse is also an accomplished piece of public architecture, and accordingly was selected as the top project.[114]

Low environmental impact and conservation of natural characteristics

Negative impacts on the environment are reduced with 700 square meters of green roof. The green surface helps to reduce natural energy use and to absorb storm water running off.

Figure 36: Green surface in the building (www.archdaily.com)

[114] Royal Architectural Institute of Canada official website, "2011 Awards of Excellence", http://www.raic.org/honours_and_awards/awards_raic_awards/2011recipients/durham_e.htm, (accessed: January 15, 2013)

Energy efficiency

An annual energy consumption target is created and the energy use exceeding the target will be paid for by Access Justice Durham, the building team responsible for the new courthouse.

Also, the transparency and openness of the skin of the building permits the light entering the interior spaces and this decreases the energy needed for lightening most of the spaces.

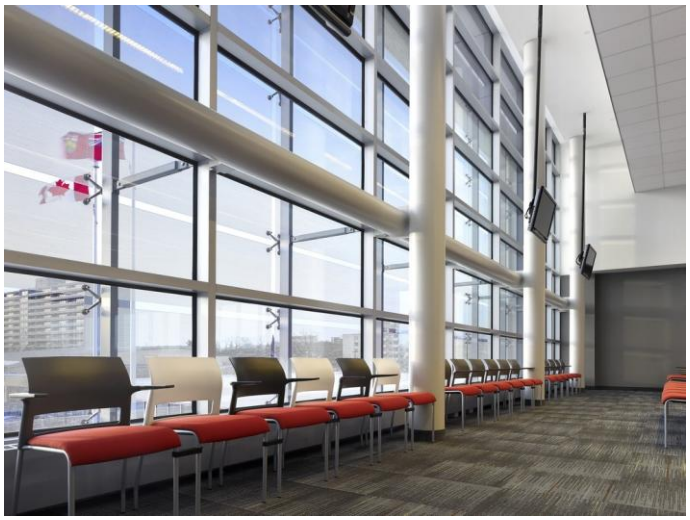

Figure 37: Natural lightening for the interior space (www.arthitectural.com)

Material efficiency

The used storm-water irrigation system reduces water demand in order to use rainwater to irrigate gardens and lawns. Also, usage of ultra low-flow plumbing fixtures, dual flush toilets and waterless urinals in washrooms all reduce the water use in the building.

Land use efficiency

Being in a suitable relationship with the surrounding urban framework and the linear park next to it makes its land use efficient.

Use of renewable energy

Re-use of the rain water in the building is observed.

Supporting the ethical standards

The Durham Consolidated Courthouse has become a space to solve the social and ethical problems of the users.

The reduction of the stress for the participants in court proceedings with the availability of daylight and views to the outside in the courtroom waiting areas is considered.

The role in social formation and community values

Maintaining wide open views to downtown Oshawa accompanying several courtyards especially the forefront one help the public use the facilities the best.

Figure 38: The central lobby maintains wide open views to downtown Oshawa. (www.canadianarchitect.com)

The all seven defined green principles in this thesis study are observed in the design of Durham Consolidated Courthouse and it can be called as a green project accordingly. Moreover, innovative approaches stated in secondary principles are considered in its innovative material use. The use of a reflective product reducing the surface temperature and the need for air conditioning in the interior spaces as Energy Star compliant roofing material is considered. It keeps the interior space comfortable. Besides, the interior space quality is at the point of attention. Natural light is brought to the most of interior spaces by accurate selection of the size and position of the windows. Natural and mechanical outdoor air displacement ventilation provides air ventilation in the project.[115]

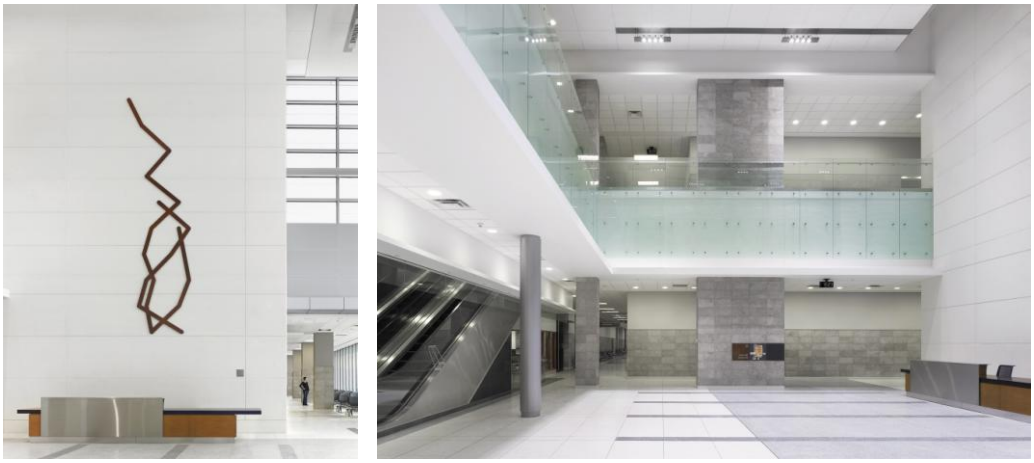

Figure 39: Interior space of the building (www.raic.org)

[115] From sources as http://www.canadianarchitect.com, http://urbantoronto.ca and http://www.archdaily.com

CHAPTER 5

CONCLUSION

In the process of green movement, different concepts such as ecological design, sustainable development and green design have been introduced into the practice of architecture. Ecological design is defined as "any form of design that minimizes environmentally destructive impacts by integrating itself with living processes"[116] and sustainable development as meeting "the needs of the present without compromising the ability of future generations to meet their own needs."[117]

But, coming to the more popular concept of "green", the critics and theoreticians are skeptical about it and refrain from defining green or green building, and most of the related interpretations are approximate ones.

It is stated from the architectural historian John Farmer in Begüm Yazgan's PhD thesis that "there is no conclusive definition of what green means" in architecture. Also, it is quoted from Colin Porteous that "the green architectural spectrum is then a relatively wide and overlapping one".[118]

Beside such statements, there are ones that try to interpret green or measure it, as James Wines believes that:

> In a majority of recent ecological buildings, green orthodoxy is measured by the degree of investment in energy-saving systems, the durability of construction materials, and the number of recycled products used in fabrication. The more obsessive supporters of technological solutions disdain aesthetic considerations as merely frivolous.[119]

What is now obvious is that, the attempts are toward specifying features and principles that could assert that a building which is green. Organizations and institutions involved in environmental issues each provide their own criteria in order to draw a green building. The organizations holding award programs are also among them, which specify green criteria and let the nominated buildings compete with each other according to those criteria.

Beside award programs, the certifications such as LEED and BREEAM by environmental organizations also evaluate the designed and constructed buildings. These programs are evaluating projects more quantitatively, but they do not compare the buildings with each other. They just maintain the amount of the succession of the green principles in buildings.

In this thesis study, four award programs were selected for analysis. Their approach to a green building and the green principles which are interpreted and used as the evaluation criteria in the competitions are studied.

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[116] Sim Van der Ryn and Stuart Cowan, *Ecological Design*, (Washington: Island Press, 1996), p34

[117] Terry Williamson, Antony Radford and Helen Bennetts, *Understanding Sustainable Architecture*, (London and New York: Spon Press, 2003; reprint: 2004), p4

[118] Begüm Yazgan, "Post -War Systems Ecology and Environmentally - Appropriate Approaches in Architecture Since 1960's", (Ph.D. diss., Middle East Technical University, 2006, supervised by Prof. F. Cânâ Bilsel), p1

[119] James Wines, *Green Architecture*, (Köln:Taschen, 2008), p226-7

Four award programs as Top Ten Green Projects Award by American Institute of Architects (AIA), Holcim Awards for Sustainable Construction by Holcim Foundation, Green Building Award by Royal Architectural Institute of Canada and SAB Canadian Green Building Award were chosen for further analysis. Their definition of a green building and the parameters which are specified and the evaluation criteria formulated in the competitions are studied in detail.

It is concluded that the evaluation criteria defined principles for a building to be evaluated as environmentally friendly, or "green." As the result of this survey and comparison of the criteria of the awards, a set of green principles is obtained, seven ones are essential and other six ones are the secondary principles. The extracted essential principles in this thesis study are as follows:

Low environmental impact and conservation of natural characteristics:

Each building as the man-made environment certainly has impacts on the environment according to its materials, construction and also its function. In order to be among the green ones, this should be the minimum. Also, in the same process, the natural characteristics of the environment around should be conserved. These characteristics can be natural materials and resources or natural form of the surrounding environment.

Energy efficiency:

Each building is ought to provide a series of services and most of the time, they are the goals of the construction and amounts of energy are required to support these services. Minimizing the amount of this energy represents the energy efficiency in the designed building.

Material efficiency:

Material selection is important in the process of construction. Using local materials which are accessible in the region should be preferred in a green building.

Land use efficiency:

The designers should pay attention to the community's needs and also the natural resources at the same time. In order to choose and adopt the best land-use options and the efficiency, a systematic assessment of land and water potential is preferred. Also, the possible neighborhood and district developments in the future are considered in a comprehensive and efficient land use planning.

Supporting the ethical standards:

Promoting behavioral and psychological values following some principles in a building with green aims is ought to be done.

Use of renewable energy:

As the energy resources in the world are limited, there must be the attention on their usage in the man-made environment. Energies such as solar energy should be utilized in the buildings' designs so that the deficiency in energy resources could be prevented.

The role in social formation and community values:

The social and economic conditions in the district and the cooperation of the building in the formation of the values are important, especially for a building which is claiming being green.

Table 4: Green principles extracted from principles (by the author)

Green Principles extracted from awards	
Essential principles	***Secondary principles***
Low environmental impact and conservation of natural characteristics	Outstanding approaches
Energy efficiency	Quality of users' conditions (comfort),
Material efficiency	Interior space quality (light and air)
Land use efficiency	Economic steadiness
Supporting the ethical standards	Reduction of carbon footprint
Use of renewable energy	Architectural quality and aesthetic impact (space, form, light and ambiance)
The role in social formation and community values	

Vancouver Convention Center West, winner of Top Ten Green Building award, the Secondary school with passive system in Burkina Faso, winner of the Holcim Foundation award, Creekside Community Recreation Centre, winner of SAB Canadian Green Building Award and also, Durham Consolidated Courthouse, winner of Green Building Award by Royal Architectural Institute of Canada are the four buildings selected as the case studies in this study, and the set of principles above are scanned in the projects according to the evaluation criteria obtained.

Vancouver Convention Center, Creekside Community recreational centre and Durham Consolidated Courthouse are observed as the green buildings according to obtained principles. The secondary school in Burkina Faso does not follow all seven principles, and renewable energy is not used. But it can be named as a green one because of its especial regional condition and having a solution for following secondary principles such as interior space quality in the design.

In the whole, several principles are specified by the evaluating committees of the award programs, which are generally accepted as the principles of environmentally friendly and green architecture. In this study, the common principles that were found in the evaluation criteria of the analyzed awards were at the point of attention, though certainly, all the criteria mentioned in each of them are among the principles defining a green building. The efforts played by the designers and builders in order to be among the winners of the awards constitute a great step to convey the architecture toward environmentally friendly architecture.

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